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THE PSU RUBBER AND ABACA PLANTATION PROJECT'S CONTRIBUTION TO THE ECOLOGICAL ENHANCEMENT OF ITS ADJOINING BARANGAYS IN RIZAL, PALAWAN

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ABSTRACT

This paper highlights the rubber and abaca plantation's contribution to the ecological enhancement of its adjoining barangays in Rizal, Palawan, namely Bgy Candawaga and Bgy Calusian particularly on species richness and plant diversity of the plantation area, the buffer zones and the farm-to-market road leading to the plantation. Data were gathered using transect walk, quadrat sampling and observation method. It also verified the results of an earlier study that compared the perceived ecological condition of the adjoining communities before and after the establishment of the Project in terms of instances of soil erosion, frequency of slash-and-burn farming (swidden agriculture), cases of illegal logging, and diversity. Respondents believed that these four areas have improved with the establishment of the plantation. Study results revealed that species richness and plant diversity in the areas along the FMR were highest, followed by those in the buffer zones. The rubber plantation was understandably lowest in species richness and plant diversity. But as perceived by the indigenous people respondents, the plantation had attracted more animal that prefer trees as habitats.

Keywords: rubber plantation; plant diversity; ecological enhancement; indigenous people

1. INTRODUCTION

Soil erosion is still one of the worst environmental problems. Smith and Smith (2004) maintained that loss of top soil continues to increase as human population growth forces agriculture to move into marginal, erodible land. The province of Palawan is no exception. The Mt. Mantalingahan, towering over Palawan at 6,800 feet above sea level, is the largest source of income of 98 percent of the indigenous people (IP) in the Palawan Province (Docto 2015). This is because the IP communities living within and near the MMPL consider the conventional method and indigenous knowledge in farming and gathering of forest products as their main means of livelihood (Philippine Clearing House Mechanism for Biodiversity 2015). However, since its proclamation as a protected area by President Gloria Macapagal Arroyo in 2009, the mountain, now known as the Mt. Mantalingahan Protected Landscape (MMPL), has been formally provided with protection including resource management, scientific monitoring, and a zoning system (Delos Santos 2009). Since then, local government officials and various government and non-government agencies have introduced interventions aimed at providing training and education for residents that would give them alternative sources of income that do not depend heavily on resource extraction and which are not harmful to the environment. Palawan State University for its part established a rubber and abaca plantation in two of the barangays encompassing the MMPL --- the Barangays Candawaga and Culasian situated in the Municipality of Rizal. These barangays are home to one of the indigenous cultural communities or ethno linguistic groups in the Province known as *Palaw'an.* Like many other IPs residing in MMPL, this tribe rely heavily on farming, poaching and gathering of forest products. Docto (2014) reported that among the indigenous people in the Province, the *Palaw'ans* constituted the majority of 84.2 percent. In his study describing this tribe's agricultural practices, he cited farming as the main source of *Palaw'ans'* livelihood within the area. "Nine percent of the residents are using traditional or labor-intensive method of farming, while majority (84.8%) are practicing the slash-and-burn or *kaingin* method (Docto 2015). The problem is that when soil becomes exposed and unprotected by vegetation through plowing, kaingin, logging or grazing, especially when rugged and sloping, it cannot maintain its integrity. Stripped off of its protective vegetation, it becomes exposed to forces of rainwater and wind, making it vulnerable to erosion that will subsequently destroy natural and agricultural ecosystems (Smith & Smith 2014).

Figure 1: Among the indigenous people in the Palawan Province, the Palaw'an tribe constitute the majority of 84.2 percent (Docto, 2015).

1.1 Background about the PSU SIFMA Project

The rubber and abaca plantation of Palawan State University located in Bgys. Candawaga and Culasian, Rizal, Palawan was established following the granting of a 321.92 -ha ancestral land by the DENR to PSU in 2006. The project was conceived not only for the purpose of generating additional revenues for the University and to increase income of the community. It primarily serves as a demo-farm to nearby communities to capacitate the IP farmers with the basics of rubber and abaca production and management through technology transfer and at the same time motivate them to engage in rubber and abaca production in their own farms (DBP Forest Project Appraisal 2006). By giving them alternative means of livelihood and diverting their interests to rubber and abaca farming, the project is hoped to help rehabilitate denuded lands and reduce illegal forest activities particularly *kaingin*. Also part of the major objectives was for the University to conduct research, and a continuing capability development (through extension programs) to facilitate the adoption of the Project activities by trainees, and the improvement of livelihood means of upland dwellers.

