PROJECT DESIGN DOCUMENT UNDER CLIMATE, COMMUNITY AND BIODIVERSITY STANDARDS
Edition 01

Forest Carbon Project in Quirino Province
Sierra Madre Biodiversity Corridor, Luzon, Philippines

May 2010

Conservation International

PROJECT DESIGN DOCUMENT UNDER CLIMATE, COMMUNITY AND BIODIVERSITY STANDARDS Edition 01

Forest Carbon Project in Quirino Province
Sierra Madre Biodiversity Corridor, Luzon, Philippines

CONTENTS

List of Figures

List of Tables

List of Appendices

I. General Section:

G1 Original Conditions at the Project Site (Required)

G.1.1 Describe the location of the project and basic physical parameters (e.g., soil, geology, climate).

The project with a total area of 177 hectares is situated in the towns of Maddela and Nagtipunan, province of Quirino, Philippines (Figure 1). It is a composite of 108 parcels of lands under the category of "forestland" (in contrast to privately owned lands). For their detailed locations, see Section G.3.3.

The project is partly within the Quirino Protected Landscape which forms part of the Sierra Madre Biodiversity Corridor. This corridor covers approximately 1.7 million hectares and one of the most biologically important areas in the Philippines as it includes 15% of the remaining closed canopy *Dipterocarp* forests in country as well as 47% of the remaining mossy forests. Aside from the diverse habitat types, the corridor is also home to the endangered Philippine eagle and Philippine crocodile.

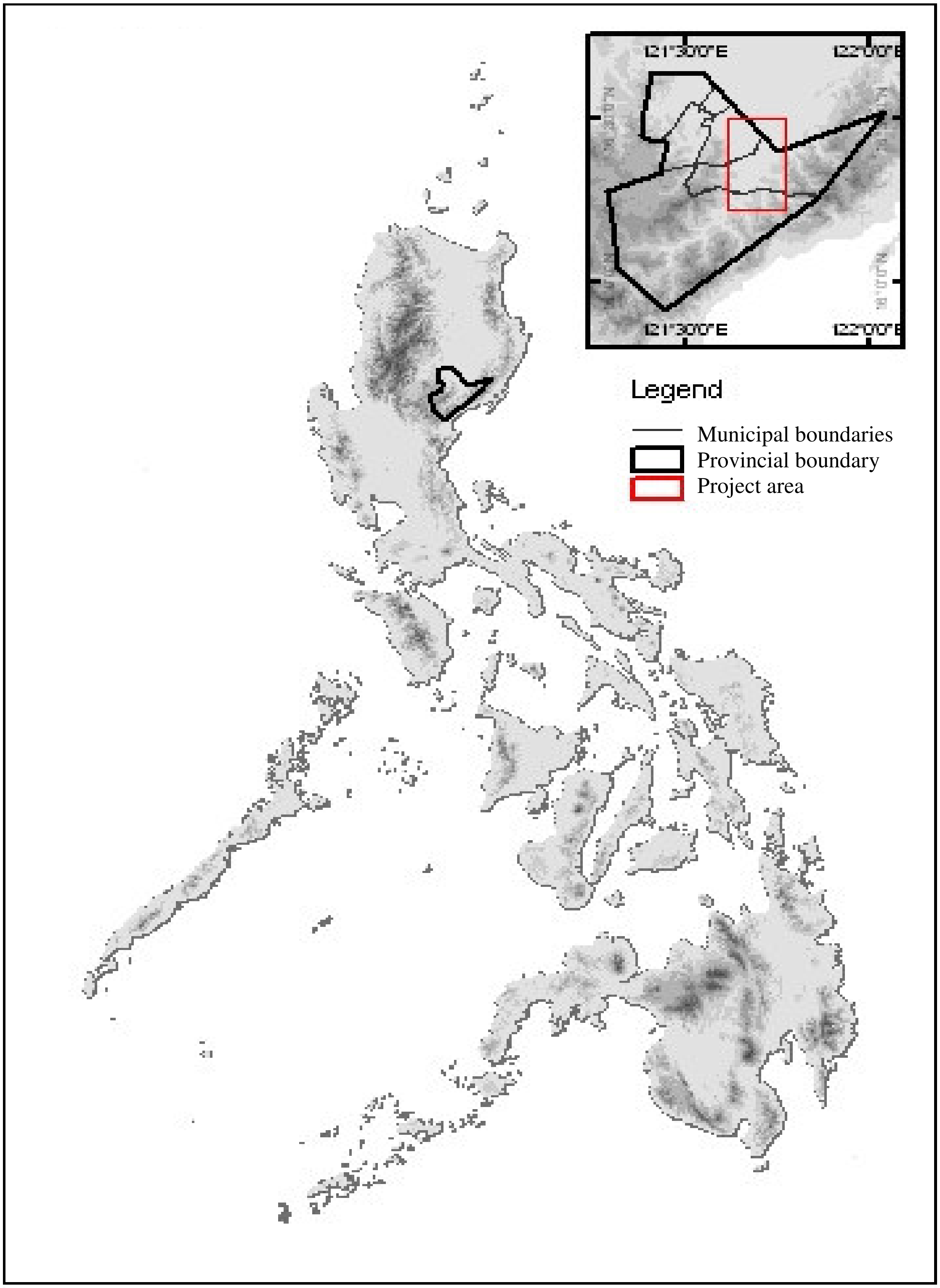


Figure 1. General location of the project site

Topography
The project site is characterized by rolling to mountainous terrain with an elevation ranging from 100 m. as to 700 m. with slopes ranging from 18 % to 50 %. The specific elevation and slope class distribution and description by area and percentage coverage of the drainage area shall be determined.

Climate
Quirino Province has a mean annual temperature of 26.6°C with a mean maximum of 32.6°C and a minimum of 22.2°C. On the average, January is the coolest month, while the warmest month is May with a mean temperature of 30.3°C. Annual rainfall within the Province ranges from less than 1,500 mm to over 2,100 mm at the southernmost border to Aurora Province. The driest area of Quirino Province is the northeast portion towards the Cagayan River Valley whereas the other parts of the lowland areas receive up to 1,700 mm (e.g., near Diffun). Rainfall distribution is not constant throughout the years.

Two agro-climatic regions were identified in the Quirino-Region, namely moist and dry zones. The moist zone is characterized by an annual rainfall from 1,500 to 2,500 mm and a growing period of 210-270 days. This zone covers most of the present agricultural and expansion areas in the lowland, upland and hilly areas. It represents by far the largest area of the province. These moist conditions are a good indication that only moderate moisture deficit exists during the dry season. As such, it could sustain maximum production through careful planning and crop adjustments taking into consideration moisture availability.

Soil
Soils in the area come in various types. In lowland areas, soil types include the Maligaya clay loam, Quinga clay loam, and Quinga silt loam. In gently sloping areas, San Manuel silt loam dominates the area. Bolinao clay loam and Cauayan clay loam are found in slightly sloping to rolling areas. In steep areas are Rugao clay and Rugao sandy loam , while in very steep slopes, soil types include Luisiana clay loam, Luisiana Anna complex, undifferentiated mountain soils, and Faraon clay (ICRAF and CIP, 2005; RP-German CFPQ, 2003).

Major and Minor River Tributaries
There are two major rivers in the area that traverse the project site; these are Addalam and Upper Cagayan River. Minor tributaries of the Addalam River composed of Angad and Tabanuang creeks; for the Upper Cagayan River are the Ngilinan River and Tungcab River. These rivers all drain towards the Cagayan River, the longest river system in the country.

Land Use and Land Cover
Land use and land cover of the project can be classified into: open or grassland and cropland, plantation crops, mixed crop, cultivated area, and built-up area. See also Section G.1.2 below.

G.1.2 Describe the types and condition of vegetation at the project site

Originally, the vegetative cover of the project site composed mainly of Dipterocarp-Molave forest with patches of grassland. However, through time and series of human intervention and disturbances the natural/old growth forest was converted into grassland and shrubland dominated by lesser-used species, and croplands mainly for corn and banana. Grassland is dominated by cogon, runo and bikal.

Table 1 shows the current land-use type of each participating parcel, as well as its size, owner's association, and land-holding information. Croplands are agricultural land, including banana plantation and land under fallow for less than three years. Grasslands are grazing land and idle land without woody bush.

Table 1. Description of participating land parcels

Lot ID	Barangay	Area (ha)	Peoples Organization (PO)	Landowners/ CSC holders	Year to renew CSC	Vegetation	Year to plant
Agroforestry							
A01	Sangbay, Nagtipunan	1.3	SUBEFO	CSC	2012	cropland	2010
A02	Sangbay, Nagtipunan	0.7	SUBEFO	CSC	2010	cropland	2010
A03	Sto Nino, Maddela	1.3	STISFA	CSC	2014	cropland	2009
A04	Divisoria Sur, Maddela	0.8	DSAFA	CSC	2013	cropland	2007
A05	Sto Nino, Maddela	1.0	STISFA	CSC	2014	cropland	2009
A06	Sto Nino, Maddela	1.7	STISFA	CSC	2014	cropland	2009
A07	Cofcaville, Maddela	2.5	DSAFA	CSC	2013	cropland	2009
A08	Divisoria Sur, Maddela	2.1	DSAFA	Private Land Owner/A and D		cropland	2007
A09	Sto Nino, Maddela	0.9	STISFA	CSC	2014	cropland	2009
A10	Sto Nino, Maddela	0.4	STISFA	CSC	2014	cropland	2009
A11	Sangbay, Nagtipunan	0.5	SUBEFO	CSC	2012	cropland	2010
A12	Cofcaville, Maddela	0.6	DSAFA	CSC	2013	cropland	2010
A13	Sto Nino, Maddela	0.5	STISFA	CSC	2015	cropland	2009
A14	Sto Nino, Maddela	0.5	STISFA	CSC	2016	cropland	2009
A15	Divisoria Sur, Maddela	0.9	DSAFA	CSC	2013	cropland	2010
A16	Divisoria Sur, Maddela	3.0	DSAFA	CSC	2013	cropland	2010
A17	Divisoria Sur, Maddela	1.3	DSAFA	CSC	2013	cropland	2010
A18	Sto Nino, Maddela	0.1	STISFA	CSC	2014	cropland	2010
A19	Sto Nino, Maddela	0.6	STISFA	CSC	2013	cropland	2010
A20	Cofcaville, Maddela	0.4	DSAFA	CSC	2013	cropland	2010
A21	Sto Nino, Maddela	0.3	STISFA	CSC	2017	cropland	2009
A22	Sto Nino, Maddela	0.2	STISFA	CSC	2018	cropland	2009
A23	Sto Nino, Maddela	0.6	STISFA	CSC	2019	cropland	2009
Reforestation							
R01-	Divisoria Sur,	4.8	DSAFA	CSC	2013	cropland	2007

