



THE MESOAMERICAN REEF

AGRICULTURE AND THE



*PROMOTING BETTER MANAGEMENT PRACTICES
AMONG PALM OIL PRODUCERS IN THE AGUAN
RIVER BASIN*

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LINKING RIDGES TO REEF:

PROMOTING BETTER MANAGEMENT PRACTICES AMONG PALM OIL PRODUCERS IN THE AGUAN RIVER BASIN

Summary

The Aguán River Basin is an extensive fertile valley located in the northern Caribbean coast of Honduras. Commercial agricultural activity dated back to early twenty century and after a successive boom of bananas, pastures and palm oil plantations became a very important center of economic and social activity where more than 200,000 people show a significant life improvement after key investment from the government and the lending community. These transformations, from bananas to pastures to palm oil plantations have have an environmental cost, which may not resemble those in Malaysia or elsewhere, but may have affected all habitats from the inland ridges to the coral reef to some degree. This impact is augmenting to the point that a measurable harming level is being expressed, and if left unattended, may turn into severe threats. This study centered on developing a thorough understanding of the agricultural activity and their environmental impact of the 28,802 ha of palm oil plantations and five processing plants. Activities included collecting baseline information, developing a preliminary geo-database, with a correspondent interactive web-based map, that together with other monitoring systems in place provide a preliminary assessment of scientific-based better management practices to be pursued and implemented. The study points out that sound social, economic and environmental sustainable precision systems, if not set up in place swiftly, will bring unfortunate consequences to this agricultural and marine habitats, and another boom may arise, which for sure, will not be a natural forest for future conservation. Support from all international and national organizations, from the private and public sectors willing to invest and develop scientific-based Better Management Practices are needed to be set up in place in the palm oil plantations of the Aguán River Basin.

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Introduction

In 2004 WWF-Central America developed the Project Concept “Linking Ridges to Reef: Promoting Better Management Practices (BMPS) among Palm Oil Producers in the Aguán River Basin” targeting the following issues:

a) identify and contact the palm oil producers within the Aguán River Basin and convene a sustainable palm oil working group that may work towards addressing the major threats derived from this industry upon forest, freshwater and particularly coastal marine habitats.; and

b) To develop an environmental impact assessment report that identifies the major impacts of palm oil production within the Aguán River Basin and identifies best practices that could be implemented locally.

The Project Concept identified three objectives/results to address the aforementioned issues, which shall serve as the baseline information for a long term monitoring of the environmental impacts caused by the palm oil industry in the Aguán River Basin area and nearby marine ecosystems. These objectives were:

1. Develop a Palm oil producers’ database.
1. Establishing of a Palm Oil working group and a MOU signed with WWF to committee to implement sustainable oil palm production.
2. Develop a palm oil threats analysis, a geo-referenced map and a preliminary report of recommended local better management practices.

Objectives

Based on these expected objective/results, WWF contracted local senior consultancy services to address the following five short-term objectives:

1. Develop a geo-database of Palm oil industry attributes that will include identification of producers, organizations, management practices, infrastructure type, and location and other identifiable sites, such as effluent and garbage disposal sites.
2. Develop a geo-referenced web-based interactive map.
3. Publish the geo-database and concomitant multiple-layer map with MapViewSVG version 4.0.
4. Development of the threat analysis matrix based on the degree of ecological impact each practice may have.
5. Development of a list of better management practices based on the environmental impact that each identified practice may have in the environment and the degree of its impact.

The purpose of this Report is to present results for the five short-term objectives addressing the Objectives 1 and 3 of the Project Concept initially described.

Materials and Methods

Methodologies used in this analysis consisted of: 1) state of the art technologies capable to identify temporal and spatial warning signals generated by the Palm Oil Agro-Industrial cluster in the Aguán River Basin; 2) scientifically rigorous analytical tools to discriminate, associate and quantify when possibly such signals, and 3) multimedia tools to distribute the findings and recommendations.

Geo-database of Palm Oil Industry at the Aguán River Basin

The generated geo-database consists of a collection of characteristics attributable to the palm oil industry that identify producers, organizations, management practices, infrastructure, effluent and garbage disposal sites and other information depicted in the Interactive Map.

The geo-database was generated in three steps: a) development of a questionnaire, b) field visits to collect information, and c) construction of the geo-database

During the field visit (June 5-11, 2005), a team of specialists visited the Aguán River Basin Palm Oil sites and collected the information outlined in the questionnaire attached in Annex 1.

The construction of the geo-database using collected information took place from June 13 to July 15, and consisted of the following steps:

- Revision of the questionnaires for completion and concordance

- Digitalization of collected data

- Cleansing of collected data

- Imputation of collected data

- Building the geo-database and developing the access and management framework using ArcGIS Version 8.3 (Industry Standard).

Threat Analysis

Data from the Section V in the questionnaire were used to identify the management practices and the fate of the waste products of the Palm oil Industry that are expected to have an identifiable environmental impact. Data collected in Sections V was used to develop the data in Section VI (Environmental impact of the agronomic and management practices of the Palm Oil Industry in the Aguán River Valley) and were directly used to develop the Threat Analysis Matrix based on the degree of ecological impact each practice may have.

Better Management Practices (BMPs)

Using different knowledge bases to analyze the spatial and temporal data collected through the questionnaire, a list of better management practices was developed based

upon the impact/threat that each identified practice possess to the environment and the degree of its impact.

Interactive Multi-layer Map

An interactive Multi-layer map was generated with state of the art software application MapViewSVG version 4.0. The map is to be published via <http://connect.panda.org> and, upon some recommendation derived from WWF.

Results and Discussions

Reading the Warning Signals

Needless to discuss, food production is the sedentary human activity that has produced probably measurable impact in ecosystems since the start of human civilizations. However, this impact depends on a set of factors that individually show varied degrees of contribution, depending on their temporal and spatial occurrence. The agricultural activities have been demonstrated to affect the natural resource base depending on several quantifiable variables.

Does the current Palm Oil Industry located in the Aguán River Basin possess a threat to the Coral Reef marine habitats at the nearby Caribbean basin?, is the issue to address with this study. Analysis of the collected information identified the current palm oil activities that may well cause measurable harm and threat the nearby Coral Reef marine habitats. At the same time, the document recommends sound better practices based on: 1) some current practices in the area and elsewhere, and 2) new proposed practices that can be implemented with the least investment, thus, high probability of successful adoption.

Agricultural Activity in the Aguán River Basin

The African Palm Oil Boom

In the last 100 years, the Aguán region has experienced three waves of agricultural economic booms. In the early part of the century, high profits in bananas had induced the United Fruit Company (now part of Chiquita) and the Standard Fruit Company (now part of Dole Fruit) to establish railroads and vast banana plantations in the valley. Nevertheless, after 1942, when an outbreak of Panama disease in bananas led United to abandon the Aguán Valley, the Aguán's infrastructure rapidly degraded and much of the land reverted to pasture or primary forest. Only one railroad line remained, in the upper part of the valley, serving some 5,000 hectares of bananas belonging to Standard Fruit.

The abandoned valley was ignored until the growing population put pressure on many inhabited areas, and began agitating for land reform. Accordingly, the Inter-American Development Bank (IADB) funded the redevelopment of the valley in conjunction with a vast settlement project. Over the 1970s, the IADB built a road network and a modern port, and re-settled 4,700 families on 101 agricultural cooperatives, covering 60,000 hectares of the richest land in the valley.

The primary purposes of the Aguán Valley Project were, in addition to re-settle peasants from high-pressure land requests, the establishment of agro-exports and related industries (OAS 1962; IADB 1976:13). Agro-export crops covered little of the Aguán valley in the 1970s, despite the fact that agro-exports generate the most profits and employment per hectare. Land reform political decisions, together with the availability of long-term loans and a somewhat clear vision of the goodness of the African palm oil to adapt to this new agricultural frontier made this crop and this area to develop the first mass colonization effort ever been undertaken in Honduras. This is to say that all elements, including a thorough knowledge of the palm oil management and processing in Honduras and elsewhere, existed to accomplish this multipurpose agro-industrial cluster, that the economist use to label this type of efforts “Big Push”.

Plantation crops, such as palm oil had their inefficiencies. No farmer would undertake to plant palm oil by himself or herself, unless certain amount of farmers were planting simultaneously to induce the establishment of processing activities, to coup up with enough volume to make the processing plants workable. Several development agencies sought to assist the government in meeting this challenge, by providing incentives for farmers to plant simultaneously palm oil trees. Cooperatives were induced and given enough land to achieve efficient scale in growing palm oil. The Honduran government arranged for the processing of palm oil, building several palm-fruit crushing mills with multilateral financing, funding the Aguán Valley Project.

Until recently, no exact or public data exists on the profitability of African palm from the Aguán Valley. Most of the Aguán Valley’s production over the 70s and 80s was consumed nationally. Not until the 90s, the palm oil became an important export worldwide, of high value per hectare.

Therefore, the mere nature of the palm oil cluster development in the Aguán Valley made this crop a “forced” low-input crop. After the initial palm oil plantations, the few buyers that set the prices significantly deterred investment in the Aguán, and only two farms in the Aguán entered palm production after the initial Push. Cooperative farms already invested in palm production did little to expand their area or improve their yields, despite incentives provided by COAPALMA (the initial Federation of Palm Oil Coops). Average yields across COAPALMA fell to 14 metric tons of fruit per hectare, as opposed to 17 to 22 elsewhere.

Therefore, the historical socio-economic nature, current market outlook, and an incipient environmental awareness of the palm oil cluster in the Honduras’ Aguán River Basin, altogether conjugate to exhibit a unique set of opportunities for developing a long term and sustainable Better Practice System, stewarded, and sponsored by national and international organizations.

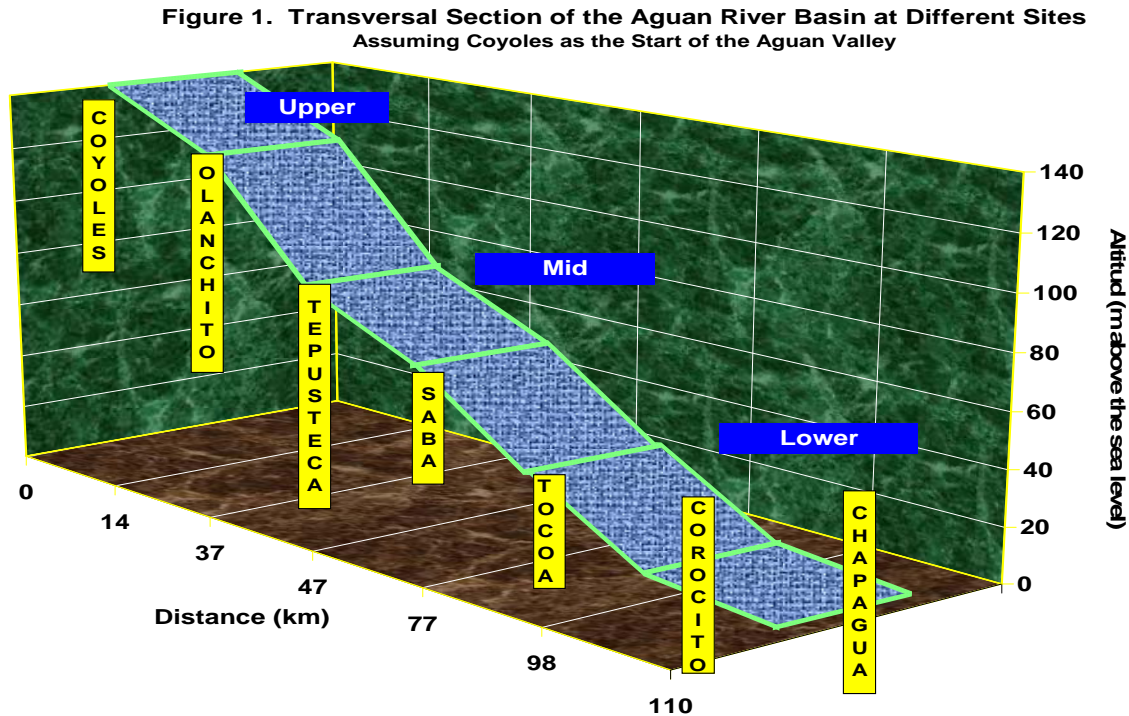
Description of the Area

The Aguán River Watershed measures 10,546.31 km², and extends across the departments Yoro, Colon, Atlántida, and Olancho, is delimited by the tributaries of the Aguan River (Figure 2). The delimiting coordinates for the Aguán River, Agricultural Land with less, or equal to 12% slope, and Palm Oil study area are depicted in Table 1

Table 1. Geographical limits (UTM) of the Aguán River Basin, Agricultural, and Palm Oil Study Area. July 2005.