Figure 2: The Project serves as a demo-farm to nearby communities to capacitate the IP farmers with the basics of rubber and abaca production and management through technology transfer.

The rubber and abaca plantation project was established in 2006 with the following objectives: 1) to establish and maintain rubber and abaca plantation for rehabilitation of denuded areas; 2) to generate additional sources of income and livelihood opportunities for people in the uplands through rubber and abaca production and processing; 3) to source out additional income for PSU to augment its operating budget; 4) to enhance/improve capabilities of farmers through adoption of new skills and technology; 5) to enhance rubber and abaca productivity in the province by encouraging community partners to engage in rubber and abaca farming; and 6) to conduct research and continuing capability development (extension) activities that will facilitate adoption of the technology and other extension interventions introduced**.**

Figure 3: One main objective of the Project was to establish and maintain rubber and abaca plantation for rehabilitation of denuded areas. Pictures (right) show areas that have fully recovered from kaingin and logging operations in the past.

Now on its 9th year, some rubber trees have grown into tappable sizes. The University at present is tapping 2,500 trees which are being processed into air dried sheets (ADS). The project has so far successfully established and maintained a 70-hectare rubber and abaca plantation, and has clearly attained to a certain extent some objectives related to socio-economic enhancement of the indigenous people in the adjacent barangays as project beneficiaries. These include generation of additional sources of income and livelihood opportunities for people in the uplands through rubber and abaca production and processing; improvement of capabilities of farmers through adoption of new skills and technology); and conduct of a continuing capability development (extension) activities that will facilitate adoption of the technology and other extension interventions introduced. The objectives related to ecological enhancement of the areas, however, has not yet been clearly studied and documented. This paper focuses on the role of the project in the ecological enhancement of the adjoining areas. The researchers find this necessary to gather information as to whether the Project, through rehabilitation of once denuded lands is supporting forest sustainability through its contribution in addressing the problems on soil erosion; slash and burn farming; illegal logging; and biodiversity. Furthermore, since the establishment of the plantation is undeniably a form of disturbance which by species flow principle can cause sensitive species to decrease in distribution while favoring the spread of other species into disturbed areas (Forman & Godron 1986), the researchers wish to find out whether indeed the Project, like other reported cases of rubber growing, does create a potential threat to biodiversity loss (Nair 2015).

1.2 Objectives of the Study

This paper aims to determine the ecological contribution of the PSU SIFMA project in the IP communities in Bgys. Candawaga and Culasian, Rizal Palawan.

Specifically, the paper aims to determine the PSU-SIFMA's contribution to the improvement of the adjoining areas in terms of the following environmental concerns:

1. Instances of soil erosion;
2. Frequency of slash and burn farming;
3. Cases of illegal logging; and
4. Plant diversity

Figure 4: Now on its 9th year, some rubber trees have grown into tappable sizes and PSU is now producing rubber sheets from its harvests.

2. PROJECT METHODOLOGY

A total of 43 household heads residing in the adjacent barangays of Candawaga and Culasian, Rizal, Palawan were randomly chosen as respondents of the first study aimed at getting the Perceived Level of Success of the PSU-SIFMA Project. This was facilitated by getting the impression of the respondents before and after the establishment of the rubber and abaca plantation project. This first study employed a descriptive method of research using a survey questionnaire intended to get the perception of the respondents about the level of success of the Project; the respondents' attitude toward environmental conservation and their impression about their surroundings in terms of instances of soil erosion, frequency of slash and burn farming, cases of illegal logging and plant diversity before and after the establishment of the plantation. Data were analyzed and interpreted using frequency counts and percentages. A focus group discussion was also conducted to verify the individual answers on the questionnaire.

Figure 5: The study was facilitated by getting the impression of the IPs about their surroundings before and after the establishment of the project and by computing the biodiversity index of the plantation and its adjacent areas.

To support the claims of the perceptions of the respondents on the contribution of the project on plant diversity, another study was conducted to gather biophysical data intended to estimate species richness and plant diversity in three areas: the rubber plantation, the farm-to-market road and the buffer zones of the rubber plantation. Data to determine species richness and plant diversity were gathered by using 1,000–meter transect walk, quadrat sampling and observation method. Species richness was estimated by simply listing the plant species and their corresponding number per species per quadrat without accounting the patchiness of the sample areas. This is considering that ecological density that requires determining the living space portion of a habitat is difficult and rarely employed (Smith & Smith 2004).