R03	Maddela						
R04	Sangbay, Nagtipunan	0.9	SUBEFO	CSC	2011	grassland	2010
R05	Sto Nino, Maddela	0.6	STISFA	CSC	2014	cropland	2009
R06	Divisoria Norte, Maddela	0.7	DSAFA	CSC	2013	cropland	2009
R07	Sto Nino, Maddela	0.8	STISFA	CSC	2014	cropland	2009
R08	Sto Nino, Maddela	0.6	STISFA	CSC	2014	cropland	2009
R09	Sto Nino, Maddela	0.8	STISFA	CSC	2014	cropland	2009
R10	Sto Nino, Maddela	2.6	STISFA	CSC	2014	cropland	2009
R11	Sto Nino, Maddela	0.6	STISFA	CSC	2014	cropland	2009
R12	Cofcaville, Maddela	4.5	DSAFA	CSC	2014	cropland	2009
R13	Sto Nino, Maddela	2.6	STISFA	CSC	2014	cropland	2009
R14	Cofcaville, Maddela	3.1	DSAFA	CSC	2014	cropland	2009
R15	Sto Nino, Maddela	2.0	STISFA	CSC	2014	cropland	2009
R16	Sangbay, Nagtipunan	1.1	SUBEFO	CSC	2013	cropland	2010
R17	Cofcaville, Maddela	1.6	DSAFA	CSC	2013	cropland	2010
R18	Sangbay, Nagtipunan	1.1	SUBEFO	CSC	2011	grassland	2010
R19	Cofcaville, Maddela	1.1	DSAFA	CSC	2013	cropland	2010
R20	Sangbay, Nagtipunan	4.2	SUBEFO	CSC	2012	cropland	2010
R21	Sangbay, Nagtipunan	0.5	SUBEFO	CSC	2013	cropland	2010
R22	Sangbay, Nagtipunan	1.5	SUBEFO	CSC	2013	grassland	2010
R23	Sangbay, Nagtipunan	3.4	SUBEFO	CSC	2014	grassland	2010
R24	Sangbay, Nagtipunan	3.1	SUBEFO	CSC	2014	grassland	2010
R25	Sangbay, Nagtipunan	2.9	SUBEFO	CSC	2013	cropland	2010
R26	Cofcaville, Maddela	0.6	DSAFA	CSC	2015	cropland	2010
R27	Sto Nino, Maddela	2.4	STISFA	CSC	2014	cropland	2010
R28	Sangbay, Nagtipunan	3.5	SUBEFO	CSC	2012	cropland	2010
R29	Cofcaville, Maddela	0.6	DSAFA	CSC	2013	cropland	2010
R30	Sangbay, Nagtipunan	2.8	SUBEFO	CSC	2014	cropland	2010
R31	Cofcaville, Maddela	6.1	DSAFA	CSC	2012	cropland	2010
R32	San Salvador, Maddela	12.8	DSAFA	Private Land Owner/A and D		grassland	2010

R33	Sangbay, Nagtipunan	2.4	SUBEFO	CSC	2012	grassland	2010
R34	Sangbay, Nagtipunan	1.8	SUBEFO	CSC	2012	grassland	2010
R35	Sangbay, Nagtipunan	1.4	SUBEFO	CSC	2012	cropland	2010
R36	Sto Nino, Maddela	0.6	STISFA	CSC	2014	cropland	2010
R37	Sto Nino, Maddela	1.3	STISFA	CSC	2014	cropland	2010
R38	Sangbay, Nagtipunan	3.7	SUBEFO	CSC	2014	cropland	2010
R39	Cofcaville, Maddela	1.7	DSAFA	CSC	2013	cropland	2010
R40	Cofcaville, Maddela	0.6	DSAFA	CSC	2013	cropland	2010
R41	Sangbay, Nagtipunan	0.4	SUBEFO	CSC	2011	cropland	2010
R42	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2015	grassland	2010
R43	Sangbay, Nagtipunan	3.8	SUBEFO	CSC	2015	cropland	2010
R44	Sangbay, Nagtipunan	1.3	SUBEFO	CSC	2011	cropland	2010
R45	Sto Nino, Maddela	1.0	STISFA	CSC	2014	cropland	2010
R46	Sto Nino, Maddela	0.7	STISFA	CSC	2014	cropland	2010
R47	Sto Nino, Maddela	4.2	STISFA	CSC	2014	cropland	2010
R48	Sto Nino, Maddela	1.6	STISFA	CSC	2014	cropland	2010
R49	Sto Nino, Maddela	1.4	STISFA	CSC	2014	cropland	2010
R50	Sto Nino, Maddela	0.9	STISFA	CSC	2014	cropland	2010
R51	Cofcaville, Maddela	2.6	SUBEFO	CSC	2013	grassland	2010
R52	Sangbay, Nagtipunan	2.7	SUBEFO	CSC	2014	grassland	2010
R53	Sangbay, Nagtipunan	2.5	SUBEFO	CSC	2010	cropland	2010
R54	Sto Nino, Maddela	2.4	STISFA	CSC	2015	cropland	2010
R55	Sangbay, Nagtipunan	2.2	SUBEFO	CSC	2014	cropland	2010
R56	Sangbay, Nagtipunan	1.9	SUBEFO	CSC	2013	cropland	2010
R57	Sto Nino, Maddela	2.1	STISFA	CSC	2014	cropland	2010
R58	Sangbay, Nagtipunan	2.0	SUBEFO	CSC	2011	grassland	2010
R59	Sangbay, Nagtipunan	2.0	SUBEFO	CSC	2010	grassland	2010
R60	Cofcaville, Maddela	2.0	DSAFA	CSC	2009	grassland	2010
R61	Sangbay, Nagtipunan	2.0	SUBEFO	CSC	2014	grassland	2010
R62	Sangbay, Nagtipunan	1.8	SUBEFO	CSC	2014	cropland	2010

R63	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2012	cropland	2010
R64	Sangbay, Nagtipunan	1.5	SUBEFO	CSC	2010	grassland	2010
R65	Sangbay, Nagtipunan	1.5	SUBEFO	CSC	2009	grassland	2010
R66	Cofcaville, Maddela	1.4	DSAFA	CSC	2013	grassland	2010
R67	Sangbay, Nagtipunan	1.4	SUBEFO	CSC	2015	cropland	2010
R68	Sangbay, Nagtipunan	1.4	SUBEFO	CSC	2010	cropland	2010
R69	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2011	cropland	2010
R70	Sto Nino, Maddela	1.4	STISFA	CSC	2013	cropland	2010
R71	Sangbay, Nagtipunan	1.3	SUBEFO	CSC	2010	grassland	2010
R73	Sangbay, Nagtipunan	1.2	SUBEFO	CSC	2011	cropland	2010
R74	Sangbay, Nagtipunan	1.2	SUBEFO	CSC	2009	grassland	2010
R75	Sangbay, Nagtipunan	1.2	SUBEFO	CSC	2014	cropland	2010
R76	Sangbay, Nagtipunan	0.9	SUBEFO	CSC	2012	cropland	2010
R77	Sangbay, Nagtipunan	1.1	SUBEFO	CSC	2012	cropland	2010
R78	Sangbay, Nagtipunan	1.1	SUBEFO	CSC	2010	cropland	2010
R79	Sangbay, Nagtipunan	1.1	SUBEFO	CSC	2012	cropland	2010
R80	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2011	cropland	2010
R81	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2012	cropland	2010
R82	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2012	grassland	2010
R83	Sangbay, Nagtipunan	1.0	SUBEFO	CSC	2009	grassland	2010
R84	Sangbay, Nagtipunan	0.9	SUBEFO	CSC	2014	cropland	2010
R85	Sangbay, Nagtipunan	0.7	SUBEFO	CSC	2014	cropland	2010
R87	Sangbay, Nagtipunan	0.8	SUBEFO	CSC	2011	grassland	2010

** DSAFA: Divisoria Sur Agroforestry Farmers Association; STISFA: Sto. Nino Integrated Social Forestry Association; SUBEFO: Sangbay Upper Basin Ecological Farmers Organization.*
*** CSC: Certificate of Stewardship Contract; A and D: Alienable and Disposable (meaning private land).*

G.1.3 Current carbon stocks at the project site(s), using methodologies from the Intergovernmental Panel on Climate Change's Good Practice Guidance (IPCC GPG) or other internationally approved methodologies (e.g. from the CDM Executive Board):

From the carbon stock study of the area containing the project area (ICRAF, 2006; Appendix 1), biomass data for grassland, cornland, and agroforestry were used to calculate existing biomass (in tCO2e). The biomass of banana was estimated from data for the agroforestry sites in which banana dominated (4 out of 10 sites surveyed). The unit biomass (sum of above- and belowground biomass) was estimated by the upper 95% confidence intervals at 30.00 tCO_2e/ha for cornfield, 77.45 tCO_2e/ha for banana plantation, and 42.17 tCO_2e/ha for grassland (meaning not corn or banana). With these values, combined with estimate of proportion of these land-use types in each parcels, the current carbon stock at the project parcels with total area of 177 hectares was estimated at 8,306.6 tCO2e.

G.1.4 Describe communities located in and around the project area, including basic socioeconomic information (using appropriate methodologies such as the livelihoods framework).

The population of Quirino Province as of the year 1995 census is 131,119, with a density of roughly 43 persons per square kilometer of land, and population growth rate of 2.81%. In comparison, in the town of Maddela where the project area is located, the total population is recorded at 28,645, which is 22% of the total population of Quirino. Sixty-nine percent of the town population lives in rural areas. Population density is 44 persons per square kilometer while population growth rate is a little bit lower than that of the province at 2.54%.

In 2006, a household interview survey was conducted, which was responded by 498 residents including 210 residents from Maddela, as well as from adjacent municipalities of Aglipay (245) and Nagtipunan (43) (the full report in Appendix 2). A majority (69%) of the respondents reported that they were native to the area, and 78% of migrants had lived in the area over 15 years. The main results relating to socioeconomic information are provided below.

Virtually all residents engage in farming as their primary occupation (Table 2). The income level is low, and 46% derived PhP 70,000 (approximately US$1500) or less (Table3). This indicates that many people in the area lived below subsistence level. Sixteen percent (78/498) reported having secondary occupations, and 2% (9/498) having tertiary occupations.

Table 2. Primary occupation of the respondents from Maddela, Aglipay and Nagtipunan, Quirino Province

Occupation	Frequency	%
Farming	476	95.58
Carpentry	2	0.40
Store keeping	2	0.40
Furniture making	2	0.40
Concrete production	1	0.20
Teaching	2	0.40
Tailoring	1	0.20
Govt employee	9	1.81
Store owner	2	0.40
Driving	1	0.20
Total	**498**	100.00

Table 3. Annual income from the primary occupation of the respondents from Maddela, Aglipay and Nagtipunan, Quirino Province

Annual income (PhP)	Frequency	%
<20,000	12	2.41
20,000-70,000	219	43.98
70,001-120,000	149	29.92
120,001-170,000	56	11.24
170,001-220,000	15	3.01
>220,000	35	7.03
No answer	12	2.41
Total	**498**	100.00

G.1.5 Describe current land use and land tenure at the project site.

Current Land Use
The parcels to be reforested or to be used for agroforestry in the Project are currently used for marginal agriculture and grazing. These parcels are not prime parcels for either agriculture or cattle grazing.