	Basin	Agricultural Land With <=12% Slope	Palm Oil Study Area
EAST	E647785 and N1759815	E691458 and N1758197	E6440527 and N1755035
WEST	E457247 and N1680879	E501157 and N1701429	E582565 and N1715401
SOUTH	E531645 and N1638822	E528086 and N1695113	E583215 and N1713226
NORTH	E632903 and N1765962	E628374 and N1768226	E628364 and N1765153
AREA km ²	10,546.31	2,980	400.89
AREA ha	1,054,631	298,000	40,089

Figure 1. Transversal section of the Aguán River Basin at different sites. Assuming Coyoles as the starting point of the Aguán Valley



The most important agricultural activities (Table 2, Figure 1) in the Aguán River Basin stretches along a distance of $\cong 110$ km from the Coyoles Dole’s Banana plantations down to the river mouth at Chapagua and Santa Rosa de Aguán. Figure 1 represents a transversal section of the Aguán River Basin. From Coyoles to the site known as Tepusteca (37 km) down the river, the Aguán River Valley is known as the Upper Aguán Valley, from Tepusteca to Tocoa is called the Mid Aguán Valley, and from Tocoa to the Chapagua mouth is called the Low Aguán Valley.

Even though, the focus of this study is Palm Oil, the diversity of the crops raised on the three different agro-ecological zones of the Aguán River Basin, shows the need to study this plantation crop under the completely agro-ecological context. Thus, the palm oil impact can be separated out from those crops that perhaps are having a different impact on the targeted terrestrial and marine habitats. This Figure 1 is draw from Table 1, where less than 15% of the Aguán River Basin is devoted to Palm Oil.

Table 2: Agricultural limits of the Aguán River Basin from Coyoles to the Chapagua site at the River Mouth

Location	Observation Site	Altitude above sea level (m)	Distance from Coyoles (km)	East	North	Main Agricultural Activities
Coyoles Central	Calpules' River Mouth	140	0.00	630376	1755721	Banana, Mangoes, Sorghum, Corn, Beans, Pastures, Vegetables
Olancho	Bridge	120	13.78	624687	1744686	
Tepusteca	90° to the Aguán River	80	37.37	572964	1714696	
Saba	Bridge	60	47.27	582632	1716835	Banana, Palm Oil, Citrus, Corn, Rice, Pastures
Tocoa	Ayestas' Lagoon	33	77.17	582658	1716814	
Corocito	La Culebra's Lagoon	10	98.02	549957	1709826	Palm Oil, Plantain, Rice, Corn Pastures, Yucca
Chapagua, Santa Rosa de Aguan	At the banks of the River Mouth	5	110.46	536641	1706390	

Monitoring Systems in the Aguán River Basin and Nearby Marine Habitats

The knowledge base gathered after the hurricane Mitch in 1998, set fourth an incipient monitoring system that enable students of the Aguán River watershed and nearby Coral Reefs Marine habitats in the Caribbean locations to develop serious testable hypothesis on the effect of several factors and their interactions. These factors, when properly analyzed, can provide, in addition to early warning signals long term forecasts of possible scenarios of the aftermath of these activities at different sites of the Aguán River Basin, including the lower Aguán Valley, where the palm oil is produced, and their impact in the nearby Coral Reef (i.e. Cayos Cochinos).

One monitoring systems deployed by the USGS after the Hurricane Mitch offers basic information for this Project to bear in mind when studying the inter-relationship of the agro-ecosystems in the Aguán River Basin with the Coral Reef Marine Habitats nearby. This monitoring system consists of an Early Warning System in the three countries suffered the most during the Hurricane Mitch in 1998, and consists of telemetric stations equipped with several sensors that include rain and streamflow gauges in near real-time.

In the Aguán Watershed, these stations are located at the highest elevation illustrated in the map of Figure 2. These data are readily accessed in the internet through the site <http://pr.water.usgs.gov/public/rt/hn/aguan.html>. More stations like these ones if deployed from the Olanchito area to the Aguán Water Mouth would be very useful to measure erosion parameters in relation to precipitation amount and intensity. Other sensors can also be connected to system that will enable to measure other agricultural important variables.

Figure 2. USGS website with Real-Time Streamflow and Rainfall Data for the Aguán Watershed. The system is part of an Early Warning Systems deployed just after the Hurricane Mitch in 1998. As July 2005.



The USAID/USGS Hurricane Mitch Program in support of hazard mitigation and reconstruction after Hurricane Mitch—ended on December 31 2001. It left an important legacy of information that together with the near-real time Monitoring System deployed by the same Program, is of fundamental importance to monitoring the health system of the Coral Reef Marine Habitats nearby the Aguán River Basin.

Authors of the final report stated, “coral reefs around Cayos Cochinos are heavily impacted by what is taking place on the mainland. Runoff carries freshwater, sediment, pollution, and contamination to this region. Mainland runoff is generally not a problem for Roatán and Guanaja. All data will be stored as time-series archives of specific reefs that will assist researchers in documenting the decline or improvement of those reefs affected by anthropogenic stresses and (or) natural environmental perturbations”. Information in this site can be accessed at:

<http://coastal.er.usgs.gov/education/mitch-movie/hi-res.html>

Figure 3. USGS related link from the Coral Reefs in Honduras: Status after the Hurricane Mitch Online Mini-Documentary Movie, as January 2003.

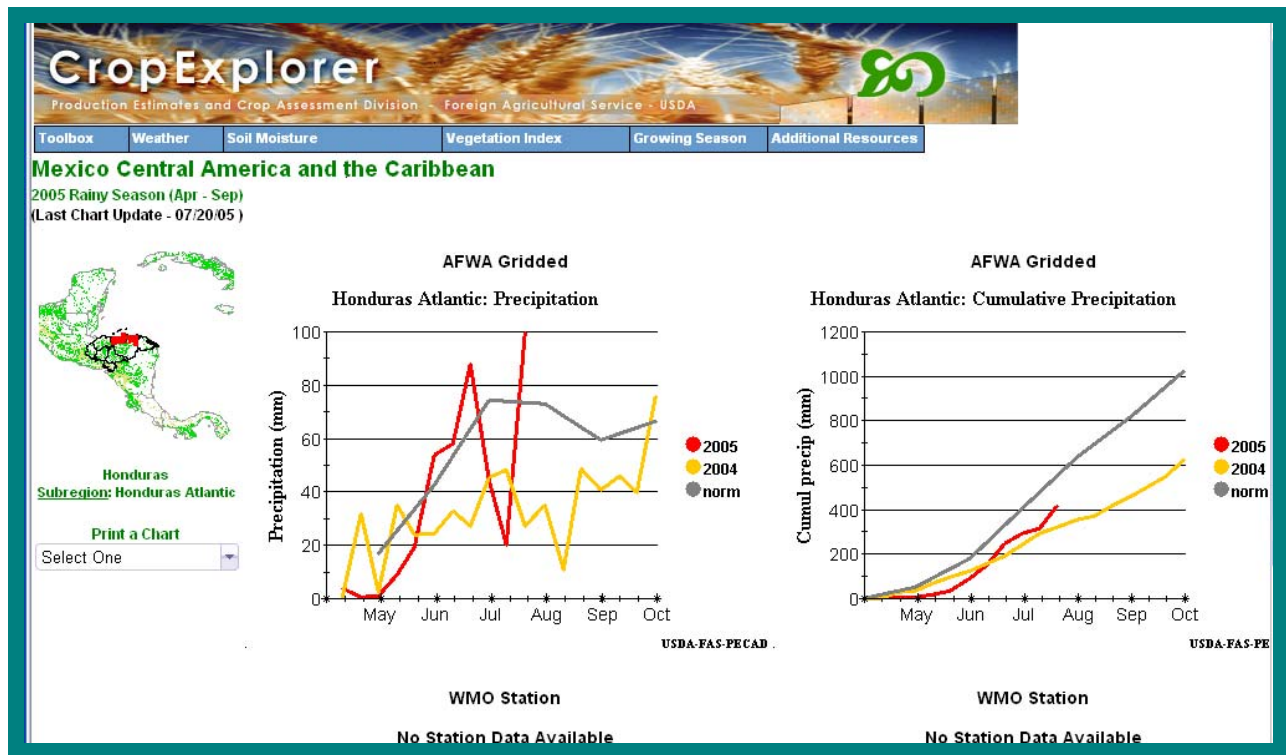
The screenshot shows the USGS website interface. At the top left is the USGS logo with the tagline "science for a changing world" and the text "Coastal & Marine Geology Program". To the right is a search bar. Below the logo is a breadcrumb trail: "Coastal & Marine Geology Program > Center for Coastal Studies > Educational Materials > Honduras Coral Reefs Documentary". The main heading is "Coral Reefs in Honduras: Status after Hurricane Mitch Online Mini-Documentary Movie". On the left is a video player window titled "High-Resolution Version" showing an underwater scene of coral reefs. Below the video is a "download & play movie" link. To the right of the video player is the text "Stand-Alone Player" and "To play the movie in the stand-alone QuickTime(TM) Player instead of the window at left, click on the icon below:". Below this is a "play movie" icon. Further down, it says "High Resolution: 320x240, 49MB, running time 8:24". At the bottom, there is a link "Get QuickTime(TM) Player" and "Introduction | Documentary Transcript".

Another important site in the internet, from the point of view of producers that can also be related to the costal marine habitats after Aguan River Mouth is

<http://www.pecad.fas.usda.gov/cropexplorer/chartview.cfm?ftypeid=1&fattributeid=1&cntryid=HO&cropid=2232000&startdate=2005%2D04%2D01%2000%3A00%3A00%2E0®ionid=cal>.

This site offers a tremendous amount of agricultural weather information associated with different crops in Honduras and other Central American Countries. Comparative data on temperature, precipitation, soil moisture and vegetation index is found for several years. Figure 4 shows an example of the decadal precipitation monitored in the Aguán Area as July 10, 2005, published by the site. Palm oil areas are:

Figure 4. Monitoring of agricultural weather variables by USDA/FAS. The picture depicts the precipitation in the palm oil area as in the second decade of July 2005.



Field Findings

The palm oil cluster in the Aguán River Basin is concentrated from Sava to Tumbaderos. The geo-referenced map includes plantations, processing plants, nurseries, and bunch collecting sites, sanitary infrastructure, populated sites, and others. There were five processing plants, 60 plantations, and 1 nursery site. The interactive map includes these three types of exploitations and some attributes that include the UTM coordinates.

Plantations

Crop Area

The area containing the palm oil plantations (Table 3) and other crops identified in this study summed up to 40,089 ha. Sixty palm oil plantations were identified and grouped under 12 palm oil operations with different business status. Within these operations, there were 28,082 ha of palm oil, 168 ha of citrus, 583 used for permanent pastures and bushlands, 510 devoted to basic grains, and the urban/rural communities' area comprised of 624 ha. Annex 2 presents the complete dataset of these operations in regards of area and crops.