Data to determine plant diversity of the above areas were gathered using the same methods. Three quadrats measuring 5x5 meters at 350-meter intervals were set-up within the 1,000 meters in each of the three areas considered as sampling units, namely: near the farm-to-market road leading the project site (Area 1), within the plantation (Area 2), and in the buffer zones of the plantation (Area 3). The buffer zone sampling quadrats that were determined by dividing the 1,000-meter transect walk into three sub-areas fall near the river bank, near the water falls, and the boundary between the mountain and the rubber plantation. Plant species of each quadrat were photographed, recorded and counted to determine species richness. Number of individuals per species was counted to serve as input in the computation for plant diversity. The pictures of each plant species were labeled first with vernacular names as known to the indigenous people and were later used as reference for further labeling using their scientific names. The scientific names were determined using the help of a plant botanist/taxonomist commissioned for the purpose. To get the biodiversity, data were analyzed using Simpson's diversity index. Computed biodiversity indices of each quadrat per area were averaged, the result of which were considered biodiversity of each of the three sampling areas.

Figure 6: To determine the Project's contribution to species richness and biodiversity, some sampling were set up in the buffer areas that fall near the waterfalls, the river bank and the core zone. Considered core zone areas were those that were not touched and left for natural forest regeneration.

3. RESULTS AND DISCUSSION

In a survey conducted by the Extension Services Office in July and August 2014 to get the perception of the IP community on the Perceived Level of Success of the Project, results (Table 1) showed that out of the randomly chosen 43 household heads, 37.2% of the respondents believed that the project is moderately successful while another 32.6% believed that it is very successful. Only three (7%) think it is not. The rest (13.96%), however, refused to give an assessment.

Table 1: Level of Success of the SIFMA Project as Perceived by the IP Community

Perceived Level of Success	Frequency	Percentage (%)
Very Successful	14	32.56
Moderately Successful	16	37.21
Not Successful	7	16.27
No Idea	6	13.96
TOTAL	**43**	**100.00**

Asked as to the bases of their opinion, many answered that the number of trees had increased and many of the once grasslands are now vegetated with trees. Erosion, slash and burn and logging activities were also said to have been controlled. This is not to mention the fact that many who have been trained have now more stable source of income as workers of the PSU plantation or elsewhere.

Table 2: Indigenous Peoples' Perceived Uses of the Forest

Perceived Forest Use*	Frequency	Percentage
Source of Food	38	88.4 %
Source of Wood (for building houses)	37	86.05 %
Source of Firewood (cooking and charcoal making)	36	83.72 %
Source of drinking water	33	76.7%
Home to wildlife	32	74.4%
Helps control soil erosion	31	72.09%

***** *multiple answers***

When asked what to them are the uses of the forests, top three answers (Table 2) were: source of food e.g. fruits, vegetables(88.4%) which respondents either use for their own consumption or sell to people in the lowlands; source of wood and other materials in building houses (86.04%); and source of firewood for cooking and charcoal making (83.72%). Many also consider the forest as source of drinking water (76.7%) and as home to birds and wildlife (74.4%). Some 72.09% also understood that forest can help lessen soil erosion. This means the partner communities do understand the value of forests in helping them and other creatures in the environment survive. To compare the perceived environmental condition of the community before and after the establishment of the PSU-SIFMA project, the respondents were asked about their perception of the environment now particularly in terms of instances of soil erosion, frequency of slash and burn (*pagkakaingin*), cases of illegal logging and biodiversity compared with how their environment was few years back before the establishment of the PSU project.

The respondents believed soil erosion problems in the community had decreased due to the Project as shown in Table 3. Unlike before when there were many sites in the area with eroded soil, soil erosion at present has practically been eliminated. Asked about possible reasons, many think it is because there are already more trees at present. The Project employs contour farming using rubber, abaca, indigenous forest trees, and cash crops in vulnerable slopes.The increased interest in planting rubber trees among neighboring farmers, and the prohibition of cutting of trees and slash and burn farming especially within the SIFMA area were also cited as among the reasons.