Tenure Instrument
Divisoria Sur Agroforestry Farmers Association (DSAFA), Sto. Nino Integrated Social Forestry Association (STISFA), and Sangbay Upper Basin Ecological Farmers Organization (SUBEFO) are the People's Organizations to which farmers who provides land lots to the project belong and that represent the farmers in the project. All participating farmers have title to public land via Integrated Social Forestry Program (appropriate documents on file). The ISF Stewardship Contracts granted to these members stays for a period of 25 years renewable for another period of 25 years. The first 25-year terms of some contracts have terminated in 2009, and the rest will terminate by 2015 (Table 1). The PLGU-PNREO and the DENR-CENRO evaluated the performance of ISF stewardship contracts holders, and have assessed in favor of renewing all contracts for a second term of 25 years (proof on file). DENR-Regional Executive Director (RED) of the Cagayan Valley Region, a higher authority in the DENR, is also in agreement in renewing the tenure instrument likewise. Awarding of renewal for contracts that expired in 2009 is pending only because the DENR RED is waiting for the Central Office of DENR to issue the necessary policy/guideline. Thus, the land tenure instrument will encompass the entire period of the carbon project.

One participant, Mr. Manuel Hallig, voluntarily provides his privately owned land lot to the project (land title document on file). He is a member of one of the POs and contributes his ISF land lots to the project as well. The Reforestation Contract concluded between CI and PEDAI and Mr. Hallig establishes that his private land will not differ from the other ISF public land in the project in terms of activities conducted and benefits received (appropriate document on file). He understands that the same rules of the project applied to the ISF public land will apply to the land under his private ownership during and after the project terms. He further agrees that he will not receive any benefits from the project beyond what other farmers with ISF titles will receive.

Post-Project Closure Sustainability

The following structural arrangements and contribution of the project to the communities during the project period will provide the sustainability of reforestation activities after the project period.

Local Government Units (LGUs) are vested with autonomous responsibility to administer and manage within their jurisdiction devolved community and people-oriented forestry programs, such as the ISF. This role of LGUs is provided for by Republic Act 7160, known as Local Government Code, and supported by Joint DENR-DILG Memorandum Circular 1998-01 on devolved forest management functions to LGUs. Both Local Government Units of Maddela and Nagtipunan have adopted the Forest Land Use Plans, which prescribe environmental and reforestation programs.

Having been strengthened during the project, close working coordination among the PLGU, DENR, Municipal LGUs of Maddela and Nagtipunan, POs, and NGOs will have been set in place as to managing the ISF projects on agroforestry and reforestation in continuity.

Moreover, the Climate Change Act of 2010 (Attached copy of the RA9729) further provides firmer ground for sustaining ISF plantation activities as it mandates LGUs to formulate local action agenda and plans for mitigating climate change effects and impacts. The appropriate local actions include strategies such as agroforestry and reforestation being considered as affordable means to mitigate climate change effects and impacts as well as to offset the carbon footprints of communities and people's organizations.

G.1.6 Describe current biodiversity in the project area and threats to that biodiversity, using appropriate methodologies (e.g., key species habitat analysis, connectivity analysis), substantiated with reference (evidence) where possible.

Conservation International Philippines conducted a biodiversity survey during July 9-18, 2009 in three selected sites to document the flora and fauna (birds and bats) found within the project area (Appendix 5).

Flora Survey

A total of 117 species of plants were documented dominated by species belonging to the Graminae, Leguminosea and Compositae families (Table 4). This is typical of open areas where weeds and grasses are the dominant types of vegetation.

Table 4. Summary of plants recorded in the forest carbon project area.

FLORAL HABITS	**SITE 1** (San Salvador)		**SITE 2** (Santo Nino)		**SITE 3** (Sangbay)	
	Ind.	%	Ind.	%	Ind.	%
NUMBER OF HERB	53	80.5	45	58.5	25	69.5
NUMBER OF TREE	3	4.5	15	19.5	4	11.0
NUMBER OF SHRUB	5	7.5	7	10.0	2	5.5
NUMBER OF LIANE/VINE	4	6.0	8	10.5	4	11.0
NUMBER OF PALM	1	1.5	1	1	0	0
NUMBER OF BAMBOO	0	0	1	1	1	3.0
TOTAL NO. OF SPECIES	**66**	**100**	**77**	**100**	**36**	**100**

Fauna Survey

For the fauna, a total of 67 species of birds and seven species of bats were recorded to occur within the project site (Table 5). Sixteen species of birds (24%) are endemic to the country, including two species (*Dicrurus balicassius* and *Rhipidura cyaniceps*) that are restricted to the island of Luzon (Table 6). The majority (54%) of the birds are non-forest species that are commonly found in open areas, such as grasslands and human dominated areas. Several non-forest tolerant species that are more commonly found in forested areas and forest species, which includes the two Luzon Island endemic species, were also observed. Presence of the forest species are mainly due to the patches of trees or even solitary trees that are scattered throughout the landscape that provide shelter and may also function as refugia to these species.

Table 5. Species richness of bats and birds recorded in the project site.

FAUNAL GROUP	SITE 1 **Divisoria Sur** Cropland/Grassland	SITE 2 **San Salvador** Grass/Shrubland	SITE 3 **Sto. Nino** Crop/Shrubland	SITE 4 **Sangbay** Grassland	TOTAL
BIRDS	35	43	52	24	67
BATS	4	3	5	-	7
TOTAL NO. OF SPECIES	39	46	57	24	74
NUMBER OF ENDEMIC SPECIES	13	5	14	5	18
NUMBER OF NET DAYS/NIGHTS	30	30	30	-	90
TRANSECT HOURS	10	10	*general obs.*	-	30

Table 6. Species of birds listed in the three sampling sites of the forest carbon project site, Maddela Quirino Province

Scientific Name		Common Name	Distribution Status
Family Accipitridae			
1	*Pernis ptilorhynchus*	Oriental Honeybuzzard	Resident/Migrant population
2	*Haliastur indus*	Brahminy Kite	Resident
3	*Circus melanoleucos*	Pied Harrier	Resident/Migrant population
Family Rallidae			
4	*Gallirallus philippensis*	Buff-banded Rail	Resident
5	*Gallirallus striatus*	Slaty-breasted Rail	Resident
6	*Gallirallus torquatus*	Barred Rail	Resident
7	*Amaurornis phoenicurus*	White-Breasted Bush-Hen	Resident
Scientific Name		**Common Name**	**Distribution Status**
Family Turnicidae			
8	*Turnix suscitator*	Barred Buttonquail	Resident
Family Columbidae			
9	*Phapitreron leucotis*	White-eared Brown-Dove	Philippine Endemic
10	*Macropygia phasianella*	Reddish Cuckoo-Dove	Resident
11	*Streptopelia chinensis*	Spotted Dove	Resident
12	*Streptopelia bitorquata*	Island Collared-Dove	Resident
13	*Streptopelia tranquebarica*	Red Turtle-Dove	Resident
14	*Geopelia striata*	Zebra Dove	Resident
15	*Chalcophaps indica*	Common Emerald-Dove	Resident
Family Psittacidae			
16	*Loriculus philippensis*	Colasisi	Philippine Endemic
Family Cuculidae			
17	*Centropus bengalensis*	Lesser Coucal	Resident
18	*Centropus viridis*	Philippine Coucal	Philippine Endemic
Family Tytonidae			
19	*Tyto capensis*	Grass Owl	Resident
Family Apodidae			
20	*Collocalia vanikorensis*	Island Swiftlet	Resident
21	*Collacalia esculenta*	Glossy Swiflet	Resident
22	*Collacalia troglodytes*	Pygmy Swiflet	Philippine Endemic
23	*Apus pacificus*	Fork-tailed Swift	Resident/migrant populations
24	*Cypsiurus balasiensis*	Asian Palm-Swift	Resident
Family Alcedinidae			
25	*Halcyon chloris*	White -collared Kingfisher	Resident
26	*Halcyon smyrnensis*	White-throated Kingfisher	Resident
27	*Actenoides lindsayi*	Spotted Wood-Kingfisher	Philippine Endemic
Family Meropidae			
28	*Merops viridis*	Blue-throated Bee-eater	Resident
29	*Merops philippinus*	Blue-tailed Bee-eater	Resident
Family Capitonidae			
30	*Magalaima haemacephala*	Coppersmith Barbet	Resident
Family Hirundinidae			
31	*Hirundo tahitica*	Pacific Swallow	Resident
32	*Hirundo rustica*	Barn Swallow	Migrant
33	*Hirundo daurica*	Red-rumped Swallow	Resident/migrant
Family Campephagidae			
34	*Lalage nigra*	Pied Triller	Resident

Family Pycnonotidae			
35	*Hypsipetes philippinus*	Philippine Bulbul	Philippine Endemic
36	*Pycnonotus goiavier*	Yellow-vented Bulbul	Resident
Family Dicruridae			
37	*Dicrurus balicassius*	Balicassiao	Luzon Endemic
Family Oriolidae			
38	*Oriolus chinensis*	Black-naped Oriole	Resident
39	*Corvus macrorhynchos*	Large-billed Crow	Resident
Family Paridae			
40	*Parus elegans*	Elegant Tit	Philippine Endemic
Family Rhabdornithidae			
41	*Rhabdornis mystacalis*	Stripe-Headed Rhabdornis	Philippine Endemic
Scientific Name		**Common Name**	**Distribution Status**
Family Turdidae			
42	*Copsychus saularis*	Oriental Magpie-Robin	Resident
43	*Saxicola caprata*	Pied Chat	Resident
Family Sylviidae			
44	*Megalurus timoeriensis*	Tawny Grassbird	Resident
45	*Megalurus palustris*	Striated Grassbird	Resident
46	*Orthotomus castanieceps*	Philippine Tailorbird	Philippine Endemic
47	*Cisticola exilis*	Bright-Capped Cisticola	Resident
Family Muscicapidae			
48	*Rhipidura javanica*	Pied Fantail	Resident
49	*Rhipidura cyaniceps*	Blue-headed Fantail	Luzon Endemic
50	*Hypothymis azurea*	Black-naped Monarch	Resident
Family Motacillidae			
51	*Anthus novaeseelandiae*	Richard's Pipit	Resident
Family Artamidae			
52	*Artamus leucorynchus*	White-Breasted Wood-Swallow	Resident
Family Laniidae			
53	*Lanius schach*	Long-Tailed Shrike	Resident
Family Sturnidae			
54	*Aplonis panayensis*	Asian Glossy Starling	Resident
55	*Acridotheres cristatellus*	Crested Myna	Resident/ Introduced
Family Nectariniidae			
56	*Nectarinia jugularis*	Olive-backed Sunbird	Resident
Family Dicaeidae			
57	*Dicaeum bicolor*	Bicolored Flowerpecker	Philippine Endemic
58	*Dicaeum australe*	Red-keeled Flowerpecker	Philippine Endemic
59	*Dicaeum pygmaeum*	Pygmy Flowerpecker	Philippine Endemic
60	*Dicaeum hypoleucum*	Buzzing Flowerpecker	Philippine Endemic
61	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	Resident
Family Zosteropidae			
62	*Zosterops nigrorum*	Yellowish White-eye	Philippine Endemic
Family Ploceidae			
63	*Passer montanus*	Eurasian Tree Sparrow	Resident
Family Estrilidae			
64	*Padda oryzivora*	Java Sparrow	Resident
65	*Lonchura leucogastra*	White-breasted Munia	Resident
66	*Lonchura punctulata*	Scaly-breasted Munia	Resident
67	*Lonchura malacca*	Chestnut Munia	Resident

For bats, seven species were captured in the project site (Table 7). Two species were endemic to the Philippines which include *Ptenochirus jagori* and *Rhinolophus* cf. *rufus*. Four species were categorized as fruit bats while three were insectivorous bats. Cynopterus brachyotis had the highest number of captured individuals observed within the project site. Only one individual of Rhionolophus cf. rufus, Rousettus amplexicaudatus and Macroglossus minimus was captured for the whole duration of the field survey.