Table 3. Summary of crop area* characteristics 60 farms in the Aguán River Basin producing palm oil. Area under study include palm field from Sava to Tumbaderos, as July 2005.

ORGANIZATION/COMPANY	N	Total Farm (ha)	Palm Oil (ha)	Citrus (ha)	Pasture and Bushland (ha)	Basic Grain (ha)	Urban/Rural Area (ha)
AGROPALMA	8	6,910	4,848	0	1,018	90	0
APROVA	12	6,064	3,843	0	1,973	102	246
COAPALMA	14	8,921	5,085	118	3,562	175	289
EXPOR. DEL ATLANTICO	13	11,342	9,202	.	1,916	.	66
Grupo Independiente	5	2,305	1,627	0	,668	83	11
Independent A	1	670	402	.	.	.	.
Independent B	1	250	100	.	.	.	.
Independent C	1	73	44	.	.	.	.
Instituto Nacional Agrario	1	57	15	.	30	.	12
SALAMA	1	891	774	50	88	60	0
SOCIEDAD IMPALMA	2	2,399	2,004	0	396	0	0
UNIVERSIDAD CURLA	1	207	138	.	69	.	0
Total	60	40,089	28,082	168	583	510	624

* all area measured using Lansat images with field collected UTM

Palm Oil Area

The palm area identified covered 28,082 ha. Better practices require precision, and Table 4 collects a textbook example of record keeping in any particular farm. Farm operator interviewed expressed slack knowledge about several characteristics asked about their operations and other variables.

Table 4. Summary of palm area collected in 60 farms by age in the Aguan River Basin. Area under study include palm field from Sava to Tumbaderos, as July 2005.

Organization/Company	Farm N	Palm Area (ha)	Palm Age < 3 Year (ha)	Palm Age 4-15 Year (ha)	Palm Age 16- 20 Year (ha)	Palm Age > 20 Year (ha)	Palm Area with Bearing Trees (ha)
AGROPALMA	8	4,848	279	3,502	93	0	3,595
APROVA	12	3,843	312	1,034	299	1,263	2,596
COAPALMA	14	5,085	47	3,000	323	1,544	4,867
Exportadora del Atlantico	13	9,202	.	.	.	.	0
Grupo Independiente	5	1,627	0	428	374	380	1,182
Independent A	1	402	.	.	.	.	0
Independent B	1	100	.	.	.	.	0
Independent C	1	44	.	.	.	.	0
Instituto Nacional Agrario	1	15	.	.	.	15	15
SALAMA	1	774	138	436	111	88	635
Sociedad IMPALMA	2	2,004	310	808	494	0	1,302
Univer. Nacional CURLA	1	138	.	.	.	138	138
Total		28,082	1,086	9,208	1694	3,428	14,330

* all area measured using Lansat images with field collected UTM

Therefore, the number expressed in Table 3 reflects a particular issue to address in future studies or on-line updating of the geo-referenced database. From the answers provided by the farm operators, a little over 50% can be aggregated by ages. This knowledge is highly important for yield estimation, replanting, nutrition, and other agronomic and environmental program activities. Annex 3 presents the palm oil plantation by name of the plantation, operation, and plant age.

Production

Annual field yield in palm oil is a function of the number of plants per planted area (ha), number of bunches per plant per year, number of fruits per bunch, weight of each individual fruit, and the age of the palm tree. A typical production curve indicates that commercial production starts, on the average, when palm trees reach 4-years old. Production climbs up to the year 15 then it levels-off and about year 20 yield starts to decrease. Yearly variations on the height of the yield curve depend on many specific factors that include weather, management, and world markets behavior. Adequate precipitation during the dry months favors adequate leaf area and physiological development of fruit size and number, thus yield. Management practices, primarily fertilizer applications favor fruit plant growth and fruit production. Another agronomic factor of importance is weed control around the base of the tree that, in addition to affect fertilizer efficiency, affects harvest practices when canopies are not fully covering the ground. Palm oil world market prices are certain to reduce some investments devoted to management practices or come to a halt. Lower market oil prices reduce these investments and higher prices tend to increase these investments.

Table 5. Summary of production parameters collected in 60 farms in the Aguán River Basin, as July 2005.

	Farm	Palm	Palm Age	Palm Age	Palm Age >20	Plant	Yield	Bunch Production 2004
AGROPALMA	8	4,848	3,502	93	0	108	18.0	69,732
APROVA	12	3,843	1,034	299	1263	143	8.7	26,061
COAPALMA	14	5,085	3,000	323	1544	143	11.4	56,882
Exportadora del Atlantico	13	9,202	.	.	.	143	18	.
Grupo Independiente	5	1,627	428	374	380	143	10.7	13,460
Independiente A	1	402	.	.	.	.	.	.
Independiente B	1	100	.	.	.	.	.	.
Independiente C	1	44	.	.	.	.	.	.
Instituto Nacional Agrario	1	15	.	.	15	.	.	.
SALAMA	1	774	436	111	88	143	18	13,919
Sociedad IMPALMA	2	2,004	808	494	0	140	17	27,420
Univer. Nacional CURLA	1	138	.	.	138	.	.	.
Total		28,082	9,208	1,694	3,248	117	14.0	207,464

Field findings on palm oil yield components indicate many lags in the statistics the interviewed Resident Farm Operators carry and could not answer thoroughly, or were confidential data that farmers will not publish. Reported area of palm oil tree at bearing age (>3 years old) accounted for only 50 percent of the total. Reported plant population per hectare ranged from 143 to 108, averaging 117. In this regard, a weighted average per farm field would give us the best estimator of plant population, which is a very important component of field yield. Reported Bunch yield averaged 14 TM/ha, ranging as low as 8.7 and as high as 18 TM/ha. This high variability empirically indicates that management practices are affecting yield components, which are very important to enhance through a sound and precise Better Management Practices.

Agrochemical Utilization

The very diverse nature of the palm oil plantations in the Aguán River Basin has precluded intensive exploitation of this crop as seen in the yield levels, but also has induced producers to manage the palm plantations as a “low-input crop”, primarily for cost reduction. Tables 6-10 express the level of chemical fertilizer, pesticides used to control insects, disease-causing pathogens, and weeds. Of course, this level will change when all producers report their true utilization values.

Fertilizer Use

The information in Table 6 presents the levels and type of chemical fertilizer registered as used in the Palm Oil River Basin plantations. Fertilizers are applied to the base of the tree, sometimes are covered some other time are not. Residence Farm Operator did provide this information completely; nevertheless, better data can be collected once a Better Management Program is implemented.

Table 6. Summary data for fertilizer use and type collected in the palm oil plantations in the Aguán River Basin as July 2005.

Organization/Company	Pal Oil Farms N	Palm Oil Area ha	Urea kg/ha	NH ₄ NO ₃ kg/ha	(NH ₄) ₂ SO ₂ kg/ha	18- 46-0 kg/ha	15-4- 27 kg/ha	12- 24- 12 kg/ha	KCl kg/ha	Boron kg/ha
AGROPALMA	8	4,848	0	133	0	0	0	0	133	1
APROVA	12	3,843	0	0	36	0	0	0	27	0
COAPALMA	14	5,085	46	0	91	0	1	11	117	0
Exportadora del Atlantico	13	9,202	.	.	.	.	.	.	.	.
Grupo Independiente	5	1,627	32	21	21	0	0	0	74	0
Independientes A	1	402	.	.	.	.	.	.	.	.
Independientes B	1	100	.	.	.	.	.	.	.	.
Independientes C	1	44	.	.	.	.	.	.	.	.
Inst. Nacional Agrario	1	15	.	.	.	.	.	.	.	.
SALAMA	1	774	319	0	0	0	0	0	319	4
Sociedad IMPALMA	2	2,004	0	107	0	53	0	0	107	3
Univ. Nacional CURLA	1	138	.	.	.	.	.	.	.	.
Average/ha	60	28,082	66	43	25	9	0	2	129	1

Nitrogen is applied through the following sources of chemical fertilizers: urea, ammonium nitrate, ammonium sulfate, and the formulas 18-26-0, 15-4-27 and 12-24-12. Phosphorus is applied through the formulas 18-46-0, 15-4-27, and 12-24-12. Potassium is applied as Potassium Chloride and Boron is applied as Borate. Only one Organization/Operation did mention that they used soil analysis to supply the need of the plants, but did not mention the use of tissue analysis, which is the core analysis to supply nutrients need more precise.

As an exercise, if all 28,082 ha planted with palm oil in the Aguán River Basin, were to use fertilizers according to the amounts and types collected in the July survey, the following quantities were to be used:

- 1,856 TM of urea,
- 220 TM of ammonium nitrate
- 3,636 TM of ammonium sulfate
- 691 TM of the formula 18-46-0
- 249 TM of the formula 15-4 -7 TM (called the Palm formula)
- 56 TM of 12-24-12
- 129 TM of KCl
- 0.039 TM of boron as borate

Plant nutrition is the highest cost a palm oil that a farmer has to incur when involved in commercial production. Applications of nutrients need to be done with the precision dictated by the plant needs according to the level of production chosen. Level of production in the plantations located in the Aguán River Basin is from low to mid.

Pesticide Use

Commercial products used in Aguán River Basin Palm Oil plantations are specifically targeted to specific pest. These pests include small mammal (rats), insects, nematodes, fungi, and weeds.

Rodenticides

Rats (*Ratus* spp.) are one of the most important pests during the life of the palm oil tree. Rats, depending on their population size, if go uncontrolled can cause significant losses by lowering the plant population at early stages or by eating the kernels at bearing age. Baits with anticoagulants in commercial dosages are the primary modes of rat control in the area. Storm (Flocoumafen) and Klerat (Brodifacoum) pellets as commercial formulations are used for this purpose. No effect of these rodenticides have ever been documented in the area and significant research can be

accomplished with these two chemical as part of an integrated control, where placement, carriers, density wrapping, behavior of rats, predators and other beneficial fauna can be studied so these baits cannot be reached by beneficial fauna.

Table 7. Collected data on the use of Storm® and Klerat® pellets for rat control in 60 the Palm Oil Plantations in the Aguán River Basin as July 2005.

Organization/Company	Farms N	Palm Oil Area ha	Storm Pellets (Flocoumafen) g/ha*	Klerat pellets (Brodifacoum) g/ha
AGROPALMA	8	4,848	0	50
APROVA	12	3,843	0	0
COAPALMA	14	5,085	0	50
Exportadora del Atlantico	13	9,202	0	.
Grupo Independiente	5	1,627	0	0
Independientes A	1	402	0	50
Independientes B	1	100	0	50
Independientes C	1	44	0	50
Inst. Nacional Agrario	1	15	0	50
SALAMA	1	774	0	0
Sociedad IMPALMA	2	2,004	20	0
Univ. Nacional CURLA	1	138	0	50

* current control as stated by the Resident Farm Operator is 1 bait/ha

Insecticides

Significant efforts are devoted daily to control the palm weevil (*Rhynchophorus palmarum* L., Coleoptera: Curculionidae) that causes significant losses of palm trees (up to 20%), by boring into the stem and producing stunt, decay and death of the tree eventually, because its association with nematodes causing the red ring symptom. Traps are dispersed strategically within the plantations and in this region; pineapples are used as bait. Pieces of this fruit are sprayed with Sevin® (Carbaryl) or Regent® (Fipronil) and placed in containers. This is a very effective trap to manage the population of palm weevils with little impact on the environment, though some other insects may be attracted to the sweet smell of pineapples. When plants are completely dead because of this disease complex, the palm trees are chopped down and sprayed with Vydate® (Oxamyl), which has a powerful nematicide-insecticide action.