Table 3: Respondents' View as to Whether the Project had Helped Lessen Soil Erosion

Perception as to Whether the Project has Helped Lessen Instances of Soil Erosion	Frequency	Percentage
Yes	28	65.12 %
No	12	27.9 %
Don't Know	3	6.98 %
TOTAL	**43**	**100.00 %**

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In terms of slash and burn (*pagkakaingin*), 31 household respondents (72.09%) viewed the project to have lessened slash and burn farming while only 8 or 18.60% claimed it has not. The view of this majority was confirmed during a separate key informant interview with several farmers who said that *pagkakaingin* in the past was more rampant and unrestrained, it being part of their culture and their means of living. Asked as to the frequency of doing it, kaingin according to them used to be done at no particular period or month of the year. This is unlike today when slash and burn activities are more controlled because monitoring is more frequent especially with the establishment of a feeder road. Asked to expound what is meant by "controlled kaingin," the farmer workers of PSU explained in a focus group discussion that *kaingin* these recent years is only done during the month of January, when most farmers clean their farms. This is supported by Docto's study (2015) which cited that the present practice is that this tribe's slash and burn an average of one hectare only, a size just enough to plant crops that could supplement their earnings from the plantation. Docto (2015) added that for them, *pagkakaingin* now is performed as more of a part of their cultural practice rather than being the main source of food and income.

Table 4: Respondents' View as to Whether the Project had Helped Lessen *Pagkakaingin* or Slash and Burn Farming

Perception as to Whether the Project has Helped Lessen Frequency of *Pagkakaingin*	**Frequency**	**Percentage**
Yes	31	72.09 %
No	8	18.60 %
Don't Know	4	9.30 %
TOTAL	**43**	**99.99 %**

Asked whether the SIFMA Project has helped in the control of wildlife poaching and illegal logging in adjoining areas, a majority of 32 household head respondents (74.42%) believed the Project had helped in the control of wildlife poaching and illegal logging within the Project site (Table 4). A small portion of seven respondents (16.28%), however, argued that logging activities are still present because sound of chainsaws, allegedly cutting trees, are still heard from a distance. But they clarified that these alleged logging activities are apparently outside the Project area already, or in adjacent barangays.

Table 5: Respondents' View as to Whether the Project had Helped Control Illegal Logging

Perception as to Whether the Project has Helped Control Cases of Illegal Logging	**Frequency**	**Percentage**
Yes	32	74.42 %
No	7	16.28 %
Don't Know	4	9.30 %
TOTAL	**43**	**100.00 %**

As to the respondents' assessment about biodiversity, around 67% believed that compared with few years ago before the establishment of the PSU project, more birds, monkeys, snakes and squirrels are seen living in the wild or visiting the vegetated and shrubby areas within their vicinity now (Table 6). Another 26%, however, believed that there is no clear difference in terms of biodiversity before and after the establishment of PSU project. The rest (7%) did not give any assessment.

Table 6: Respondents' View as to Whether the Project had Helped Increase Biodiversity

Perception as to Whether the Project has Helped Improve Plant Diversity	**Frequency**	**Percentage**
Yes	29	67.44 %
No	11	25.58%
Don't Know	3	6.98 %
TOTAL	**43**	**100.00 %**

Figure 7: Some of the plant species spotted at the sampling areas along the farm-to-market road as unique and not observed in the other sampling areas.

Figure 8: Some of the insects spotted at the sampling areas along the farm-to-market road as unique and not observed in the other sampling areas.

To verify the views of the IP respondents on the Project's contribution to plant species richness and plant diversity, another study was conducted using the more scientifically acceptable methods, particularly transect walk, quadrat sampling and observation method. Table 7 shows that plant species richness in the sampling units along the farm-to-market-road (FMR) had the highest average of 25.33, followed by those in the buffer zones (river, falls and mountain areas) which had an average of 17 species. This result supports the view of Forman and Godron (1986) that a single disturbance (like the establishment of the farm-to-market road to and from the plantation), causes a large increase in the rate of immigration because immigrating species enter the patch and then spread into the matrix, simply enriching the species. The buffer zones, in contrast, being undisturbed, would not be experiencing this, and hence its number of species tends to be in the equilibrium.