Table 7. List of bats recorded within the project site.

	Scientific Name	Common Name	Distribution and Conservation Status
Family Pteropodidae			
1	*Cynopterus brachyotis*	Common Short-nosed fruit bat	Widespread-Abundant
2	*Macroglossus minimus*	Dagger toothed fruit bat	Widespread-Abundant
3	***Ptenochirus jagori***	Musky Fruit Bat	**Endemic-Common**
4	*Rousettus amplexicaudatus*	Common Rousette	Widespread-Abundant
Family Rhinolopidae			
5	*Rhinolophus cf. arcuatus*	Arcuate Horseshoe Bat	Widespread-Common
6	***Rhinolophus cf rufus***	Large Rufous Horseshoe Bat	**Endemic - Uncommon**
Family Vespertilionidae			
7	*Myotis cf. macrotarsus*	Philippine Large-footed Myotis	Uncommon

G.1.7 List all IUCN Red List threatened species (which encompasses endangered and vulnerable species) and species on nationally recognized list (where applicable) found within the Project boundary.

The survey described in G1.6 did not record any globally threatened species within the project area. Only exception was the presence of *Pterocarpus indicus* in flora, which is listed in CITES and Red List.

Biological survey restricted just to the Project's boundaries is limited, but the region surrounding the project has already been extensively studied. In Sierra Madre Biodiversity Corridor, 409 species of fauna (24 amphibians, 67 reptiles, 258 birds, and 60 mammals) have been recorded. One hundred fifty three these are endemic to the Philippines, and 30 are considered threatened (Heneay et al 1997, Kennedy et al 2000, Brown et al 2000, NORDECO and DENR 1998, Duya et al 2002 unpublished). On the other hand, potential and new species, new country records (Duya et al 2007, Brown et al 2000, 2007) are still being found demonstrating the potential for more species present.

Quirino Province has been identified as one of the Philippines' biodiversity conservation priorities (Ong et al., 2002). The priority area includes the Municipality of Maddela. The area's value for bird habitat has been highly recognized as an Important Bird Area (IBA), and subsequently as a Key Biodiversity Area (KBA; Conservation International Philippines, et al., 2006). See B1.3 for the threatened species found in Quirino Protected Landscape.

G2 Baseline Projections (Required)

G.2.1 Describe the most likely land-use scenario in the absence of the Project activity. Identify whether the scenario assumes that existing laws or regulations would have required that project activities be undertaken anyway.

The land-use and land-cover data for 1993 and 2003 indicate that forests are being converted to other land uses or covers (Table 8).The interview survey (see G.1.4) revealed that there were barriers for both reforestation and agroforestry to occur spontaneously (Table 9 and 10).

Interviews with stakeholders and land use surveys show that similar lands in the vicinity are not being converted to either commercial plantations or agroforestry.

- Investment barriers deny land holders the finances to invest in commercial timber or agroforestry seeds or necessary equipment;
- Institutional barriers prevent farmers from manipulating the chain from investment through production and sales;
- Technological barriers limit the access of farmers to either quality seed or the necessary skills for successful commercial timber or agroforestry plantations; and
- The barrier due to market risks, of new income streams, drives farmers to be conservative to maintain a constant income.

The field surveys and interviews with stakeholders indicated that the only realistic and credible alternative available to the project participants is to continue the current marginal agricultural practices. Furthermore, secondary succession of shrublands and grasslands to forest will not occur due to continuous disturbances such as vegetation burning, conversion into upland farms or kaingin-making, and grazing activities. Thus, the Project assumes that this trend will continue into the future.

Table 8. Changes in land use and land cover in Maddela during 1993-2003

Land use and land cover	1993 (ha)	2003 (ha)	Change (ha)	Change (%)
Natural forest	32,666	27,057	-5,609	-17.2
Remnant forest	29,626	17,106	-12,520	-42.3
Shrubs and grassland	2,030	10,823	8,793	433.2
Agriculture	10,610	7,478	-3,132	-29.5
Built-up	470	761	291	61.9
River	330	892	562	170.3
Non-vegetated/open land	0	3,387	3,387	--
Agroforestry	0	1,185	1,185	--
Tree plantation	0	6,993	6,993	--
Fish ponds	0	50	50	--
Total	75,732	75,732	0	

Source: 1993 JAFTA Map & 2003 CFPQ Vegetative Cover Map, as presented in Forest Land Use Plan of Maddela

Table 9. Barriers against reforestation

Barrier	Frequency	Percent
Lack of financial resources	406	81.53
Lack of technical expertise	139	27.91
Lack of experience	69	13.86
Lack of technology	35	7.03
Rampant illegal logging	7	1.41
Poor enforcement of forest laws	6	1.20
Demographic pressure	1	0.20
No nearby forest	1	0.20
TOTAL	**498**	

Table 10. Barriers against adopting agroforestry

Barrier	Frequency	Percent
Lack of technical know-how	215	43.17
Lack of capital	199	39.96
Longer period of harvesting	11	2.21
Difficult to market the products	9	1.81
Farmers are used to cash crop farming	6	1.2
Decreased area for agricultural crops	3	0.60
People are lazy	3	0.60
Not interested	2	0.40
Hard to implement	1	0.20
No demonstration of agroforestry farm	1	0.20
No answer	48	9.64
TOTAL	**498**	**100.00**

Though Integrated Social Forestry (ISF) holders have commitments to undertake reforestation/agroforesty in their contract areas it has not materialized due to inadequate financial support from LGUs. In the two municipalities (Maddela and Nagtipunan) where the forest carbon project is situated, it is clearly indicated that environmental programs and activities are placed at the backburners. The Internal Revenue Allocations (IRA) of Local Government Units (LGU) are earmarked for regular expenditures usually the greatest expense go to Personal Services which condition is common for all government agencies.

The standard policy mandates 20% of the IRA by government agencies, including LGUs, to be allocated to finance development projects as prioritized in their respective development plans as guidelines in pursuing development. However, the budget allocations for environmental projects/services in Maddela and Nagtipunan, Quirino ranged from 6% to 7% of the total amount used for priority development projects. Note further that most of the 6%-7% allotted to the environmental projects are spent for waste management and sanitation. The situation clearly points to the need for new investments to secure reforestation, agroforestry, watershed and soil conservation activities.

G.2.2a Provide a projection of future carbon stock changes in the absence of the project, based on the land-use scenario described above. The timeframe for this analysis can be either the project lifetime or the project accounting period, whichever is more appropriate.

The land inside the Project parcels will continue to degrade in the without-project scenario, and therefore carbon stocks will decrease as well. However to be conservative, the Project assumes a static carbon baseline. This is consistent with the small-scale A/R CDM methodologies. The project applied AR-AMS0004 to areas defined as cropland, and AR-AMS0001 to the rest of the areas. Application of these methodologies are justified as described below.

AR-AMS0001

The applicability conditions laid down in AR-AMS0001 are:

(a) Project activities are implemented on grasslands or croplands;
(b) Project activities are implemented on lands where the area of the cropland within the project boundary displaced due to the project activity is less than 50 per cent of the total project area;
(c) Project activities are implemented on lands where the number of displaced grazing animals is less than 50 per cent of the average grazing capacity1 of the project area;
(d) Project activities are implemented on lands where ≤ 10% of the total surface project area is disturbed as result of soil preparation for planting.

These applicability conditions are fulfilled as given below.

(a) The project area to which AR-AMS0001 is applied comprises 51 ha of grassland mostly grazing land.
(b) No cropland will be displaced from the area where AR-AMS0001 will be applied.

(c) Only grazing animals which can be found in the project area are draft-buffaloes roaming. They are fed with forage collected from the farmers' backyard in most of the time. Most of the draft animals are allowed to graze the areas after harvesting the farms when they left under fallow or during times the areas are not cultivated for reason that water is not available. Time-average number of grazing animals for each site was calculated and compared with grazing capacity, which was calculated as 29.8 head for the 51 ha land. It was shown that the time-average number of grazing animals displaced from the project area is 2.84 and is less than 10% of the grazing capacity for the project area. See Section C. 3 for details.

(d) A maximum of 1,111 plants per hectare will be planted for reforestation (3 m x 3 m spacing). Seedlings will be planted in holes with diameters and depths twice the sizes of the seedling pots, that is, 30 cm in diameter. Therefore, the surface which will be disturbed for soil preparation for planting will be less than 10% of the total surface of the area. There will be no ploughing of land before the establishment of plantation.

AR-AMS0004

The applicability conditions laid down in AR-AMS0004 are:

(a) Project activities are implemented on croplands;
(b) Project activities include a cropping regime that is considered an agroforestry system that is consistent with international or national definitions;
(c) The pre project living biomass in trees or woody perennials within the project boundary is:
    (i) Not more than ten per cent of the maximum above- and below-ground biomass of trees with the project activity; or
    (ii) More than ten per cent of the maximum above- and below-ground biomass of trees, and such biomass shall not be removed in the implementation of the project activity.
(d) If there is a decrease in the area cultivated with crops attributable to implementation of the project compared to the total area cultivated with crops at the start of the project then the methodology is applicable if at least one of the following conditions is met:
    (i) There is no displacement of crops; or
    (ii) The displacement of crops will not cause deforestation; or
    (iii) The displacement is to lands surrounding the project activity that contain insignificant biomass (for example degraded land with no or only a few trees or shrubs per hectare); or
    (iv) The decrease in the area cultivated with crops within the project boundary as a result of the project activity is less than 50 per cent of the total project area.

These applicability conditions are fulfilled as given below.

(a) The project area to which AR-AMS0004 is applied comprises of 126 ha of cropland of mainly corn and banana.
(b) Agroforestry system will be installed for 22 ha land within the 126 ha area.
(c) Not more than ten per cent of the maximum above- and below-ground biomass of trees with the project activity exists. The result of the ground survey of existing vegetation is available.
(d) The cropping activities in the project area are not main activities for supporting livelihood in

this area, and moreover, corn and banana cultivations will be allowed in the project boundary for the first 5 years until trees grow. Therefore displacement of cropland will not be expected.

G.2.2b If there is evidence that non-CO_2 greenhouse gas (GHG) emissions such as CH_4 or N_2O are more than 15% of the baseline GHG fluxes at the project site (in terms of CO_2 equivalents), they must be estimated.

Non-CO_2 GHGs are not likely to account for more than 15% of the project's overall GHG impact. Furthermore, the CDM Executive Board agreed at its 42nd meeting held during 24-26 September in Bonn, Germany that GHG emissions in A/R CDM project activities from (i) fertilizer application, (ii) removal of herbaceous vegetation, and (iii) transportation may be considered as insignificant and hence can be neglected in A/R baseline and monitoring methodologies (http://cdm.unfccc.int/EB/042/eb42rep.pdf; p.6).

G.2.3 Describe how the "without-project" scenario would affect local communities in the project area.

As stated in G2.1 (using information from socioeconomic surveys and interviews conducted in the general area including and surrounding the project area; see also G1.4), the only realistic and credible land use available to the project participants is to continue the current agricultural practice. The same interviews also revealed that lands similar to the project area are not converted to commercial plantation or agroforestry in the project vicinity. This information serves as fair justification for the project's baseline projection: continuation of the current practice. Also it enforces this position further to note that the land included in the project is not prime farmlands, but very marginal that brings minimal profit to farmers to begin with.