Table 8. Chemicals reported to control the palm oil weevil-red ring complex in the Aguan River Basin, as July 2005.

Organization/Company	Pal oil farms N	Palm Oil Area ha	Traps with Sevin (Carbaryl) (g/ha)	Traps with Regent (Fipronil) (cc/ha)	Vydate (Oxamyl) (Lt/ha)
AGROPALMA	8	4,848	10	0	0.0
APROVA	12	3,843	10	0	0.0
COAPALMA	14	5,085	10	0	0.0
Exportadora del Atlantico	13	9,202	10	25	7.0
Grupo Independiente	5	1,627	10	0	0.0
Independientes A	1	402	10	0	0.0
Independientes B	1	100	10	0	0.0
Independientes C	1	44	10	0	0.0
Inst. Nacional Agrario	1	15	10	0	7.0
SALAMA	1	774	10	0	7.0
Sociedad IMPALMA	2	2,004	10	0	0.0
Univ. Nacional CURLA	1	138	10	0	0.0

This combination of practices keeps the weevil population low and significantly decreases the red ring disease incidence. Deployment of this practice in all the palm area and under the supervision of skilled professionals on integrated pest management shall keep its environmental impact down. Research on new baits, insecticides and trap number and type, shall also be initiated to reduce further potential damage and costs.

Several genuses of leaf eater insects attack the palm trees during their life cycle in the Aguán River Basin plantations. Five different types of insecticides were reported by the resident farm operators to control. All indications suggest that they are sprayed with 20-Lt backpack sprayers, and probably with inadequate equipment. All except one operation said they have written manuals for these insecticide applications.

Table 9. Reported chemical insecticides used to control leaf-eating insects in palm oil plantation in the Aguán River Basin, as July 2005.

Organization/Company	Palm oil farms N	Palm Oil Area ha	Dipel (Bacillus thuringiensis) (kg/ha)	Karate (Lambda Cyhalothrine) (kg/ha)	Monarca (Thiacloprid+Beta- Cyfluthrin) (Lt/ha)	Lannate (Methomyl) (kg/ha)	Folidol (Parathion- methyl) (Lt/ha)
AGROPALMA	8	4,848	0.50*	0.00	0.00	0.00	0.00
APROVA	12	3,843	0.00	0.00	0.00	0.00	1.50
COAPALMA	14	5,085	0.00	0.00	0.07	0.00	0.00
Exportadora del Atlantico	13	9,202	0.50	0.00	0.00	0.00	0.00
Grupo Independiente	5	1,627	0.00	0.00	0.00	0.00	0.00
Independientes A	1	402	0.50	0.00	0.00	0.00	0.00
Independientes B	1	100	0.50	0.00	0.00	0.00	0.00
Independientes C	1	44	0.50	0.00	0.00	0.00	0.00
Inst. Nacional Agrario	1	15	0.50	0.00	0.00	2.50	0.00
SALAMA	1	774	0.50	0.00	0.00	0.00	0.00
Sociedad IMPALMA	2	2,004	0.25	0.15	0.00	0.00	0.00
Univ. Nacional CURLA	1	138	0.50	0.00	0.00	0.00	0.00

* dosages reported by farm operators were converted to dosage/ha, aided with expert criteria and specimen labels.

Fungicides

Palm diseases in the Aguán River Basin palm oil Plantations are commonly treated with Benlate (Benomyl). This fungicide has been used for many decades to prevent several vascular wilt disease (VWD) that when attacked rarely survive. High humidity during most of the year is favorable to diseases. Other diseases in adult plantations are rarely treated. Ditane (Mancozeb), a preventive-action fungicide was mentioned at one location, but specific data were not provided. Data on root rots, leaf rots, and bunch rots may be available upon research to measure the incidence and severity.

One specific point needed to bring up for discussion is the renewal of old plantations. Producers have just started to renew their old trees and in the next few years, the area will undergo an accelerated rate of renewal, since a significant proportion of the plantations have reached more than 30 years. Thirty years of monoculture has for sure, produced specific habitats for plant-pathogen, plant-pest relationships. Thus, we hypothesize that there has been a build-up of pathogens and pests, that the new palms may be exposed. Old-tree destruction shall be a careful practice; otherwise, the use of pesticides will increase dramatically.

Table 10. Reported chemical fungicide used to control diseases in palm oil plantation in the Aguán River Basin, as July 2005.

Organization/Company	Palm oil Farms N	Total Palm Area (ha)	Benlate (Benomyl) (kg/ha)
AGROPALMA	8	4,848	0.0
APROVA	12	3,844	0.0
COAPALMA	14	5,085	0.0
Exportadora del Atlantico	13	9,203	2.0
Grupo Independiente	5	1,627	0.0
Independientes A	1	402	0.0
Independientes B	1	100	0.0
Independientes C	1	44	0.0
Inst. Nacional Agrario	1	15	1.0
SALAMA	1	774	0.0
Sociedad IMPALMA	2	2,004	0.0
Univ. Nacional CURLA	1	138	0.0

* dosages reported by farm operators were converted to dosage/ha, aided with expert criteria and specimen labels.

Herbicides

Weed control is a daily activity that comprises, chemical, mechanical and biological control means. Weed control is performed in between the alleys, at the base of the tree, and at the edges of roads and other points where weeds are a problem. A good weed control expedites other practices such as fertilization, pruning, harvesting, scouting and pest and disease control.

In the Aguán Valley conditions, before palm oil canopies are not fully developed and sunlight is penetrating the ground, weeds are very aggressive and frequent controls are needed. As the tree grows taller, sunlight penetration is reduced significantly and weed control tends to be limited to certain areas to favor agronomic practices. Mechanical weed mowers hauled by agricultural tractors are used to keep weeds at a manageable height in between alleys. In addition, pruned leaves from trees are accommodated in between trees and provide an excellent weed control on that ground area. Before the canopy is fully developed, young plants are kept free of weeds mostly by chemical herbicides described in Table 10, and by hand.

Table 11. Reported chemical herbicides used to control weeds in palm oil plantation in the Aguán River Basin, as July 2005.

Organization/Company	Palm Area N	Total Palm Area (ha)	Roundup (Glyphosate) (Lt/ha)	Gramuron (Paraquat+Diuron) (kg/ha)	Gramoxone (Paraquat) (Lt/ha)	Fusilade (Fluazifop-butyl) cc/ha
AGROPALMA	8	4,848	1.5	0.0	0.0	0.0
APROVA	12	3,844	1.0	0.0	0.0	0.0
COAPALMA	14	5,085	1.5	1.5	0.0	0.0
Exportadora del Atlantico	13	9,203	1.0	1.0	0.0	0.0
Grupo Independiente	5	1,627	1.0	0.0	1.0	0.0
Independientes A	1	402	1.0	1.0	0.0	1.0
Independientes B	1	100	1.0	1.0	0.0	1.0
Independientes C	1	44	1.0	1.0	0.0	1.0
Inst. Nacional Agrario	1	15	1.0	1.0	0.0	1.0
SALAMA	1	774	1.0	1.0	0.0	0.0
Sociedad IMPALMA	2	2,004	1.0	0.0	1.0	0.0
Univ. Nacional CURLA	1	138	1.0	1.0	1.0	1.0

*dosages reported by farm operators were converted to dosage/ha, aided with expert criteria and specimen labels.

Herbicides reported were Roundup (Glyphosate), Gramuron (Paraquat+Diuron), and Gramoxone (Paraquat), and Fusilade (Fluazifop-butyl), a selective graminicide for broadleaves. Not all of these herbicides are intended to eradicate or maintain the ground free of weeds, rather, to suppress weed growth as to facilitate agronomic practices, enhance nutrient absorption and landscape management.

Disposal of Residues

Field maintenance activities of palm oil plantations require significant amount of inputs that produce residues, which are discarded in several ways, in different sites. All of these waste products have different fates, depending on their chemical and physical origin.

Waste Water Disposal:

Plantations by themselves do not produce residual waters. Rainfall water passing through the plantations (no irrigation was reported), carries away molecules of the different agrochemicals used. This

runoff water follows the natural or artificial drainage system available in the farm. Detection of molecules may be monitored at the input and output posts of the farms; however, monitoring each farm is very expensive, rather better practices will indirectly reduce amount of molecules that may possess harm to marine habitats. Nearby rivers were geo-referenced to identify drainage sites for any particular farm.

Organic Waste Disposal

Abundant organic waste is produced from plantations as palm leaves. Palm leaves are pruned regularly to access the fruit bunch that will be removed in the next harvesting round. Leaves are accommodated in rows between the trees for weed control and mostly because there is no point in placing them elsewhere. The cut leaves simple crush and shadow any weed that is under it. Leaves take long time to decompose, thus weeds in those spots remain suppressed until trees canopies completely shadow the ground.

Other organic waste produced in palm oil plantations is the product of mechanical weed control. Mowed or machete's cut weeds are simple left in the field and until these residues are decomposed, they exert some weed control. These practices, certainly reduces the use of other type of weed control and can be called biological weed control.

Non-organic Waste Disposal

Non-organic wastes refers to non-metallic waste produced as a from the plantation maintenance activities. They include mostly bags and containers made of plastic. Non-organic wastes from these plantations are discarded at non-specific sites around the houses or warehouses; some are piled-up in municipal or in-site dumping sites. At these sites, there is probably more accumulation of agrochemical molecules, subjected to be washed away by runoff waters. Some even "recycle" them, especially the plastic containers for water storage or grains. Recycling is a misinterpreted activity by the community and special efforts needs to be done, mainly for pesticide containers. Plates 11 and 12 present a graphic description of this type of non-organic disposal and recycling.

Plastic containers from agrochemicals present an excellent opportunity to collaborate with the agrochemical industry through Crop Life Honduras.

<http://161.58.103.114/default.asp?id=14&mnu=14&ACT=5&content=1>

CropLife has deployed some collection centers in Honduras, as well as other types of pesticides management practices. The Aguán River basin can be a beneficiary of one these centers, providing that the need be thoroughly exposed.

Petroleum Waste Disposal

Petroleum waste products from plantations arise from machinery maintenance. Very few companies have their own mechanical shops to provide proper maintenance to their machinery. Instead, a significant amount of small shops has been established in different communities that serve the palm oil machinery. Petroleum waste products are mainly discarded oils from tractors, cars and other types of engines. These small shops simply pour the oils into the ground at more convenient sites around their installations. A couple of companies mentioned that they store these waste oils in containers for further use for boilers in the processing plants. One interviewed person mentioned that they used it as lubricant for chainsaws used to chop down palm trees. No account of the amount of these petroleum products is being estimated so far. Collecting of these oils may be profitable for some small enterprises and sell it to processing plants to be used for the boilers. Depending on the amount of used oil that is available, some petroleum companies can provide storage tanks and transportation to other parts of the country where is used in the cement industry furnaces.

Solid Waste Disposal

Solid-waste disposal refers to metallic waste products because of the palm oil maintenance activities. These include old discarded machinery, parts, batteries, tools, equipment, and others. Some of these solid waste products may contain heavy metals that may slowly be washing away by weathering action, and be added to the water bodies. There is probably no specific sites where these solid waste products are disposed, but mainly around the machinery shops. Taking into consideration the time that the palm industry is being around in the Aguán River Basin, there should be a considerable dispersed amount of these solid waste products, quantities are important to be monitored and disposal alternatives be offered to reduce possible impact in the nearby marine habitats.

Processing Plants

There are five palm oil processing plants currently in operation in the Aguán River Basin. AGROPALMA is the oldest plant, while ACEYDESA is the most recent. Plates 13 to 17 presents some pictures of the palm oil processing plants in the Aguán River Basin.

Processing Capacity

Reported processing capacity for all five plants is presented in Table 11, and reaches 150 TM/hr. At 100 percent efficiency, all of these five plants can process 3,576 TM/day and 1,305,240 TM/year.