On the other hand, the plantation area, which was once grasslands that had been converted into rubber plantation, was understandably lowest in species richness at 13. Although the plantation is not really a monoculture (being an intercrop of rubber, abaca, indigenous trees and high value fruit trees), it is still an introduced or planted patch, hence rubber and the other planted crops would naturally exert a dominating and continuing effect on the patch. It is perhaps for the same reason that Forman and Godron (1986) underscored that human-introduced patches and species are "among the most widespread on earth" (Marrschber, 1959 as cited by Forman and Godron, 1986). Furthermore, chronic disturbance by human, through regular maintenance of the plantation, will obviously prevent other native and immigrating species from growing. But due to the increase in vegetation, animals (e.g. skunk, snakes and several kinds of birds, squirrels, bull frogs,) are more frequently observed in the rubber plantation areas as claimed by the IP respondents. Wild pigs are less frequently seen nowadays but this they said are due to hunting activities done by both IPs and nonIPs in the past.

Table 7: Species Richness of the Plantation and Adjacent Areas

Sampling Areas	Quadrat 1	Quadrat 2	Quadrat 3	Mean
Area 1: Along the FMR	31	35	10	25.33
Area 2: Rubber plantation	14	7	18	13.00
Area 3: Buffer Zones	17	21	14	17.33

However, species richness as a measure on its own, takes no account on the number of individuals of each present species (www.rewardinglearning.org). To take into account the abundance of each species and determine which among the sampling areas are more diverse, plant diversity was calculated using Simpson's index. Table 8 below shows that among the three areas sampled, the farm-to-market-road leading to the plantation is most diverse with a biodiversity index of .099. This means that among the three, it is the area near the FMR that has the greatest number of growing species at the time of the study. This may be because despite the fact that the natural ecosystem was also disturbed with the construction of the road leading to the plantation site, the disruption was less likely to be not as damaging to the general environment or ecosystem as a whole as it happened only once and the area has already recovered or is recovering.

Forman and Godron (1986) explanation on "edge effect" also sheds light on the above results. The establishment of the FMR or feeder road creates an "edge" defined in landscape ecology as "an outer band of a patch that has an environment significantly different from the interior of the patch." The edge effect or relative abundance in the outer band of the patch (in this case the FMR) happen due to the higher light availability at the edge and due to the reduced plant competition on the open side. This according to the authors explains why generally a patch, with an open space on one side or surrounding, has denser vegetation than the patch interior.

Meanwhile, the rubber plantation, being a planted patch, may be better tree-vegetated but land cover is dominated by the same species --- the rubber trees, hence has the lowest plant diversity index of .303. In planted patches, the species dynamics and patch turnover according to Forman and Godron (1986) depend largely upon the chronic disturbance or maintenance activities of people. For example, if there is no regular weeding or regular use of pathways between trees by workers maintaining the plantation, the patch (in this case the rubber plantation) will be invaded by species from the matrix, and succession and ultimate disturbance of the patch will follow. The only difference is that the introduced species (the rubber seedlings after planting) may remain dominant for a long time and therefore retard the successional process.

Table 8. Plant Biodiversity of the Plantation and Adjacent Areas

Sampling Areas	Quadrat 1	Quadrat 2	Quadrat 3	Mean
Along the FMR	0.060	0.068	0.171	0.099
Rubber plantation	0.227	0.540	0.141	0.303
Buffer Zones	0.024	0.120	0.174	0.106

In terms of their assessment of the environment in general, Table 9 below shows that majority of the respondents (79%) generally perceived it to have improved compared with how it was when there was no PSU-SIFMA project yet or when many of the areas were mere brushlands that are more susceptible to soil erosion and when slash and burn farming and cutting of trees for varied purposes were more rampant and uncontrolled.

Table 9. Respondents' View as to Whether the Project had Improved the General Environment of the Community

Perception as to Whether the Project has Improved the General Environment of the Community	Frequency	Percentage
Yes	34	79.07 %
No	6	13.95%
Don't Know	3	6.98 %
TOTAL	**43**	**100.00 %**

4. SUMMARY AND CONCLUSION

The establishment of the rubber and abaca plantation of the University in Bgys. Candawaga and Culasian, Rizal, has ecologically improved a considerable area that were once grasslands. This is by establishing a rubber and abaca plantation in 70 hectares that has also become a substantial source of income of the dwellers. In terms of environmental benefits, the project is perceived by the dwellers as having improved the adjoining areas in terms of instances of soil erosion, frequency of slash and burn farming, cases of illegal logging, and animal diversity due to increase in vegetation. Furthermore, richness and plant diversity of the adjoining areas showed that the establishment of the farm-to-market-road from the plantation to the highway had not decreased plant richness and diversity. On the other hand, due to regular human activity in the plantation (e.g. regular maintenance and harvest of latex), species richness and plant diversity are lowest among the three sampling areas. But since the plantation is an intercrop, (it being an intercrop of rubber and abaca), the researchers believe its effect to diversity is not as much as when it was a monocrop. Moreover, due to increase in tree vegetation, it had attracted more birds and other animals that favor trees rather than grasslands and shrubs as habitats. The project had been found to be beneficial environmentally and economically by the IP dwellers.