As described in G.1.4, half of the people in the Project area live below subsistence level. Without the Project, this poverty is expected to persist as discussed below. Furthermore, the project activities had been explained to the potential participants, and farmers have made their decision on their free will whether or not to participate. Cost-benefit analyses had been performed at individual farmers' level as well.

The two major upland farm crops—corn and banana—do not provide adequate incomes to fully support household basic needs. CI and PEDAI survey (presented in CM.1.1) shows that corn production yields net income of PhP26,000/ha. Even if a farmer cultivated 2 ha of his ISF parcel, which is seldom the case, his net annual income from corn production would be PhP52,000. This annual income does not adequately support an average household number of 6 members (the poverty threshold in 2006 was PhP15,057 per capita: NSCB 2008, accessed at http://www.nscb.gov.ph). Monoculture corn farming has been associated with intensive soil cultivation, heavy use of synthetic fertilizers and pesticides/herbicides which is packaged to the technology, which results in many adverse consequences in soil and water resources. The continued practice of corn monoculture will inevitably impoverish the land rendering it unproductive. The corn production does not provide sufficient economic benefits to individual farmers and it provides collective, societal harm in terms of environmental conditions as well. Results of the CI and PEDAI survey also show that many corn farmers in the project areas have quit cultivating because the costs of fertilizer and pesticide had increased to a point where it is no longer economically beneficial. The fact that the land lots farmers contribute to the project is not their prime land for agriculture demonstrates that this is the future of the project area.

Banana used to be popular among farmers because it could result in 8-10 year of harvest for minimal maintenance after the one-time establishment cost. Income from banana plantations can be relatively high at PhP50,000-PhP60,000 per ha. However, farmers suffered heavy losses from banana disease "bunchy top" that wiped out almost the entire banana plantations in Quirino. While prevention for the disease has been claimed to be available, rehabilitation of banana plantations has not completely taken place because it entails prohibitive costs. At present many participants have opted offering their ISF parcels to the project for reforestation because their bananas are diseased and no longer produce good yields.

As it is the case with corn monoculture, banana cultivation in monoculture accelerates soil erosion with rates reported at 414tons/ha/yr *(Veracion and Lopez, 1979).* The rate is manifold higher than the critical threshold of 12tons/ha/yr. Banana plantations are a source of erosion materials brought by surface runoff to the rivers and streams, causing heavy sedimentation, shallowing of river beds prone to flooding during rainy seasons.

During lean months of the year when farming households are waiting for banana or corn harvests, the only available resort for income augmentation is charcoal making, which had encouraged harvesting of wood materials from nearby forests. Charcoal making also undermines the regeneration of these forests.

Poverty persistence will be aggravated by barriers in access to investment, new technologies, market, and institutional obstacles, as discussed in G 2.1.

The continued monocultures of banana and corn on ISF areas pose following environmental threats:

1. Threats to soil and water resources;
2. Threats of pollution of water bodies affecting domestic water supplies and downstream communities and farms;
3. Threats of increased extraction of trees in nearby forests; and
4. Threats to habitat and ecosystem stability.

These conditions, inadequacies, obstacles and threats that the communities are exposed to will be addressed in the progressive process of project development and implementation adopting new interventions consist of community organizing and mobilization, capability building and empowerment, agroforestry and reforestation activities.

G.2.4 Describe how the "without-project" land-use scenario would affect biodiversity in the project area.

There are no expected changes in the biodiversity within the project area in the absence of the project's intervention, as the baseline land-use scenario assumes no change. Thus, the state of biodiversity as described in G1.6 is expected to persist under the "without-project" conditions, which is already significantly below what the site can be.

It is, however, likely that remaining scattered forest patches will be lost further in the general area in which project parcels are situated, as shown in the land-use change statistic. It is expected that some of the forest dependent species that are currently present in the project area will eventually be lost from the area. It is also worth noting that disturbed sites are prone to negative impact of invasion by non-native, invasive species of plants and animals, which also lead to loss of native biotic community.

Since the project area is situated in a general region that is important for biodiversity, as described in G1.7, it possesses potential to support much higher biodiversity. Without project, however, it is highly unlikely that endemic species and globally threatened species that are found in the adjacent forests of the Quirino Protected Landscape, one of the key biodiversity area identified in the country, will be attracted to the project area.

G.2.5 Describe how the "without-project" land-use scenario would affect water and soil resources.

Since the project area is small compared to the area of watershed, quantitative discussion will not be provided as it will not be meaningfully measureable. However, the soil conservation benefit can be discussed using the widely applied Universal Soil Loss Equation (USLE; USDA, 1978). USLE is expressed as:

A =R x K x LS x C x P; where

A is the potential long term average annual soil loss in tons per acre per year (the unit is different from SI units, but the difference does not matter for the purpose of the discussion here as it deals with relative magnitudes only);
R is the rainfall and runoff factor by geographic location;
K is the soil erodibility factor;
LS is the slope length-gradient factor;
C is the crop/vegetation and management factor; and
P is the support practice factor, and reflects the effects of practices that will reduce the amount and rate of the water runoff and thus reduce the amount of erosion.

R and K cannot be altered by management or land use change.

The LS factor can be changed by changing the slope length. With the assumption of static future land use, this value will not change. It is possible, however, that wooded patches in the sloped landscape (an effective slope breaker with respect to soil erosion) may be removed, resulting in the increase the slope length. Most participating land parcels are located on sloped landscape and reforesting them will result in reducing the slope length, thus the LS factor.

The estimated C factor for degraded grazed land (exposed soil, with partial grass cover of 0-60%) ranges between 0.42 and 0.0042 (USDA, 1978; p.32). That for undisturbed woodland, such as the nearby forest patches, ranges from 0.003 and 0.009, even with very modest tree cover of 20-40% (USDA, 1978; p.33).

In summary, the current condition for soil conservation is lower than the potential of the landscape, but no improvement is expected from the baseline projection based on the without-project land-use scenario.

Soil erosion from landscape in Quirino will contribute to sedimentation downstream, which could increases the risk in frequency and severity of flood events. It is worth noting that Quirino is located in the headwater region of the Cagayan River, the longest river in the country. Large cities downstream, such as Tuguegarao, are subject to increased rate of flooding in recent years. Reduction of soil erosion in Quirino will benefit downstream by reducing sedimentation. At the same time, increased water retention and groundwater recharge will also have more local benefits.

G3 Project Design and Goals (Required)

G.3.1 Provide a description of the scope of the project and a summary of the major climate, community and biodiversity goals.

Project Overview

Due to its geographical and climatic characteristics, the Philippines is rich in biodiversity mainly in its tropical rainforests. However, as it happens in other countries in the Southwest Asia, increase in population has significantly reduced the rainforest cover through expansion of human habitat and agricultural lands in the forest, commercial logging. Even after the deforestation was banned, the deterioration continues. A decrease in forest cover not only results in a loss of habitat for animals and plants but also a loss of ecosystem services that it provides, such as stable water supply and soil stability. It is necessary to protect and restore these damaged lands to secure the natural resource for regional development and conservation of biodiversity. However, it is also essential to consider the current situation that poor people rely on forests and its natural resources, including the land through unsustainable means of utilization.

In the Sierra Madre Biodiversity Corridor where the project area is generally situated, even though there has been much deforestation, there is still a large area of forest left that supports high biodiversity. The region plays an important role as it still retains the potential to maintain the complex ecosystem with diverse species. In addition, the Sierra Madre Mountain serves as a watershed for the region, supplying water for hydroelectric generation and household and agricultural use, and therefore an appropriate watershed management is essential for the livelihood of the local residents.

This project aims for 'Triple Benefits', namely, to create an alternative source of income for the local community, to protect and improve the habitat for plants and animals, and at the same time to stabilize the ecosystem functions of the watershed to ensure a steady supply of water and to help mitigate climate change through carbon sequestration.

In this project, the following activities will be conducted on cropland and grassland:

1. Reforest 155 hectares with indigenous species suitable to bring back the forest condition and appropriate biophysical requirement of the site.
2. Establish 22 hectares of agroforesty from which the local communities derive additional income and improve the long-term productivity of their farms.

During project implementation, proper establishment and management techniques shall be incorporated into the project operational guidelines and protocols. Proper implementation and monitoring shall be guided by a detailed implementation and monitoring plan. To support the implementation of reforestation and agroforestry, community organization for planning and community capacity building will also be conducted.

G.3.2 Describe each major project activity (if more than one) and its relevance to achieving the project's goals.

A. Reforestation Component

1. Nursery operations--Three nurseries are established, a central nursery strategically located within the barangay core and two (2) subsidiary nurseries accessible at the farm sites where planting will be done. These nurseries will accommodate planting stocks to be produced by the communities. In case that nursery seedling production will not meet the total planting requirements, planting material deficit will be purchased from nearby local seedling suppliers.

2. Survey and Mapping – The proposed project site were surveyed and delineated on the ground, and project maps were produced.

3. Compartmentalization – The project area are compartmentalized to show the species or combination of species to be planted. Mixed planting of different tree species identified is encouraged to meet the purpose and objective of the project.

4. Establishment of access roads and trails –Access road and graded trails are necessary for establishing, maintaining and protecting a reforestation project considering the location, slope and terrain of the project area. Trails and roads will be constructed through manual labor discouraging the use of heavy equipment machineries to minimize CO_2 emission and surface disturbance.

5. Species site compatibility – The topographic and soil classification map will serve as basis in which to designate species location in a given area. Within the species identified, there are those species assigned depending on the exposure of a given site. Selection of other species based on site and elevation may also be dictated by the purposes for which planting is done (e.g., mere vegetative rehabilitation, food production (agroforesty), and biodiversity conservation).

6. Site Preparation

6.1. Brushing – On areas with steep gradient and with erodible soil, extra care must be exercise so as not to induce soil erosion. The best way of conducting site preparation is the partial removal of vegetation it may be either spot brushing or strip brushing. In strip brushing, it is usually a meter wide strip preferably following the contour. Cut vegetation is laid below the strip, which also holds the soil up. Planting is done in the middle of the strip. Distance between strips depends upon the planting distance employed. Normally, 3 meters x 3 meters is the recommended distance to be employed. In spot clearing, this is done for the Agro forestry. Spots or patches area cleared usually 2 meters diameter where the fruit tree seedlings to be planted.

6.2. Staking- Staking should be done in order to set the location of seedlings to be planted along the strips or spot brushed areas and where to dig holes. For the purpose of checking survival, seedlings planted may easily be recognized with the stakes.

6.3 Hole digging –The size of the plastic bag used for the potted seedlings will determine the size of holes for digging. In digging holes, top soil is separated from the sub soil removed from the hole, and during planting the topsoil should be put back first into the hole followed by the subsoil. If possible, basal application of organic fertilizer to planted seedlings is recommended.

6.4. Seedlings transport – The seedlings are transported from the nursery to the planting area through the use of animal driven sledge or cart, or manually carried with sturdy container ensuring that the seedlings are not overexposed to scorching sunlight and shaking during transported to avoid severe shocking. They should not be held to the stem to prevent uprooting from the earth-ball and cause injury to the root system.