All of them process mostly their own fruit, but COAPALMA takes fruit from several independent producers, as different owner modalities are reported in these palm oil plantations.

Table 12. Reported processing capacity of five palm oil processing plants in the Aguán River Basin, as July 2005.

Organization/Company	Year of First Operation	Reported Processing Capacity (TM/hr)	Estimated Processing Capacity TM/Day	Estimated Processing Capacity M/Year
ACEYDESA	2000	30	720	26,2800
AGROPALMA	1980	40	960	350,400
COAPALMA	1997	20	480	175,200
Exportadora del Atlantico	1995	60	1,200	438,000
SALAMA	1998	9	216	78,840
Total		159	3,576	1,305,240

Disposal of Residues

Palm oil processing plants produce significant amount of biomass residues, which are discarded in several ways and in different sites. All of these residues are treated as waste products and rarely used for soil amendment or other purpose. Working at 40 percent efficiency, that is to say, an annual processing of around 500,000 TM of fruit, and using Malaysia processing indexes, these five plants will produce the following biomass and values for a single year.

Table 13. Reported and estimated palm oil biomass production by five processing plants in the Aguán River Basin, using Malaysia production indexes, as July 2005.

Country	Fresh Bunch Production TM/Year	Empty Fruit Bunch TM/Year	Effluent Boiler Ashes TM/Year	Nuts TM/Year	Oil TM/Year
Malaysia (TM)	55,500,000	13,800,000	22,000,000	9,200,000	10,500,000
Malaysia (%)	100	24.9	39.6	16.6	18.9
Honduras (TM)	500,000	124,324	198,198	82,883	94,595

These numbers, in all cases, is a considerable amount of biomass produced by the extraction process, and not returned to the soil, but in one instance, mentioned by the Environmental Unit of one company who reported some composting and processing for soil amendment. Incipient recognition of these biomass values is becoming important and the potential need to be exploited using modern technologies is a great opportunity and a challenge.

In addition, other waste products, not directly related to the process, are produced and discarded in similar way as the plantations' waste products. These products include solid waste, and used fuels from the various operations of machinery.

Waste Water Disposal

In general, wastewater is disposed through channels that direct the effluent to a lagoon. Plates 5 to 10 present a graphic display of the most common practice to discard water effluents. These lagoons are simple depression in the ground that has borders built around to contain the wastewaters from spill over. There is possible a mixing of aerobic and anaerobic conditions, but a report on the efficiency of these lagoons was not provided, nor any maintenance was reported.

Organic Waste Disposal

Organic waste disposal refers to the solid biomass that is produced such as empty fruit bunches (EFB), boiler ashes (BA) and other material from processing, such as mesocarp fiber (MF) and kernel shells (KS). These discarded waste products can become by-products upon proper management and processing, so that an economical and environmental benefit can be obtained.

Plates 1 to 4 present some graphic display of the disposal of the EFB. Some processor, pile up the EFB in specific sites of the farm and burn then to ashes. This is a slow process and is more effective during the dry months of the year. During the rainy season, these piles absorb a lot of moisture and favor some pathogen to develop.

Burning the EFB in the incinerator requires a low level of moisture that can only be achieved during some part of the year due to the lack of proper storage conditions; however, high temperatures in the incinerator can get rid of the moisture. Composting the EFB is a very slow process due to high fiber content that resist decomposition by microorganisms; nevertheless, it can be achieved in the mid-term, providing that proper mixing and other organic materials be added. Research opportunities for several institutions to develop these technologies are important components. The author, while developing some composting with pineapple, tried EFB to mix with the pine plants, and found that high-speed choppers are needed to produce an appropriate size chunk to be composted.

Ashes from the boilers are also discarded in some instances, but in one case, it was reported that ashes were used as organic fertilizer to reduce chemical fertilizer use. Kernel shells are also discarded as the EFB. Burning of KS in the incinerator is limited to de crust formation in the burner when large quantities are used.

Non-organic Waste Disposal

Non-organic waste disposal refer in this case of plant processing, to all plastics material used in the process. In general, processing

requires little of these inputs, but some are used and reutilized several times over. Disposal is just a simple discarding in the dumping sites.

Petroleum Wastes Disposal

Petroleum waste products from processing plants arise from machinery maintenance, mainly cars, tractor. As we stated before, maintenance is done in the community small machinery shops, which they simple pour the oils into the ground at more convenient sites around their installations.

Solid-waste disposal

Machinery wears out after some time, and old parts are constantly being replaced. Old discarded parts are piled up in junkyard places where the rest of the metallic parts are stocked for that particular operation.

Threat Analysis

Palm oil plantations in the Aguán River Basin have replaced pasturelands that were left behind after the banana boom in the first part of the twenty century. The “big push” in the Low Aguán Valley, probably did not fill the expectations of many economists from the international lender institutions, which were expecting to see an ordered process and a high productive agro-export system that included palm oil and its derivatives as well as some fresh citrus fruits. Instead, a social-productive compromise has been achieved to provide an undeniable better standard of living to more than 200,000 people that live in the area and make their living in all three economical sectors of the economy-production, agro-industrial, and services. These transformations, from bananas to pastures to palm oil plantations have had an environmental cost, which may not resemble those in Malaysia or elsewhere, but may have affected all habitats from the inland ridges to the coral reef to some degree. This impact is augmenting to the point that a measurable harming level is being expressed, and if left unattended, may turn into severe threats. Sound social, economic and environmental sustainable precision systems, if not set up in place swiftly, will bring unfortunate consequences to this agricultural and marine habitats, and another boom may arise, which for sure, will not be a natural forest for future conservation. Support from all international and national organizations, from the private and public sectors willing to invest and develop scientific-based Better Management Practices are needed to be set up in place in the palm oil plantations of the Aguán River Basin.

This section presents an elaborated threat analysis based on: July 2005 field-visit findings that detected some harmful activities, analyses of several expert knowledge bases, including author’s long-term involvement in agriculture, and opportunities observed and documented for the region before and while developing this project. Thus, the following Tables 14-21 offers a preliminary

version of these warning signals that may become severe threats. The categorical estimates are a pooled judgment of the items outlined in Section VI_ Environmental impact of Agronomic and management Practices in the Palm Oil Industries in the Aguan River Basin— an expert assessment.

Description of the Variable

To measure the environmental impact a 7-variable set were used to form a threat analysis matrix discriminated by operation were constructed. These variables included:

1. Activity: It refers to specific actions executed during the field operations and disposal of waste products
2. Environmental Impact: Based on the dichotomous expressions answering the question: Does these practices have an environmental impact? Yes or Not:
3. Type of Environmental Impact: Unknown, Positive and Negative
 - *Unknown*: There are indications that an environmental impact may exist, but its type is simple unknown.
 - *Positive*: There is all expert knowledge that indicates that such practice is beneficial to the natural resources.
 - *Negative*: There is all expert knowledge that indicates that such practice possesses harmful effects to the natural resources.
4. Degree of Impact: Expert knowledge on the categorical qualification of the positive and negative impacts of the particular practice
 - *Slight*: It is a detectable minor positive or negative effect on the natural resources that under especial situational or management conditions may become a threat or a desired safety measure
 - *Moderate*: It is a modest positive or negative effect on the environment that upon certain situational or management conditions, may harm or help the natural resources becoming a threat or strong safety measure in the short time
 - *High*: It is an important negative or positive effect on the environment, which can cause significant harm or help to sustain the natural resources. This type of effect can be labeled a threat or a safety measure.

- *Very High*: A severe negative or positive effect is harmful or protective to the natural resources, and is considered a threat or a safety factor to the environment.
5. *Written Procedures*: The presence or absence of written procedures is of paramount importance to measure the potential harmful or beneficial effects of one particular practice. A written procedure is not only be useful to perform the same practice with the same precision time after time, but is needed to perform environmental audits that are required by national normative or for international certification such as ISO 14000.
 6. *National Laws*: The presence or absence or national laws and their normative documents are issues that farm and plant operators did not were aware, not even in the case that the company maintains an environmental department. Thus, the national law indicates the awareness of such laws by the personnel managing the farms and processing plants. Law enforcement, as we know in Honduras is a severe handicap to environmental issues.

Threat analysis matrices were constructed for different scenarios of the palm oil industry, that include:

- a) Nurseries. Table 14
- b) Palm oil plantation <3-year old. Table 15
- c) Palm oil plantation 4-15-year old. Table 16
- d) Palm oil plantation 16-20-year old. Table 17
- e) Palm oil plantation >21-year old. Table 18
- f) Elimination of old palm oil plantations. Table 19
- g) Palm oil plantation waste disposal. Table 20
- h) Palm oil processing plant waste disposal. Table 21

Table 14. Threat analysis in nurseries developed for the Aguán River Basin palm oil plantations, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Seed Pre-germination		X	X							1.7	98.3		X
Bag Filling	X		X							1.7	98.3		
Seed planting in Bags		X								1.7	98.3		X
Irrigation	X				X	X	X			1.7	98.3		X
Fertilization	X				X	X	X			1.7	98.3		X
Pest Control	X				X	X	X			1.7	98.3		X
Disease Control	X				X	X	X			1.7	98.3		X
Weed Control	X				X	X	X			1.7	98.3		X
Seedling Transport to the Field		X	X							1.7	98.3		X

Table 15. Threat analysis in 1-3-Years Old palm oil plantations developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law Exist	
	Yes	No	Unknown;	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Digging planting holes	X		X							1.7	98.3		X
Transplant		X								1.7	98.3		X
Disposal of plastic bags	X				X	X	X	X		1.7	98.3		X
Fertilization	X				X	X	X			1.7	98.3		X
Chemical pest control	X				X	X	X			1.7	98.3		X
Chemical disease control	X				X	X	X			1.7	98.3		X
Chemical control of rodents	X				X	X	X			1.7	98.3		X
Chemical weed control	X				X	X	X			1.7	98.3		X
Natural pasture cover	X			X		X	X	X		1.7	98.3		X
Cover Crops	X			X		X	X	X		1.7	98.3		X

Table 16. Threat analysis in 4-15-Years Old palm oil plantations developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Fertilization	X				X	X	X			1.7	98.3		X
Chemical Pest Control	X				X	X	X			1.7	98.3		X
Chemical Disease control	X				X	X	X			1.7	98.3		X
Chemical Weed Control,	X				X	X	X			1.7	98.3		X
Natural pasture cover	X			X		X	X	X		1,7	98,3		X
Cover Crops	X			X		X	X	X		1.7	98.3		X
Placing pruned leaves in field	X			X		X	X	X		1.7	98.3		X
Bunch Harvesting		X								1.7	98.3		X
Bunch Transportation		X								1.7	98.3		X

Table 17. Threat analysis in 16-20-Years Old palm oil plantations developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Fertilization	X				X	X	X			1.7	98.3		X
Chemical Pest Control	X				X	X	X			1.7	98.3		X
Chemical Disease control	X				X	X	X			1.7	98.3		X
Chemical Weed Control,	X				X	X	X			1.7	98.3		X
Natural pasture cover	X			X		X	X	X		1,7	98,3		X
Cover Crops	X			X		X	X	X		1.7	98.3		X
Placing pruned leaves in field	X			X		X	X	X		1.7	98.3		X
Bunch Harvesting		X								1.7	98.3		X
Bunch Transportation		X								1.7	98.3		X

Table 18. Threat analysis in >21-Years Old palm oil plantations developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Fertilization	X				X	X	X			1.7	98.3		X
Chemical Pest Control	X				X	X	X			1.7	98.3		X
Chemical Disease control	X				X	X	X			0.7	98.3		X
Chemical Weed Control,	X				X	X	X			1.7	98.3		X
Natural pasture cover				X		X	X	X		1.7	98.3		X
Cover Crops				X		X	X	X		1.7	98.3		X
Leave pruned and leaves them in field	X			X		X	X	X		1.7	98.3		X
Bunch Harvesting		X								1.7	98.3		X
Bunch Transportation		X								1.7	98.3		X

Table 19. Threat analysis in the elimination process of old palm oil plantations developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown;	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Chemical Dissection	X				X	X	X			1.7	98.3		X
Chopping down old trunks	X			X	X	X	X	X	X	1.7	98.3		X
Chemical application for disinfection	X				X	X	X			1.7	98.3		X

Table 20. Threat analysis for the waste disposal of palm oil plantations developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Water waste disposal	X		X							1.7	98.3		X
Organic waste disposal	X			X		X	X	X	X	1.7	98.3		X
Non-organic waste disposal	X				X	X	X	X		1.7	98.3		X
Solid Waste disposal	X				X	X	X			1.7	98.3		X
Petroleum waste disposal	X				X	X	X			1.7	98.3		X

Table 21. Threat analysis for the waste disposal of palm oil processing plants developed for the Aguán River Basin, as July 2005.