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ATTACHMENT A: Species Richness for Quadrats along the Farm to Market Road

Plants (local names) in Quadrats 1-3 along the Farm to Market Road		
Quadrat 1 (32 species)	**Quadrat 2** (35 species)	**Quadrat 3** (10 species)
1. Andarasahan	1. Ablas	1. Aron-aron
2. Antataba	2. Alawna	2. Buyan
3. Antotopo	3. Andadalog	3. Dalapas
4. Aremuchakan	4. Balin	4. Dunkalang
5. Balik-sumpa	5. Banga	5. Gahid
6. Banag	6. Basak	6. Lumot
7. Banang namog	7. Bawing-bawing	7. Pako-pako
8. Bariri	8. Bulno	8. Palo-palo
9. Baybay	9. Burirawan	9. Purdaw
10. Dogkatan	10. Burukan	10. Tukod biskar
11. Dulayday	11. Busukan	
12. Galapas	12. Buyan	
13. Gangas	13. Dogkatan	
14. Hubaran	14. Dugyan	
15. Kalalambuto	15. Ginoo	
16. Kamoteng kahoy	16. Haba-haba	
17. Kanet-kanet	17. Kalasa	
18. Kogon	18. Kandong	
19. Kurundaw	19. Korondaw	
20. Labasbuto	20. Lindagong	
21. Lanoy	21. Mag arit-arit	
22. Lapinig	22. Maglapaan	
23. Mag aret-aret	23. Magponti	
24. Maglunawan	24. Malakugon	
25. Ogtap	25. Mangga-mangga	
26. Pako-pako	26. Manggis	
27. Palo-palo	27. Maraparay	
28. Pilonghat	28. Muloknog	
29. Purokidong	29. Ogtap	
30. Tagap (Marang)	30. Sapok-sapok	
31. Togbak	31. Tabag	
32. Urdakan	32. Tagop	
	33. Tambirsi	
	34. Taulay	
	35. Ubaran	

ATTACHMENT B: Species Richness for Quadrats inside the Rubber Plantation

Plants (local names) in Quadrats 4-6 inside the rubber plantation		
Quadrat 4 (15 species)	**Quadrat 5** (7 species)	**Quadrat 6** (18 species)
1. Bakong-bakong	1. Anibok	1. Badak
2. Balingad	2. Apitong	2. Bakong-bakong
3. Banuat limat	3. Asang-asang	3. Bali-bali
4. Bunsikag	4. Bakong-bakong	4. Balinad
5. Buyan	5. Banga	5. Banga
6. Gagamba	6. Baroung-barong	6. Baras
7. Gahid	7. Pakpak Lawin	7. Bariri
8. Galapas		8. Bonching
9. Ipusan		9. Bulalan
10. Kamagong		10. Buyo Talon
11. Kayuyubang		11. Galapas
12. Mag arit-arit		12. Lakogon
13. Sagit-sagit		13. Manggagabi
14. Tabo		14. Manggis
15. Tagbak		15. Pako
		16. Palong-palo
		17. Pik pik
		18. Tabo