6.5. Out planting – This refers to the actual planting of seedlings in the field. A potted seedling is recommended. The seedling is to be removed from the container (plastic bags) by tearing or cutting with a knife or bolo. Care must be taken not to break the earth-ball. The upper part of the earth-ball must be on level with or slightly deeper than the ground surface. Soil is filled into the hole spaces and pressed firmly all around the planted seedlings.

7. Care, Maintenance and Protection– After planting, planted seedlings need to be cared through activities such as replanting, weeding, cultivating, mulching, fertilizing and watering if need be and control of pest and diseases, including fire prevention and control. Constant monitoring of planted area is necessary to detect needed caring and timely management intervention to ensure high survival and growth of planted seedlings.

B. Agroforestry Component

1. Preparation of planting materials – Most of the project farmer-participants have no technical expertise and capability to produce quality fruit trees seedlings. Hence, there is a need to purchase grafted/budded or asexually propagated good variety of fruit tree seedlings from reliable and government-accredited seedling suppliers. The central nursery for the reforestation will also serve as depository for the agroforestry seedlings while waiting for the outplanting period.

2. Survey and Mapping - The agroforestry sites were surveyed and delineated on the ground and mapped.

3. Compartmentalization - The areas are compartmentalized to show the combination of agro forestry species to be planted. Mixed planting is required. Within the compartment it is not only planted solely with fruit trees, but there is also a need to integrate agricultural cash crops. At least 20% of the agroforestry area will be devoted for short-term crops. The multiple-cropping system is encouraged.

4. Species Site compatibility - the topographic and soil classification map has a great role to designate species location in a given area. Considering the exposure of a given site there are species assigned depending on the exposure of the site.

5. Establishment of Access Roads and Trails - For the agroforestry component access roads and graded trails are necessary considering the location, slope and terrain of the project area. This will be put-up through manual labor, discouraging the use of heavy equipment machineries to minimize CO_2 emission and surface disturbance.

6. Site Preparation

6.1 Spot Brushing - for this component spot brushing is more appropriate. Patches are cleared/ brushed 2 meters diameter where the seedlings are to be planted.

6.2 Staking - Stakes will be provide for every patches cleared to determine the area where the seedlings are to be planted and likewise hole digging. Stakes should be 1 meter high or higher to be visibly seen in the area.

6.3 Hole Digging - Size of holes to be dug depend upon the size of the plastic bags used for the potted seedlings. In digging the hole, the top soil should be separated from that of the sub soil.

6.4 Out planting - this refers to the actual planting of seedling in the field potted seedlings are to be used. The seedling is removed from the container (plastic bag) by tearing or cutting with a knife or bolo. Care must be taken not to break the earth ball or disturb the root system of the seedling. During planting, the top soil should be filled up first to the base of the dug hole followed by the sub soil, filling up the spaces of the hole up to the root collar of the seedling. Soil is firmly pressed around the base of the planted seedling. The upper part of the earth ball or root collar must be on level with or slightly deeper than the ground surface. Basal application of organic fertilizer is encouraged during ring-weeding and cultivation.

7. Care, Maintenance and Protection - After planting, planted seedlings need to be attended to through activities such as replanting, weeding, cultivating, mulching, fertilizing and watering if need be and control of pest and diseases, including fire prevention and control. Constant monitoring of planted area is necessary to detect needed caring and timely management intervention to ensure high survival and growth of planted seedlings.

C. Community Organization for Planning Component

Initial planning activities include coordination with the target communities, consultation with different stakeholders and planning workshop together with partners, such as PEDAI, DENR, LGU, and POs. This planning activity shall be conducted in the first year of the project, and periodic assessment will be conducted as part of project monitoring.

D. Community Capacity Building Component

Provision of trainings for the beneficiaries to ensure that they are empowered and attain a successful project is indeed vital. Trainings will be provided in the field of financial management, technical skills, and livelihood alternatives. The participants can make use of the skills and knowledge gained through these trainings for the project and outside the project. For instance, the skill of raising seedlings may generate additional income by selling planting materials to other reforestation operations.

G.3.3 Provide a map identifying the project location, where the major project activities will occur, geo-referenced boundaries of the project site(s).

Figure 2 identifies all the parcels participating in the Project. The geographical coordinates for the corners of the parcels and a large-scale map are presented in Appendix 6.

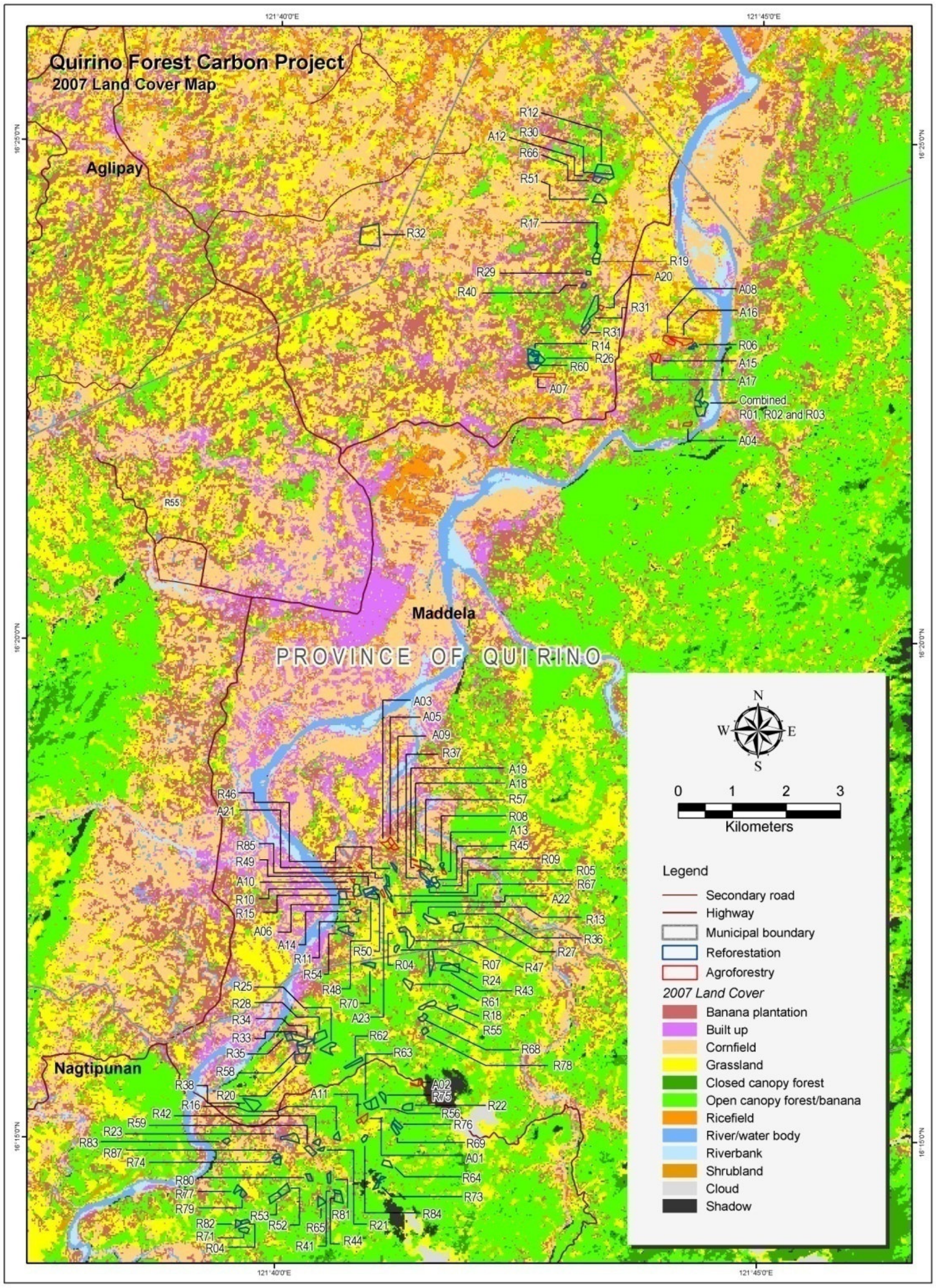


Figure 2. Locations of parcels participating in the Project

G.3.4 Provide a timeframe for the project's duration. Describe the rationale used for determining the Project lifetime. If the accounting period for carbon credits differs from the project lifetime, explain.

The project accounting period is twenty three (23) years. This duration is deemed sufficient to cover the finding-demanding period for reforestation and to build necessary technical and management capacity in the local communities and local governments for maintaining forest without funding from the project. The land tenure instruments for parcels under public land holding come to the end of their first term sometime during 2009-2015, but their renewals for another 25 years are assured (see G1.5). The project considers its lifetime to be the duration of the permanence of reforestation.

With the provision of ISF, with well capacitated community and government, and subsequently with local land use plans and regulations, the period of permanence extends beyond the 23-year accounting period to relatively indefinite future.

G.3.5 Identify likely risks to climate, community and biodiversity benefits during the project lifetime. Outline measures that the project plans to undertake to mitigate the risks.

One of the pitfalls in project implementation in the Philippines is the collapse of development efforts initiated by the project once the funding ends. One reason for this is the short duration of these projects (typically 3-5 years) which is not enough to institutionalize the changes introduced.

To overcome this problem, the project developed a long-term budget through 2029, and the donor, moreTrees, has agreed to provide needed funds. This commitment is codified in the Grant Agreement between moreTrees and CI.

Thus, funding requirement for the entire 177 ha is met for the entire project accounting period.

Partnership during the project must be firm and roles of each partner must be clear. To realize this, a legally binding Memorandum of Agreement (MOA; Appendix 7) has been concluded among all ten parties; namely, moreTrees, CI, PEDAI, DENR Region 02, Provincial Government of Quirino, Local Government Units of Maddela and Nagtipunan, Divisoria Sur Agroforestry Farmers Association (DSAFA), Sto. Nino Integrated Social Forestry Association (STISFA), and Sangbay Upper Basin Ecological Farmers Organization (SUBEFO). One private landowner, who is also a member of one of the People's Organizations, has concluded separate individual reforestation contract with CI and PEDAI also (Appendix 8).

The lack of local capacity to maintain the project impact, such as forest management, could also be a risk. Thus, capacity building training occupies an important part in project activities.

Inadequate and unstable household income to support food and basic needs of the family can also lead project participants to divert their attention and abandon the project. To address this risk, project partner-institutions such as the local government units at the municipal and provincial levels have agreed to allocate resources from their development funds to support the participants in terms of complementary livelihood, technical and marketing assistance. Finally, the project will be implemented in partnership with Palacian Economic Development Association Inc (PEDAI), a local NGO based in Quirino with the mission of supporting local livelihoods by providing technical and financial support through micro-lending program as the facilitator for the project implementation. CI will provide technical expertise, particularly in biodiversity and international carbon issues as well as liaison with the donor moreTrees.

Appendix 9 provides further assessment of risks prepared following the format required by VCS.

G.3.6 Document and defend how local stakeholders have been or will be defined.

All entities and individuals that have title to or jurisdiction over the project area are considered stakeholders. These local stakeholders were confirmed as such during the series of consultations with them. Thus, government units that have jurisdiction over the project area at all levels (i.e., Barangay, municipal, provincial, and national) have been identified as stakeholders. Members of the People's Organizations, DSAFA, STISFA, and SUBEFO are also considered stakeholders. The donor, moreTrees; management organization, PEDAI; and other project proponents are also considered stakeholders. The Memorandum of Agreement (MOA) has been concluded among all of these entities defining their respective roles and responsibilities in the project (Appendix 7).