Activity	Does this practice have environmental impact?		Type of environmental impact			Degree of impact				Does a written procedure exist? (%)		Does a national law exist	
	Yes	No	Unknown	Positive	Negative	Slight	Moderate	High	Very High	Yes	No	Yes	No
Water waste disposal	X				X	X	X			1.7	98.3		X
Organic waste disposal	X				X	X	X			1.7	98.3		X
Non-organic waste disposal	X				X	X	X	X		1.7	98.3		X
Solid Waste disposal	X				X	X	X	X		1.7	98.3		X
Petroleum waste disposal	X				X	X	X	X		1.7	98.3		X

Better Management Practices

The information collected, analyzed and described earlier in this report, emphasizes the need for improving the current practices the palm oil industry in the Aguán river basin is currently implementing. To be successful, any one attempting to address intelligently this issue, must take into consideration key social, political, economic, scientific/technological, and environmental issues, altogether. Collectively, the palm oil industry in the Aguán River basin shows the following aspects based on the expert's knowledge.

Social Aspects

All social aspects within the Aguán River Basin depend on the plantation way of production. Palm Oil, Bananas, and Citrus, and to less extent, livestock and rice influence the social aspects of communities around these enterprises. In addition, the very evolutionary nature of these plantations systems have created a wide variety of organizational types that ranges from individual producer with no association at all, to cooperatives, and large corporation.

Organizational Diversity: Diversity of organizations presents advantages and disadvantages. Even though, this diversity exhibits unquestionable strengths, its weakness precludes them to carry out some activities for the good of the industry as a whole.

Political Aspects

Political Lobbying: Weak organizational structures preclude the palm oil producers to present a strong front and lobbying to obtain government financed projects and programs. This includes access to agrochemical at wholesale prices, educational programs and others.

Government Policies: Protempore, demagogic and unclear definition of government policies to support commodities that are social and economic instruments to alleviate poverty and boost agro-industries, along with reduced lobbying capacity, have created a poor but hopeful environment to implement social, economic and environmental project initiatives.

Economic Aspects

Market: Contrary to Malaysia, where a significant portion of its market is Europe, the oil produced by the Aguán River Basin palm oil industry is commercialized and utilized in Central America and Mexico's industries where consumer awareness of Better Management Practices, sustainable agriculture, and other coined environmental terms is incipient or non-existing.

Increasing contribution of Palm Oil to the GNP: Honduras' palm oil industry exported over 21 million dollars in 2004; this is an important fifth

place from a billion dollar export portfolio. Recent news on Malaysia investment in the Honduras Palm Oil, is putting pressure to augment area in the Aguán River Basin and to increase yield. Yield level, can only be increased with the use of agrochemicals such as fertilizer and this will demand more pesticides, which in turn all the moderate environmental impact of the agrochemicals will turn into a true threat.

Scientific Technological Aspects

Low-input operations: Taken as a whole, the Aguán River Basin palm oil industry has not reached a level that can be considered a threat to the habitats in the area. Nor has developed a scientific and technological approach to increase efficiency and boost sustainable production. This can be read as an opportunity to develop a sustainable research and developing system that would be the corner stone for continuing improvement and successfully deploy BMPs and reduce any threat to habitats located between the ridges and coral reef. In addition, this low use of agrochemicals together with an incipient environmental awareness stewarded by international organizations offers a fertile ground for significant improvement.

Research and Development Systems: The research and developing systems for the Palm Oil Industry in the Aguán River are not officially called as such. The R&D systems are mainly devoted to observe technology elsewhere and implementing the promising ones in their plantations and processing plants. When a promising technology is observed, is implemented by intuition. Only large companies such as Chiquita and Dole that have plantations outside the Aguán River Basin do have a serious R&D system, which is the cornerstone of all their ISO-14000 certification efforts.

International institutions have a tremendous expertise in palm oil research and together with environmental organizations can certainly develop a high sustainable productions system that complies with all environmental regulations that will significantly reduce any threat to the surrounding habitats.

Environmental Aspects

Environmental Awareness: Some industries are aware to some extent of an environmental program in their plantations, which would like to see others to follow them for whatever reasons they have. However, as we mentioned in the first item, there is a weak organizational structure, which deter this kind of initiative or any other kind of environmental implementation.

National and International Environmental Organizations: There is a wide arrange of organizations that can be reached and establish solid partnerships to develop and implement a cost efficient BMP system.

Recommended Better Practices Initiatives

Strengthen the organizations, taking into consideration their diversity and level of productions.

Develop a strong political lobbying system to upgrade the whole industry in all social, economic, scientific/technological, and environmental aspects.

Utilize all instances of government access to develop sustainable funding and technical assistance from national and international organizations

Develop consumer awareness among Mesoamerican inhabitants on production and environmental aspects of the Honduran Palm Oil industry.

Develop and implement a cost effective communication system to explain the Honduran population about the importance of the palm oil industry and its contribution to the GNP, their social and environmental impact.

Establish and fully finance a Research and Develop System focus on sustainable production.

Develop guidelines to implement written procedures for all production and processing activities.

Close monitoring the environmental variables, input use and disposal materials

Identify and develop partnership with organization that can add value to the sustainable production efforts.

Start developing certification programs to provide credible means to demonstrate social responsibility to stakeholders, stockholders, and shareholders.

ANNEXS

ANNEX 1. Questionnaire developed to collect field data in 65 palm oil exploitation/operation in June 2005.



HONDURAS
 "Desde las Montanas a los
 Arrecifes de Coral:
 Promoción de Mejores
 Practicas de Manejo entre
 los Productores de Palma
 de Aceite del Valle del
 Aguan

Sección I. Solamente para Uso de Oficina Procesadora de datos

Revisor		Digitador	
Nombre		Nombre	
Apellido		Apellido	
e-mail		e-mail	
Fecha	DD/MM	Fecha	DD/MM

FEDERACION NACIONAL DE PALMEROS DE HONDURAS
FENAPALMAH

Esta Información es estrictamente confidencial y solamente será publicada con consentimiento de las partes interesadas

Sección II. Identificación del Entrevistador

Nombre		Apellido		Fecha (DD/MM)	
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Sección III. Tipo de Objeto y Ubicación

UBICACION	Vivero	Plantación	Planta Procesadora	Rio o Quebrada 1	Rio o Quebrada 2	Lugar de Desechos	Caserío o Colonia
Nombre de la explotación							
Propietario							
Gerente/administrador/operador							
Teléfono							
Departamento							
Municipio							
Aldea							
Celular							
e-mail							
UTM1							
UTM2							
UTM3							
UTM4							
UTM5							
UTM6							

Sección IV. Características Físicas de la Explotación

Viveros

Nombre	UTM	Área	Numero de plantas	No. Plantas <1 ano	No. Plantas >1 ano
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Plantación de Palma

	UTM	Área (ha)	Rendimiento TM/ha	Producción Total 2003 (TM)	Producción Total 2004 (TM)	No. Plantas/ha
Total de Finca						
Total de Palma						
Total edad <3 anos						
Total edad 4-15						
Total edad 16-20						
Total edad <20						

Otros cultivos

	UTM	Área (ha)
Pastos		
Cítricos		
Plátanos		
Otros		

Sección V.

Identificación de prácticas de manejo y destino de productos de desecho de la Industria con esperado efecto ambiental

Químico	Productos 1	Dosis	Producto 2	Dosis	Producto 3	Dosis
Control químico de plagas						
Control químico de						
Control químico de malezas						
Control químico de roedores						
	Urea	Dosis	Formula 1	Dosis	Formula 3	Dosis
Fertilizantes químicos						
	Incorporado	Combustible	Composteado	Amontonado		
Manejo de desperdicios orgánicos						
	Amontonados	Reciclados				
Manejo de desperdicios no orgánicos						
	Combustible	Almacenados	Enviados a Recicladora			
Manejo de derivados del petróleo						
	Tratadas	Sin Tratar				
Manejo de aguas residuales						

Sección VI. Impacto Ambiental de practicas agronómicas y de manejo en la industria de palma del Valle del Aguan

Viveros

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Germinación de semilla										
Llenado de bolsas										
Siembra en bolsa										
Riego										
Fertilización										
Control de Plagas										
Control de Enfermedades										
Control de Malezas										
Transporte de Plántulas a campo										

Plantaciones 1-3 Anos

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Hoyado de campo										
Transplante										
Desecho de bolsa plástica										
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Roedores										
Control químico de Malezas										
Cobertura de pasto natural										
Siembra de cultivos de cobertura										

Plantaciones 4-15 Años

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Malezas										
Mantenimiento de cobertura de pasto natural										
Mantenimiento de cultivos de cobertura										
Podas de hojas										
Cosecha de racimos										
Transporte de racimos										

Plantaciones 16-20 años

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Malezas										
Mantenimiento de cobertura de pasto natural										
Mantenimiento de cultivos de cobertura										
Podas de hojas										
Cosecha de racimos										
Transporte de racimos										

Plantaciones >21 años

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Malezas										
Mantenimiento de cobertura de pasto natural										
Mantenimiento de cultivos de cobertura										
Podas de hojas										
Cosecha de racimos										
Transporte de racimos										

Eliminación de Plantaciones viejas

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Desecación química										
Corte de Tallos										

Plantaciones 4-15 Años

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Malezas										
Mantenimiento de cobertura de pasto natural										
Mantenimiento de cultivos de cobertura										
Podas de hojas										
Cosecha de racimos										
Transporte de racimos										

Plantaciones 16-20 años

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Malezas										
Mantenimiento de cobertura de pasto natural										
Mantenimiento de cultivos de cobertura										
Podas de hojas										
Cosecha de racimos										
Transporte de racimos										

Plantaciones >21 años

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Fertilización										
Control químico de Plagas										
Control químico de Enfermedades										
Control químico de Malezas										
Mantenimiento de cobertura de pasto natural										
Mantenimiento de cultivos de cobertura										
Podas de hojas										
Cosecha de racimos										
Transporte de racimos										

Eliminación de Plantaciones viejas

Actividad	Impacto Ambiental		Grado de Impacto				Procedimiento Escrito		Existe Legislación Nacional	
	Si	No	Leve	Moderado	Severo	Extremo	Si	No	Si	No
Desecación química										
Corte de Tallos										

ANNEX 2. Resume of Area and production characteristics 60 palm oil plantations in the Aguan River Basin from Sava to Tumbaderos. July 2005.