ATTACHMENT C: Species Richness for Quadrats inside the Rubber Plantation

Plants (local names) in Quadrats 7-9 in the buffer zones		
Quadrat 7 (17 species)	**Quadrat 8** (21 species)	**Quadrat 9** (14 species)
1. Antotopo	1. Ablas	1. Kamote
2. Baras	2. Antotopo	2. Galapas
3. Baslay-baslay	3. Banag	3. Labneng
4. Bukagan	4. Basak	4. Lalasboto
5. Dila-sapi	5. Baslay	5. Wag
6. Dungkalaw	6. Boras	6. Banag
7. Gahid	7. Burokan	7. Kanit-kanit
8. Galapas	8. Galapas	8. Tagong yaman
9. Gangas	9. Kalasa	9. Magkaram
10. Hagonoy	10. Kandis	10. Maglunawan
11. Ipusan	11. Kandis-kandis	11. Tagbak
12. Kanit-kanit	12. Launa	12. Piawas
13. Kopol-kopol	13. Lawag	13. Tabo-tabo
14. Makahiya (patay-patay)	14. Malakogon	14. Pinggan-pinggan
15. Pako-pako	15. Malbak	
16. Romaraw	16. Pikat	
17. Tagbak	17. Pilanghat	
	18. Rimaraw (manga-manga)	
	19. Samok	
	20. Tagbak	
	21. Tiawas	

ATTACHMENT D. COMPUTED PLANT BIODIVERSITY OF QUADRATS ALONG FARM TO MARKET ROAD

QUADRANT 1			QUADRANT 2			QUADRANT3		
Species	Frequency	Percentage	Species	Frequency	Percentage	Species	Frequency	Percentage
Dulayday	15	11.53846154	Ogtap	5	5.376344086	Dunkalang	26	25.2427184
Labasbuto	4	3.076923077	Ubaran	3	3.225806452	Purdaw	1	0.97087379
Pako-pako	8	6.153846154	Tambirsi	1	1.075268817	Gahid	13	12.6213592
Galapas	6	4.615384615	Andadalog	1	1.075268817	Aron-aron	3	2.91262136
Hubaran	2	1.538461538	Manggis	1	1.075268817	Buyan	2	1.94174757
Maglunawan	1	0.769230769	Maraparay	1	1.075268817	Tukod biskar	24	23.3009709
Palo-palo	2	1.538461538	Malakugon	1	1.075268817	Pako-pako	11	10.6796117
Antotopo	6	4.615384615	Lindagong	15	1.075268817	Palong-palo	17	16.5048544
Kamoteng kahoy	1	0.769230769	Tabag	1	16.12903226	Dalapas	5	4.85436893
Urdakan	3	2.307692308	Kurundaw	1	1.075268817	Lumot	1	0.97087379
Gangas	2	1.538461538	Burirawan	4	1.075268817			
Andarasahan	5	3.846153846	Alawna	1	4.301075269			
Baybay	2	1.538461538	Bulno	1	1.075268817			
Pilonghat	4	3.076923077	Kandong	3	1.075268817			
Togbak	1	0.769230769	Dugyan	2	3.225806452			
Ogtap	1	0.769230769	Banga	1	2.150537634			
Mag aret-aret	5	3.846153846	Kalasa	1	1.075268817			
Kurundaw	1	0.769230769	Dogkatan	1	1.075268817			
Aremuchakan	1	0.769230769	Muloknog	1	1.075268817			
Lanoy	2	1.538461538	Taulay	1	1.075268817			
Balik-sumpa	1	0.769230769	Ginoo	1	1.075268817			
Kogon	5	3.846153846	Tagop	22	1.075268817			
Bariri	12	9.230769231	Magponti	2	23.65591398			
Purok idong	16	12.30769231	Basak	4	2.150537634			
Kanet-kanet	14	10.76923077	Buyan	1	4.301075269			
Banag	2	1.538461538	Busukan	1	1.075268817			
Antataba	1	0.769230769	Mag arit-arit	4	1.075268817			
Banang namog	3	2.307692308	Maglapaan	2	4.301075269			
Kalalambuto	1	0.769230769	Ablas	1	2.150537634			
Lapinig	1	0.769230769	Bawing-bawing	1	1.075268817			
Tagap (Marang)	1	0.769230769	Burukan	4	1.075268817			
Dogkatan	1	0.769230769	Mangga-mangga	1	4.301075269			
			Balin	1	1.075268817			
			Sapok-sapok	1	1.075268817			
			Haba-haba	1	1.075268817			
TOTAL	**130**	**100**		**93**	**100**		**103**	**100**
Computed Biodiversity per Quadrat		**0.060**			**0.068**			**0.171**
OVER-ALL COMPUTED BIODIVERSITY MEAN (Q1,2 and3)								**0.099**