G4 Management Capacity (Required)

CI Philippines will be responsible for the overall implementation of this project as a project manager establishing the project implementation mechanism with various local stakeholders. Under its Sierra Madre Biodiversity Corridor (SMBC) strategy, CI Philippines will collaborate with the Department of Environment and Natural Resources (DENR), the local government units (LGUs) within the project site and the local communities involved.

CI Philippines Country Office in Manila through its Executive Director and the technical and operations support units provide project oversight and policy support, with the responsibility for project execution being designated to the SMBC Program Manager. To provide technical backstopping are five (5) SMBC technical staff members who have accumulated actual field experience in executing the different activities of the project. As the need arises or deemed appropriate, local NGO-partners of CI Philippines who are capable as subgrantees maybe engaged to execute the reforestation and agroforestry field activities. Furthermore, CI Philippines receives appropriate technical, managerial and coordination assistance from CI-Headquarters and CI-Japan.

G.4.1 Document the management team's experience implementing land management projects. If relevant experience is lacking, the proponents must demonstrate how other organizations will be partnered with to support the project.

Conservation International has been implementing similar projects around the world, and these experiences are being shared within the organization through visits and discussions to share knowledge in different countries. Examples of CI's forest carbon projects may be found: http://www.conservation.org/learn/forests/Pages/projects.aspx.

Locally its pool of technical staff has rich experiences in community organizing, reforestation and agro-forestry projects and activities. It has also its own expertise on land use management and land use change analysis and has high levels of experience in protected area establishment and management.

SMBC implements similar reforestation, agroforestry and community development project in Peñablanca Protected Landscape and Seascape (PPLS) in northern Luzon Island with funding from Toyota Motor Corporation, Japan (please see for reference: http://www.conservation.org/sites/celb/news/pages/news.aspx). This PPLS project, which attained a gold rating under the CCB standard, is finishing its third year and is proceeding on schedule.

The Department of Environment and Natural Resources (DENR), the project's major partner, have organized and implemented a number of national, regional and local forestry projects, accumulating rich experience in coordinating and/or implementing reforestation and agro-forestry projects. Other local partner- NGOs involved in the project have established complete and operationally effective organization/management systems, have technical capacity and rich experience in working with communities, community mobilization, project planning and implementation, and to some extent some working knowledge on forest carbon projects.

G.4.2 Demonstrate that management capacity is appropriate to the scale of the project.

Conservation International-Philippines (CI-Philippines) has been providing support in the last 10 years for the rehabilitation of forests within the Sierra Madre Biodiversity Corridor (SMBC), focusing on the forests of three protected areas namely: the Peñablanca Protected Landscape and Seascape, Northern Sierra Madre Natural Park, and Quirino Protected Landscape, to restore the habitat and ecosystem services that will have positive impact on local climate, biodiversity and the communities.

Oversight and policy and technical support is being provided by the office of the Country Executive Director and other technical units within CI-Philippines. The SMBC Program Manager is responsible for the project execution and is supported by 5 technical staff in the execution of different project activities. Furthermore, the project team will also be receiving additional technical, managerial and coordination assistance from CI branch offices, including the CI-Headquarters Office in Arlington, Virginia (USA) and CI-Japan.

G.4.3 Document key technical skills that will be required to successfully implement the project and identify members of the management team or project partners who possess the appropriate skills.

Key technical skills for this project and persons with such skills and persons in change are presented in Table 11.

Table 11. Key technical skills and members possessing these skills

Skills	Members possessing the skills
Nursery operation and seedlings preparation; propagation of indigenous species	**>CIP: Guidance and Support** • Juan Acay, Jr: in charge • Estrella Pasion, technical support **> PEDAI: Field management** • Elizabeth S. Nicolas, in-charge • George Natividad, technical field supervision **>DENR: Guidance and Support** • Alex Barayuga, Protected Area Superintendent • Elder Pacios, Forestry Specialist **>LGU: Guidance and Support** • Yolando B. Binag • Lemuel Maranion • Rimel C. Tolentino • Joey White
Forest/Agroforestry establishment,	**>CIP: Guidance and Support**

care and maintenance: Seedling planting and maintenance (including activities such as weeding, forest fire/pest and disease detection and control)	• Juan Acay, Jr: in charge • Estrella Pasion, technical support **> PEDAI: Field management** • Elizabeth S. Nicolas, in-charge • George Natividad, technical field supervision **>DENR: Guidance and Support** • Alex Barayuga, Protected Area Superintendent • Elder Pacios, Forestry Specialist **>LGU: Guidance and Support** • Yolando B. Binag • Lemuel Maranion • Rimel C. Tolentino • Joey White
Agroforestry farm planning and implementation	**> CIP: Guidance and Support** • Juan Acay, Jr: in charge • Estrella Pasion, technical support **> PEDAI: Field management** • Elizabeth S. Nicolas, in-charge • George Natividad , technical field supervision **>DENR: Guidance and Support** • Alex Barayuga, Protected Area Superintendent • Elder Pacios, Forestry Specialist **>LGU: Guidance and Support** • Yolando B. Binag • Lemuel Maranion • Rimel C. Tolentino • Joey White
Surveying and mapping	**> CIP: Guidance and Support** • Oliver C. Coroza, in-charge • Andy Alvaran, GIS support • Estrella Pasion, technical support **> PEDAI: Field management** • Elizabeth S. Nicolas, in-charge • George Natividad, technical field supervision **>DENR: Guidance and Support** • Alex Barayuga, Protected Area Superintendent • Elder Pacios, Forestry Specialist **>LGU: Guidance and Support** • Yolando B. Binag • Lemuel Maranion • Rimel C. Tolentino • Joey White • Dencio A. Pagbilao • Homer B. Bueno

Community organization for planning	**> CIP: Guidance and Support** • Juan Acay, Jr: in charge • Estrella Pasion, technical support **> PEDAI: Field management** • Elizabeth S. Nicolas, in-charge • George Natividad, technical field supervision **>DENR: Guidance and Support** • Alex Barayuga, Protected Area Superintendent • Elder Pacios, Forestry Specialist **>LGU: Guidance and Support** • Yolando B. Binag • Lemuel Maranion • Rimel C. Tolentino • Joey White • Dencio A. Pagbilao
Community capacity building	**> CIP: Guidance and Support** • Juan Acay, Jr: in charge • Estrella Pasion, technical support **> PEDAI: Field management** • Elizabeth S. Nicolas, in-charge • George Natividad, technical field supervision **>DENR: Guidance and Support** • Alex Barayuga, Protected Area Superintendent • Elder Pacios, Forestry Specialist **>LGU: Guidance and Support** • Yolando B. Binag • Lemuel Maranion • Rimel C. Tolentino • Joey White • Dencio A. Pagbilao
Financing	**MORETREES: lead VCU marketing and fundraising** • Shinkichi Mizutani, executive director **CI Japan: VCU marketing support** • Kana Yamashita • Yoji Natori • Aya Uraguchi

The abovementioned technical staff members of CI and PEDAI will collectively work to build and maintain a databank, Information and Knowledge Management System (IKMS; see G7.2). Monitoring and evaluation (M and E) and Quality assurance and Quality control (QA/QC) will be the shared responsibility of PEDAI and CI complemented by staff from DENR and LGU.

To improve the capacity of the project staff and related local communities, series of training workshops related to the transfer of skills as listed above including cross-visit activities shall be conducted.

G.4.4 Document the financial health of the implementing organization(s).

Conservation International-Philippines (CIP) is one of the 26 county offices of CI world wide. It has maintained an average annual budget of over 1 million USD for the past 10 years. CIP funds are from grant-funding private foundations, corporate businesses, foreign governments, and multilateral organizations.

Currently, CIP has 23 projects in different geographic areas in Sulu-Sulawesi Seascapes, Cagayan, Isabela, Palawan, Batangas and Mindoro provinces and cover marine works, coral triangle initiative, reforestation, agroforestry, research, population/health & environment, human wellbeing, climate change, forest carbon, and partnership building. Walton Family Foundation and Toyota Motor Corporation are the major donors of CIP for the marine and terrestrial projects, respectively. Last year (FY08), external grant was 11% of CIP's total expenses.

CI's fiscal year starts on July 1st and ends on June 30th. CI's financial statements are audited and certified annually by a respectable firm in the auditing industry. CI strives to exercise the highest level of stewardship over donor contributions and is proud to earn accolades for our financial management. CI was listed in Charity Navigator's list, "10 of the Best Charities Everyone's Heard Of." CI also earned an "A" efficiency rating from the American Institute of Philanthropy for the 11th year in a row, with 84 percent of expenses directly supporting conservation programs and just 5 percent supporting fundraising efforts.

Funding support for this Project comes primarily as grant from moreTrees, a Japanese carbon offset provider.

G5 Land Tenure (Required)

G.5.1 Guarantee that the project will not encroach uninvited on private property, community property, or government property.

The majority of the land covered by the project is public land under the Integrated Social Forestry Program (ISF). Under the ISF Program, Certificate of Stewardship Contracts (CSC) are awarded by the DENR to qualified households for a period of 25 years and renewable for succeeding period of 25 years. These households are organized under peoples' organizations which provide support for sustainable use of land resources and implementation of farm plans for generating economic benefits for the landholders. People's organizations relevant to the project, namely Divisoria Sur Agroforestry Association (DSAFA), the Sto. Nino Integrated Social Forestry Association (STISFA) and the Sangbay Upper Basin Ecological Farmers Organization (SUBEFO), are signatories to the project's MOA. Furthermore, the project consulted each CSC holders in selecting the lots to be part of the project. The owner of the private land (there is only one in the project) voluntarily participate in the project, and the project has concluded individual reforestation contract with him. Thus, there is a clear intent of the land right holders to participate in the project. The Project guarantees that it will operate only within these land lots and will not encroach uninvited on private property, community property, or government property.

G.5.2 Guarantee that the project does not require the relocation of people or any relocation is 100% voluntary and fundamentally helps resolve land tenure problems in the area.

The Project guarantees that the project does not require the relocation of people, or any relocation is 100% voluntary and fundamentally helps resolve land tenure problems in the area.

The Project is a community-based and household-based project. The participating families decided for themselves which part of their land to provide to the project. No relocation of people will occur as a result of the project.

G.5.3 Describe potential “in-migration” of people from surrounding areas, if relevant, and explain how the project will respond.

Currently occupied ISF parcels covered by tenurial instruments will have no problem with in-migration; thus, the project area does not have any potential in-migration. However there is great potential for in-migration by outside people wanting to squat on lands in adjacent forest zones.

The existing policy is for POs to cooperate and assist the DENR and concerned LGUs to police their respective areas and enforce pertinent forest laws, regulations and ordinances governing forest occupancy and squatting. The municipal LGUs have recently adopted their forest land use plans in a bid to strengthen efforts directed to managing and protecting the forest lands and resources in close coordination with the POs and the DENR. Implementing these plans should enhance for better management and regulation of forestlands.

With the project, the POs will undergo capability building processes not only concerning the direct establishment of agroforestry and reforestation in ISF farms. Other associated activities as proper management and protection of farms and water resources, forest protection and related law enforcement for legitimate land occupancy will be strengthened. The project will play both direct and indirect roles to facilitate such efforts as the prevention of illegal occupancy of forest lands.