NAME OF THE OPERATION	ORGANIZATION/COMPANY	N ROWS	TOTAL FARM AREA (HA)	PALM OIL (HA)	PERMANENT PASTURES/ BUSHLAND (HA)	CITRUS (HA)	BASIC GRAIN (HA)	URBAN/RURAL (HA)
FINCA BUENOS AMIGOS	AGROPALMA	1	1193	991	82	0	0	0
FINCA DESPERTAR	AGROPALMA	1	566	423	126	0	0	0
FINCA GUANCHIAS	AGROPALMA	1	1637	1133	356	0	0	0
FINCA LA BREA	AGROPALMA	1	493	406	87	0	0	0
FINCA OLEICA	AGROPALMA	1	524	436	52	0	0	0
FINCA SAN ESTEBAN	AGROPALMA	1	705	570	82	0	0	0
FINCA SUYAPA	AGROPALMA	1	584	305	234	0	0	0
FINCA TRINIDAD	AGROPALMA	1	1207	584	.	0	90	0
COLONIA SABA	APROVA	1	419	251	125	0	7	44
COOPERATIVE TEPI	APROVA	1	541	243	298	0	17	0
GRUPO CHOLOMEÑA	APROVA	1	589	352	209	0	29	28
GRUPO COLONIA BAJO AGUAN	APROVA	1	678	453	200	0	17	25
GRUPO COROCITO	APROVA	1	774	242	531	0	17	0
GRUPO LAS MERCEDES	APROVA	1	488	342	71	0	0	75
GRUPO ORICA	APROVA	1	400	276	111	0	0	13
GRUPO PAGUALES	APROVA	1	443	356	74	0	0	13
GRUPO PALOS DE AGUA	APROVA	1	397	337	56	0	0	4
GRUPO SAGRADO CORAZON	APROVA	1	439	388	51	0	0	0
GRUPO VOLUNTADES UNIDAS	APROVA	1	481	336	137	0	0	8
GRUPO ZAMORA	APROVA	1	416	268	112	0	17	37
COOPERATIVE 13 DE JUNIO	COAPALMA	1	682	333	439	0	17	0
COOPERATIVE BRISAS CUAQUEÑAS	COAPALMA	1	522	415	98	0	0	9
COOPERATIVE BRISAS DE SAN PEDRO	COAPALMA	1	716	316	273	79	100	48
COOPERATIVE CHIRIPA	COAPALMA	1	426	303	116	0	0	7
COOPERATIVE COLINAS	COAPALMA	1	330	210	98	0	0	23
COOPERATIVE COLONEÑA	COAPALMA	1	944	501	443	0	17	0
COOPERATIVE GUAPINOL	COAPALMA	1	798	515	217	39	0	28
COOPERATIVE HONDURAS AGUAN	COAPALMA	1	757	397	360	0	17	0
COOPERATIVE LA BOVEDA	COAPALMA	1	575	263	312	0	9	0
COOPERATIVE NORTEÑA	COAPALMA	1	641	538	102	0	0	0
COOPERATIVE PALMICHAL	COAPALMA	1	1103	435	549	0	0	120
COOPERATIVE PERLA DEL NORTE	COAPALMA	1	395	296	75	0	0	24
COOPERATIVE PRIETA	COAPALMA	1	445	320	136	0	0	31
COOPERATIVE SAN ANTONIO DEL BRID	COAPALMA	1	588	243	345	0	17	0
FINCA BRISAS DEL AGUAN	EXPORTADORA DEL ATLANTICO	1	610	322	288	.	.	0
FINCA CAMARONES	EXPORTADORA DEL ATLANTICO	1	671	549	122	.	.	0
FINCA EL CHILE	EXPORTADORA DEL ATLANTICO	1	538	398	69	.	.	20

NAME OF THE OPERATION	ORGANIZATION/COMPANY	N ROWS	TOTAL FARM AREA (HA)	PALM OIL (HA)	PERMANENT PASTURES/ BUSHLAND (HA)	CITRUS (HA)	BASIC GRAIN (HA)	URBAN/RURAL (HA)
FINCA LA AURORA	EXPORTADORA DEL ATLANTICO	1	782	571	212	.	.	0
FINCA LA CONCEPCIÓN	EXPORTADORA DEL ATLANTICO	1	450	374	76	.	.	0
FINCA LA CONFIANZA	EXPORTADORA DEL ATLANTICO	1	953	796	157	.	.	0
FINCA LA OCCIDENTAL	EXPORTADORA DEL ATLANTICO	1	419	311	109	.	.	0
FINCA LEMPIRA	EXPORTADORA DEL ATLANTICO	1	465	350	93	.	.	23
FINCA LOS LAURELES	EXPORTADORA DEL ATLANTICO	1	529	328	183	.	.	18
FINCA PASO AGUAN	EXPORTADORA DEL ATLANTICO	1	834	609	225	.	.	0
FINCA SAN ISIDRO	EXPORTADORA DEL ATLANTICO	1	870	621	248	.	.	0
FINCA TRANSVIO	EXPORTADORA DEL ATLANTICO	1	807	668	134	.	.	5
FINCA TUMBADOR	EXPORTADORA DEL ATLANTICO	1	3413	3306	.	.	.	.
GRUPO 15 DE MAYO	GRUPO INDEPENDIENTE	1	389	337	52	0	17	0
GRUPO COLÓN	GRUPO INDEPENDIENTE	1	347	282	66	0	50	0
GRUPO LOS LEONES	GRUPO INDEPENDIENTE	1	653	467	186	0	17	0
GRUPO LUXON PALMERAS	GRUPO INDEPENDIENTE	1	512	342	162	.	.	9
GRUPO UNION SAN FRANCISCO	GRUPO INDEPENDIENTE	1	403	199	202	.	.	2
VARIOS EN BONITO ORIENTAL	INDEPENDENT A	1	670	402	.	.	.	.
VARIOS EN SONAGUERA	INDEPENDENT B	1	250	100	.	.	.	.
BETWEEN SAVA-TOCOA	INDEPENDIENT C	1	73	44	.	.	.	.
INSTITUTO NACIONAL AGRARIO	INSTITUTO NACIONAL AGRARIO	1	57	15	30	.	.	12
COOPERATIVE SALAMA	SALAMA	1	891	774	88	50	60	0
FINCA MOCHITO Y QUEBRADA HONDA	SOCIEDAD IMPALMA	1	1118	861	257	0	0	0
REMOLINOS	SOCIEDAD IMPALMA	1	1281	1143	139	0	0	0
UNIVERSIDAD NACIONAL CURLA	UNIVERS. NACIONAL CURLA	1	207	138	69	.	.	0

ANNEX 3. Summary of palm area 60 farms by age in the Aguan River Basin. Area under study include palm field from Sava to Tumbaderos, as July 2005.

NAME OF THE OPERATION	ORGANIZATION/COMPANY	N	PALM AREA (HA)	PALM AGE < 3 YEAR (HA)	PALM AGE 4-15 YEAR (HA)	PALM AGE 16- 20 YEAR (HA)	PALM AGE > 20 YEAR (HA)
FINCA BUENOS AMIGOS	AGROPALMA	1	991	51	436	0	0
FINCA DESPERTAR	AGROPALMA	1	423	0	382	38	0
FINCA GUANCHIAS	AGROPALMA	1	1133	15	580	0	0
FINCA LA BREA	AGROPALMA	1	406	208	153	39	0
FINCA OLEICA	AGROPALMA	1	436	0	458	0	0
FINCA SAN ESTEBAN	AGROPALMA	1	570	6	540	16	0
FINCA SUYAPA	AGROPALMA	1	305	0	383	0	0
FINCA TRINIDAD	AGROPALMA	1	584	0	570	0	.
COLONIA SABA	APROVA	1	251	210	105	20	57
COOPERATIVE TEPI	APROVA	1	243	0	174	47	104
GRUPO CHOLOMEÑA	APROVA	1	352	90	116	154	0
GRUPO COLONIA BAJO AGUAN	APROVA	1	453	0	5	0	112
GRUPO COROCITO	APROVA	1	242	0	50	0	83
GRUPO LAS MERCEDES	APROVA	1	342	0	19	0	240
GRUPO ORICA	APROVA	1	276	0	111	58	101
GRUPO PAGUALES	APROVA	1	356	4	38	3	119
GRUPO PALOS DE AGUA	APROVA	1	337	0	74	0	132
GRUPO SAGRADO CORAZON	APROVA	1	388	0	107	9	153
GRUPO VOLUNTADES UNIDAS	APROVA	1	336	0	99	0	102
GRUPO ZAMORA	APROVA	1	268	8	136	8	60
COOPERATIVE 13 DE JUNIO	COAPALMA	1	333	0	121	32	163
COOPERATIVE BRISAS CUAQUEÑAS	COAPALMA	1	415	0	229	0	138
COOPERATIVE BRISAS DE SAN PEDRO	COAPALMA	1	316	0	190	33	71
COOPERATIVE CHIRIPA	COAPALMA	1	303	0	220	40	19
COOPERATIVE COLINAS	COAPALMA	1	210	0	167	27	40
COOPERATIVE COLONEÑA	COAPALMA	1	501	0	386	29	108
COOPERATIVE GUAPINOL	COAPALMA	1	515	0	271	23	219
COOPERATIVE HONDURAS AGUAN	COAPALMA	1	397	0	228	8	145
COOPERATIVE LA BOVEDA	COAPALMA	1	263	0	140	20	76
COOPERATIVE NORTEÑA	COAPALMA	1	538	0	436	48	134
COOPERATIVE PALMICHAL	COAPALMA	1	435	0	173	0	129
COOPERATIVE PERLA DEL NORTE	COAPALMA	1	296	47	165	0	108
COOPERATIVE PRIETA	COAPALMA	1	320	0	146	53	79
COOPERATIVE SAN ANTONIO DEL BRID	COAPALMA	1	243	0	129	10	115
FINCA BRISAS DEL AGUAN	EXPORTADORA DEL ATLANTICO	1	322	.	.	.	.
FINCA CAMARONES	EXPORTADORA DEL ATLANTICO	1	549	.	.	.	.
FINCA EL CHILE	EXPORTADORA DEL ATLANTICO	1	398	.	.	.	.
FINCA LA AURORA	EXPORTADORA DEL ATLANTICO	1	571	.	.	.	.

NAME OF THE OPERATION	ORGANIZATION/COMPANY	N	PALM AREA (HA)	PALM AGE < 3 YEAR (HA)	PALM AGE 4-15 YEAR (HA)	PALM AGE 16- 20 YEAR (HA)	PALM AGE > 20 YEAR (HA)
FINCA LA CONCEPCIÓN	EXPORTADORA DEL ATLANTICO	1	374	.	.	.	.
FINCA LA CONFIANZA	EXPORTADORA DEL ATLANTICO	1	796	.	.	.	.
FINCA LA OCCIDENTAL	EXPORTADORA DEL ATLANTICO	1	311	.	.	.	.
FINCA LEMPIRA	EXPORTADORA DEL ATLANTICO	1	350	.	.	.	.
FINCA LOS LAURELES	EXPORTADORA DEL ATLANTICO	1	328	.	.	.	.
FINCA PASO AGUAN	EXPORTADORA DEL ATLANTICO	1	609	.	.	.	.
FINCA SAN ISIDRO	EXPORTADORA DEL ATLANTICO	1	621	.	.	.	.
FINCA TRANSVIO	EXPORTADORA DEL ATLANTICO	1	668	.	.	.	.
FINCA TUMBADOR	EXPORTADORA DEL ATLANTICO	1	3306	.	.	.	.
GRUPO 15 DE MAYO	GRUPO INDEPENDIENTE	1	337	0	170	212	0
GRUPO COLÓN	GRUPO INDEPENDIENTE	1	282	0	150	0	110
GRUPO LOS LEONES	GRUPO INDEPENDIENTE	1	467	0	108	162	270
GRUPO LUXON PALMERAS	GRUPO INDEPENDIENTE	1	342	.	.	.	.
GRUPO UNION SAN FRANCISCO	GRUPO INDEPENDIENTE	1	199	.	.	.	.
VARIOS EN BONITO ORIENTAL	INDEPENDENT A	1	402	.	.	.	.
VARIOS EN SONAGUERA	INDEPENDENT B	1	100	.	.	.	.
BETWEEN SAVA-TOCOA	INDEPENDENT C	1	44	.	.	.	.
INSTITUTO NACIONAL AGRARIO	INSTITUTO NACIONAL AGRARIO	1	15	.	.	.	15
COOPERATIVE SALAMA	SALAMA	1	774	138	436	111	88
FINCA MOCHITO Y QUEBRADA HONDA	SOCIEDAD IMPALMA	1	861	32	510	251	0
REMOLINOS	SOCIEDAD IMPALMA	1	1143	278	298	243	0
UNIVERSIDAD NACIONAL CURLA	UNIVER. NACIONAL CURLA	1	138	.	.	.	138