ATTACHMENT E. COMPUTED PLANT BIODIVERSITY OF QUADRATS IN THE RUBBER PLANTATION

QUADRANT 4			QUADRANT 5			QUADRANT 6		
Species	**Frequency**	**Percentage**	**Species**	**Frequency**	**Percentage**	**Species**	**Frequency**	**Percentage**
Buyan	8	5.442176871	Bakong-bakong	35	72.91666667	Pik pik	1	0.78740157
Tabo	1	0.680272109	Baroung-barong	2	4.166666667	Bonching	2	1.57480315
Mag arit-arit	10	6.802721088	Anibok	3	6.25	Bakong-bakong	18	14.1732283
Gagamba	1	0.680272109	Banga	5	10.41666667	Palo-palo	9	7.08661417
Kayuyubang	3	2.040816327	Apitong	1	2.083333333	Tabo	40	31.496063
Tagbak	8	5.442176871	Asang-asang	1	2.083333333	Banga	1	0.78740157
Banuat limat	60	40.81632653	Pakpak Lawin	1	2.083333333	Pako	1	0.78740157
Ipusan	10	6.802721088			100	Baras	7	5.51181102
Sagit-sagit	1	0.680272109				Balinad	9	7.08661417
Galapas	32	21.76870748				Galapas	2	1.57480315
Balingad	1	0.680272109				Manggagabi	13	10.2362205
Kamagong	4	2.721088435				Badak	1	0.78740157
Gahid	3	2.040816327				Buyo Talon	7	5.51181102
Bunsikag	2	1.360544218				Bariri	10	7.87401575
Bakong-bakong	3	2.040816327				Manggis	1	0.78740157
						Bali-bali	2	1.57480315
						Bulalan	2	1.57480315
						Lakogon	1	0.78740157
TOTAL	**147**	**100**		48	**100**		**127**	**100**
Computed Biodiversity per Quadrat		**0.227**			**0.540**			**0.141107362**
OVER-ALL COMPUTED BIODIVERSITY MEAN (Q4,5 and6)								**0.303**

ATTACHMENT F. COMPUTED PLANT BIODIVERSITY OF QUADRATS IN THE BUFFER AREAS

QUADRANT 7			QUADRANT 8			QUADRANT 9		
Species	**Frequency**	**Percentage**	**Species**	**Frequency**	**Percentage**	**Species**	**Frequency**	**Percentage**
Romaraw	5	2.994011976	Galapas	14	18.91891892	Kamote	10	17.8571429
Dungkalaw	2	1.19760479	Boras	20	27.02702703	Galapas	12	21.4285714
Baslay-baslay	8	4.790419162	Ablas	2	2.702702703	Labneng	1	1.78571429
Makahiya (patay-patay)	3	1.796407186	Kandis-kandis	1	1.351351351	Lalasboto	2	3.57142857
Bukagan	11	6.586826347	Antotopo	1	1.351351351	Wag	2	3.57142857
Antotopo	6	3.592814371	Lawag	2	2.702702703	Banag	2	3.57142857
Kanit-kanit	100	59.88023952	Rimaraw (manga-manga)	2	2.702702703	Kanit-kanit	11	19.6428571
Ipusan	1	0.598802395	Pilanghat	2	2.702702703	Tagong yaman	2	3.57142857
Baras	1	0.598802395	Baslay	6	8.108108108	Magkaram	1	1.78571429
Galapas	20	11.9760479	Launa	2	2.702702703	Maglunawan	3	5.35714286
Pako-pako	1	0.598802395	Basak	3	4.054054054	Tagbak	2	3.57142857
Dila-sapi	2	1.19760479	Samok	2	2.702702703	Piawas	1	1.78571429
Tagbak	1	0.598802395	Malakogon	1	1.351351351	Tabo-tabo	6	10.7142857
Hagonoy	1	0.598802395	Tiawas	1	1.351351351	Pinggan-pinggan	1	1.78571429
Kopol-kopol	3	1.796407186	Banag	2	2.702702703			
Gahid	1	0.598802395	Tagbak	6	8.108108108			
Gangas	1	0.598802395	Kandis	1	1.351351351			
			Burokan	1	1.351351351			
			Malbak	2	2.702702703			
			Kalasa	2	2.702702703			
			Pikat	1	1.351351351			
TOTAL	**167**	**100**		**74**	**100**		**56**	**100**
Computed Biodiversity per Quadrat		**0.024**			**0.120**			**0.123**
OVER-ALL COMPUTED BIODIVERSITY MEAN (Q 7, 8 and 9)								**0.106**