ANNEX 4. Summary of palm oil production facts of 60 farms in the Aguan River Basin. Area under study include palm field from Sava to Tumbaderos, as July 2005

NAME OF THE OPERATION	ORGANIZATION/COMPANY	FARM N	PALM AREA (HA)	PALM AGE 4-15 YEARS (HA)	PALM AGE 16-20 YEARS (HA)	PALM AGE > 20 YEARS (HA)	PLANT POPULATION (NO./HA)	YIELD BUNCH (TM/HA)	BUNCH PRODUCTION 2004 TM)
BETWEEN SAVA-TOCOA	INDEPENDENT C	1	44	.	.	.	.	.	.
COLONIA SABA	APROVA	1	251	105	20	57	143	10	3920
COOPERATIVE 13 DE JUNIO	COAPALMA	1	333	121	32	163	143	10	3164
COOPERATIVE BRISAS CUAQUEÑAS	COAPALMA	1	415	229	0	138	143	10	3668
COOPERATIVE BRISAS DE SAN PEDRO	COAPALMA	1	316	190	33	71	143	8	2358
COOPERATIVE CHIRIPA	COAPALMA	1	303	220	40	19	143	10	2786
COOPERATIVE COLINAS	COAPALMA	1	210	167	27	40	143	10	2344
COOPERATIVE COLONEÑA	COAPALMA	1	501	386	29	108	143	10	5226
COOPERATIVE GUAPINOL	COAPALMA	1	515	271	23	219	143	15	7689
COOPERATIVE HONDURAS AGUAN	COAPALMA	1	397	228	8	145	143	18	6848
COOPERATIVE LA BOVEDA	COAPALMA	1	263	140	20	76	143	8	1895
COOPERATIVE NORTEÑA	COAPALMA	1	538	436	48	134	143	10	6185
COOPERATIVE PALMICHAL	COAPALMA	1	435	173	0	129	143	10	3012
COOPERATIVE PERLA DEL NORTE	COAPALMA	1	296	165	0	108	143	20	6390
COOPERATIVE PRIETA	COAPALMA	1	320	146	53	79	143	10	2779
COOPERATIVE SALAMA	SALAMA	1	774	436	111	88	143	18	13919
COOPERATIVE SAN ANTONIO DEL BRID	COAPALMA	1	243	129	10	115	143	10	2540
COOPERATIVE TEPI	APROVA	1	243	174	47	104	143	12	3900
FINCA BRISAS DEL AGUAN	EXPORTADORA DEL ATLANTICO	1	322	.	.	.	143	18	.
FINCA BUENOS AMIGOS	AGROPALMA	1	991	436	0	0	70	18	8768
FINCA CAMARONES	EXPORTADORA DEL ATLANTICO	1	549	.	.	.	143	18	.
FINCA DESPERTAR	AGROPALMA	1	423	382	38	0	109	18	7554
FINCA EL CHILE	EXPORTADORA DEL ATLANTICO	1	398	.	.	.	143	18	.
FINCA GUANCHIAS	AGROPALMA	1	1133	580	0	0	120	18	10701
FINCA LA AURORA	EXPORTADORA DEL ATLANTICO	1	571	.	.	.	143	18	.
FINCA LA BREA	AGROPALMA	1	406	153	39	0	110	18	7201
FINCA LA CONCEPCIÓN	EXPORTADORA DEL ATLANTICO	1	374	.	.	.	143	18	.
FINCA LA CONFIANZA	EXPORTADORA DEL ATLANTICO	1	796	.	.	.	143	18	.
FINCA LA OCCIDENTAL	EXPORTADORA DEL ATLANTICO	1	311	.	.	.	143	18	.
FINCA LEMPIRA	EXPORTADORA DEL ATLANTICO	1	350	.	.	.	143	18	.
FINCA LOS LAURELES	EXPORTADORA DEL ATLANTICO	1	328	.	.	.	143	18	.
FINCA MOCHITO Y QUEBRADA HONDA	SOCIEDAD IMPALMA	1	861	510	251	0	137	16	12692
FINCA OLEICA	AGROPALMA	1	436	458	0	0	130	18	8240
FINCA PASO AGUAN	EXPORTADORA DEL ATLANTICO	1	609	.	.	.	143	18	.
FINCA SAN ESTEBAN	AGROPALMA	1	570	540	16	0	116	18	10126
FINCA SAN ISIDRO	EXPORTADORA DEL ATLANTICO	1	621	.	.	.	143	18	.
FINCA SUYAPA	AGROPALMA	1	305	383	0	0	97	18	6887
FINCA TRANSVIO	EXPORTADORA DEL ATLANTICO	1	668	.	.	.	143	18	.
FINCA TRINIDAD	AGROPALMA	1	584	570	0	.	109	18	10256

<i>NAME OF THE OPERATION</i>	<i>ORGANIZATION/COMPANY</i>	<i>FARM</i>	<i>PALM AREA (HA)</i>	<i>PALM AGE 4-15 YEARS (HA)</i>	<i>PALM AGE 16-20 YEARS (HA)</i>	<i>PALM AGE > 20 YEARS (HA)</i>	<i>PLANT POPULATION (NO./HA)</i>	<i>YIELD BUNCH (TM/HA)</i>	<i>BUNCH PRODUCTION 2004 TM)</i>
<i>FINCA TUMBADOR</i>	<i>EXPORTADORA DEL ATLANTICO</i>	<i>1</i>	<i>3306</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>
<i>GRUPO 15 DE MAYO</i>	<i>GRUPO INDEPENDIENTE</i>	<i>1</i>	<i>337</i>	<i>170</i>	<i>212</i>	<i>0</i>	<i>143</i>	<i>10</i>	<i>3820</i>
<i>GRUPO CHOLOMEÑA</i>	<i>APROVA</i>	<i>1</i>	<i>352</i>	<i>116</i>	<i>154</i>	<i>0</i>	<i>143</i>	<i>10</i>	<i>3600</i>
<i>GRUPO COLONIA BAJO AGUAN</i>	<i>APROVA</i>	<i>1</i>	<i>453</i>	<i>5</i>	<i>0</i>	<i>112</i>	<i>143</i>	<i>8</i>	<i>937</i>
<i>GRUPO COLÓN</i>	<i>GRUPO INDEPENDIENTE</i>	<i>1</i>	<i>282</i>	<i>150</i>	<i>0</i>	<i>110</i>	<i>143</i>	<i>8</i>	<i>2080</i>
<i>GRUPO COROCITO</i>	<i>APROVA</i>	<i>1</i>	<i>242</i>	<i>50</i>	<i>0</i>	<i>83</i>	<i>143</i>	<i>8</i>	<i>1061</i>
<i>GRUPO LAS MERCEDES</i>	<i>APROVA</i>	<i>1</i>	<i>342</i>	<i>19</i>	<i>0</i>	<i>240</i>	<i>143</i>	<i>8</i>	<i>2075</i>
<i>GRUPO LOS LEONES</i>	<i>GRUPO INDEPENDIENTE</i>	<i>1</i>	<i>467</i>	<i>108</i>	<i>162</i>	<i>270</i>	<i>143</i>	<i>14</i>	<i>7560</i>
<i>GRUPO LUXON PALMERAS</i>	<i>GRUPO INDEPENDIENTE</i>	<i>1</i>	<i>342</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>
<i>GRUPO ORICA</i>	<i>APROVA</i>	<i>1</i>	<i>276</i>	<i>111</i>	<i>58</i>	<i>101</i>	<i>143</i>	<i>8</i>	<i>2160</i>
<i>GRUPO PAGUALES</i>	<i>APROVA</i>	<i>1</i>	<i>356</i>	<i>38</i>	<i>3</i>	<i>119</i>	<i>143</i>	<i>8</i>	<i>1306</i>
<i>GRUPO PALOS DE AGUA</i>	<i>APROVA</i>	<i>1</i>	<i>337</i>	<i>74</i>	<i>0</i>	<i>132</i>	<i>143</i>	<i>8</i>	<i>1647</i>
<i>GRUPO SAGRADO CORAZON</i>	<i>APROVA</i>	<i>1</i>	<i>388</i>	<i>107</i>	<i>9</i>	<i>153</i>	<i>143</i>	<i>8</i>	<i>2150</i>
<i>GRUPO UNION SAN FRANCISCO</i>	<i>GRUPO INDEPENDIENTE</i>	<i>1</i>	<i>199</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>
<i>GRUPO VOLUNTADES UNIDAS</i>	<i>APROVA</i>	<i>1</i>	<i>336</i>	<i>99</i>	<i>0</i>	<i>102</i>	<i>143</i>	<i>8</i>	<i>1606</i>
<i>GRUPO ZAMORA</i>	<i>APROVA</i>	<i>1</i>	<i>268</i>	<i>136</i>	<i>8</i>	<i>60</i>	<i>143</i>	<i>8</i>	<i>1700</i>
<i>INSTITUTO NACIONAL AGRARIO</i>	<i>INSTITUTO NACIONAL AGRARIO</i>	<i>1</i>	<i>15</i>	<i>.</i>	<i>.</i>	<i>15</i>	<i>.</i>	<i>.</i>	<i>.</i>
<i>REMOLINOS</i>	<i>SOCIEDAD IMPALMA</i>	<i>1</i>	<i>1143</i>	<i>298</i>	<i>243</i>	<i>0</i>	<i>143</i>	<i>18</i>	<i>14728</i>
<i>UNIVERSIDAD NACIONAL CURLA</i>	<i>UNIVER. NACIONAL CURLA</i>	<i>1</i>	<i>138</i>	<i>.</i>	<i>.</i>	<i>138</i>	<i>.</i>	<i>.</i>	<i>.</i>
<i>VARIOS EN BONITO ORIENTAL</i>	<i>INDEPENDENT A</i>	<i>1</i>	<i>402</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>
<i>VARIOS EN SONAGUERA</i>	<i>INDEPENDENT B</i>	<i>1</i>	<i>100</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>	<i>.</i>

ANNEX 5. Disposal system used in most of the Palm Oil Industry in the Aguán River Basin to dispose for organic wastes, water effluents, and solid non-organic waste as July 2005.



Plate 1. Organic waste from processing plant dumping Site



Plate 2. Organic waste from processing plant dumping Site



Plate 3. Organic waste from processing plant dumping Site



Plate 4. Organic waste from processing plant dumping Site



Plate 5. Water discharge effluent



Plate 6... Water discharge effluent



Plate 7. Water collection site



Plate 8. Water collection site



Plate 9. Water collection site



Plate 10. Water collection lagoon



Plate 11. Non-solid waste dumping site



Plate 12. "Recycling" of agrochemical containers



Plate 13. Palm oil extraction plant



Plate 14. Palm oil extraction plant



Plate 15. Palm oil extraction plant



Plate 16. Palm oil extraction plant



Plate 17. Palm oil extraction plant



Plate 18. New generation of palm oil producers



Plate 19. Ing. Elbyn Ramirez, member of the data collection team.



Plate 20. Nestor Meneses (right), member of the data collection team.