G6 Legal Status (Required)

G.6.1 Guarantee that no laws will be broken by the project.

The project will not break laws. On the contrary, this project will help implement the sustainable management of the land in the framework of CBFM program, the intended future direction of the ISF program in the country (.DENR Administrative Order No. 96-29) Since the DENR and LGUs are project partners as well as implementors of local and national laws surrounding the project, any potential conflict with local laws will be anticipated and mitigated.

The project is consistent with local and national policies. Deforestation and upland degradation are two of the priority issues in national development. Specifically, the project is in support of the following national policies:

(a) DENR Administrative Order No. 24 Series of 1991- This order bans logging in all old-growth forests of the country.

(b) R.A. No. 7586 "National Integrated Protected Areas Systems Act of 1992"- This law establishes a system of protected areas nationwide one of which is the Northern Sierra Madre protected area.

(c) Executive Order 363 Series of 1995- This presidential fiat adopts the Community-Based Forest Management (CBFM) as the national strategy in pursuit of sustainable development in the uplands and promote social justice. It provides for the issuance of an appropriate tenurial instrument for participating upland communities.

G.6.2 Document that the project has, or expects to secure, approval from the appropriate authorities.

The entities with mandates over the project area—the Department of Environment and Natural Resources, Quirino Province, and the Local Government Units of Maddela and Nagtipunan—have signed the Memorandum of Agreement (MOA) for cooperation with the Project. This MOA is a legal instrument that specifies the relationship between and respective roles of project sponsor (moreTrees), the Department of Environment and Natural Resources (DENR), People's Organizations (Divisoria Sur Agroforestry Farmers Association-DSAFA, Sto Nino ntegrated Social Forestry Association-STISFA and Sangbay Upper Basin Ecological Farmers Organization-SUBEFO), The Palacian Economic Development Association (PEDAI), and Conservation International. The project has been endorsed by the Protected Area Management Board of Quirino Protected Landscape (Resolution No. 2010-01) which serves as the basis for securing the host country endorsement.

This project is a positive step to promote government's direction in climate change and forest conservation.

G7 Adaptive Management for Sustainability (1 Point)

G.7.1 Demonstrate how management actions and monitoring programs are designed to generate reliable feedback that is used to improve project outcomes.

Prior to the project implementation, a stakeholders meeting were conducted to draw up the detailed workplan for the project implementation and monitoring plan. Furthermore, regular meetings (quarterly for the first 3 years and bi-annually thereafter) will be conducted with the stakeholders to monitor and update the progress of the activities. These meetings will provide a venue for discussion and resolution of issues and concerns arising during project implementation. The project monitoring plan includes regular recording of the number of seedlings planted by species and the survival rate of the planted seedlings, as well as the types, amount, and date of application of fertilizer. Seedling mortalities will be replaced with new seedlings. With the monitoring information, seedling management methods will be improved. In addition, monitoring through regular patrolling and site visits to the reforestation and agroforestry areas will also be discussed and planned with the communities, LGU and DENR to ensure that activities identified and agreed are properly implemented, and countermeasures taken.

The field management entity, PEDAI, will make three quarterly interim reports and an annual report to CI each year on the progress during the past year and issues that have been identified. CI will, in turn, assess the submitted reports from PEDAI, and also verify the same on site as needed. Besides these formal reporting, CI staff will also conduct informal routine communication with the field implementers for more frequent updates and, if necessary, timely attention.

For the biodiversity and community monitoring, the project will adopt the Biodiversity Monitoring System (NORDECO and DENR, 2001). The system is designed to monitor biodiversity and land use change within a particular area with the involvement of the local community and other stakeholders to determine trends in land use change, biodiversity and community resource use throughout the year. This method includes Focus Group Discussions, Transect Walk, Field Diary and Photo Documentation (See B.3 for details on the methodology).

G.7.2 Describe the a management plan for documenting decisions, actions and outcomes and sharing this information with others within the project team, so experience is passed on rather than being lost when individuals leave the project.

As described in G.7.1, annual reporting will be the main formal mechanism for documenting decisions, actions and outcomes. CI and/or PEDAI will produce minutes of meetings that will be held with project partners and stakeholders. The participants will be given opportunity to review such minutes before signing them.

These reports will be accessible to all project team members throughout the duration of the project. To facilitate this, all data/information gathered through regular reporting, meeting minutes, and monitoring results will be placed in a databank, Information and Knowledge Management System (IKMS). IKMS will be a soft and hard copy document depository (i.e., computer stations and bookcases), to be housed in CI and PEDAI. CI and PEDAI will have identical copies and all information will be made available to project partners. This should facilitate retaining the project experience within the team.

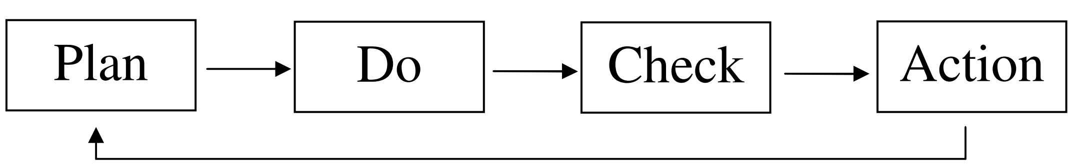
Furthermore, the project emphasizes capacity-building activities. This aspect of the project will also ensure that key experiences be passed on within the project team. Thus, the project-related experience will be retained within the project.

G.7.3 Demonstrate how the project design is sufficiently flexible to accommodate potential changes and that the project has a defined process in place to adjust.

The project follows the PDCA cycle (below) for progress management to ensure that the problems in project implementation and issues and concernsamong partners are properly addressed. The cycle of PDCA starts from detailed planning for the activities (the “P” or Plan phase). The plans are duly implemented (the “D” or Do phase). Progress is evaluated against the initial plan through regular reporting described in G.7.1 and G.7.2. to identify matters that require corrective actions (the “C” or Check phase). Small corrections are immediately instituted and implemented. Large corrections are considered and instituted into the plans for the next step (the “A” or Action phase). The A phase for the current step becomes the P phase for the next step, and the cycle repeats. The PDCA is the project’s formal practice of adaptive management. It allows flexibility to accommodate unforeseen issues during the course of the project implementation, while maintaining coordinated, well-structured decision making and documenting.

As a formal process, the project will review the progress of the implementation annually, using the annual report by PEDAI and CI staff’s observations as factual sources. Quarterly reports by the Community, Environment and Natural Resources Officer (CENRO) of DENR (see CM.3.1) will also provide useful information for PEDAI and CI in identifying problems and necessary adjustments.

Since the project’s impacts in climate, community and biodiversity aspects are largely determined by the progress in reforestation activities and capacity building, the annual review will focus these activities. The outcomes of at the end of the year will be compared against the plan at the beginning of the year. Where the differences are considered large enough, corrective measures (including, but not limited to, change in project plan) will be devised and implemented after due consultation with project partners.



G.7.4 Demonstrate an early commitment to the long-term sustainability of project benefits once initial project funding expires, including e.g. a new project; securing payments for ecosystem services; promoting micro-enterprise; and establishing alliances to continue sustainable land management.

The project developed a budget through 2029 and the donor, moreTrees, has agreed to provide the needed funds annually. Funding flow through 2029 has been secured. MoreTrees will contribute part of the net revenue from carbon marketing back to the project, more specifically to the POs to form the incentive fund. MoreTrees market the carbon credits so that some financial benefit can be provided to the POs. Since moreTrees provides funds needed to implement necessary project activities and market carbon credits based on the ex ante estimate of carbon sequestration on a non-profit basis, better performance of the project (i.e., more carbon sequestration for less expenses) will result in larger revenue. The majority of the increased revenue will be contributed by moreTrees to the POs; thus the name, incentive fund.

The incentive fund will support long-term sustainability by supporting livelihood of participating communities. This fund is envisioned to be revolving, in that the funds that generate the fund are derived from the project activities (credit marketing, agroforestry, etc.) and the funds from the fund may be used for activities, which in turn, will bring back more funds. It is an "incentive" fund in this sense as well.

The operationalization of the fund, including fund management scheme, rules of fund use/access, accounting protocols, will be formalized by the time of the first verification of the project, which coincides with the time the POs will receive first contribution.

G8 Knowledge Dissemination (1 Point)

G.8.1 Describe how they will document the relevant or applicable lessons learned.

Through constant periodic group meetings and discussions, CI and project partners will assess progress of project implementation activities that will highlight accomplishments and identifying conditions or factors that serve to facilitate or constrain their attainment. Documentation of such monitoring meetings will form part of project monitoring as stated in G.7.1.

On the ground level, a management of databank and information will include systematic gathering of data and information, documenting of activities and practices at the farm level, recording of cultural practices and activities rendered by the farmers. A simple journaling to serve as bookkeeping tool will be provided to the farmers-participants where they keep records in chronology of all activities they render in the course of administering their farms. All these records of data and information will become part of the databank and information system that will be installed at the office of PEDAI to provide bases for informed decisions on current and future project activities and actions.

G.8.2 Describe how they will disseminate this information in order to encourage replication of successful practices. Examples include: undertaking and disseminating research that has wide reaching applications; holding training workshops for community members from other locales; promoting "farmer to farmer" knowledge-transfer activities; linking to regional databases; and working with interested academic, corporate, governmental or non-governmental organizations to replicate successful project activities.

Among the major project activities is local capacity building to include communities, DENR and government. A series of training on reforestation and agroforestry development and management will be conducted for the local communities at the onset of the project implementation. Currently, ICRAF, CI and Environmental Leadership and Training Initiative (ELTI)[1] is conducting series of trainings and seminars on Climate change adaptation and mitigation for government (LGU, DENR), local NGOs and Peoples Organization throughout the country. The objective of these trainings and seminars is to enhance the understanding of local partners on the processes involved in Forest Carbon Projects and demonstrate how the VCU mechanism can address the local development needs. CIP has facilitated participation of Peoples Organizations, DENR and LGUs involved in the project to attend these trainings.

The project will also facilitate cross learning visits of upland-farmer project participants to successful agroforestry projects of public and private individuals to learn more on the management and actual benefits agroforestry can provide, share their lessons, and in return promote the project for others' cross visit to the project site.

From the databank and records of practices and activities done in related to the execution of activities in the project (see G7.2), insights, suggestions for improvements, and recommendations will be formulated to generated new body of best management practices, lessons learned and opportunities for adoption in following operating project cycles or by similar projects. The project partners (particularly CI, PEDAI and moreTrees) will participate in forums, as well as exchanging knowledge and experiences with other similar projects to disseminate generated best practices and lessons learned.

CI will continue to participate in conferences, trainings and workshops on climate change to share lessons learned and experiences in developing forest carbon projects to other local NGOs, LGUs and Peoples Organizations such as the training series conducted by ELTI.

[1] The Environmental Leadership and Training Initiative (ELTI) is a joint program that combines the unique strengths of the Yale School of Forestry & Environmental Studies (F&ES) and the Smithsonian Tropical Research Institute (STRI) to enhance environmental management and leadership in the tropics by offering cutting-edge learning and networking opportunities aimed at improving biodiversity conservation and human welfare.

II. Climate Section:

The Project's climate benefit is summarized in Table12. The expected CO_2 removal by the project is 1,808 tCO_2/yr, or 41,576 tCO_2 over the 23 years crediting period.

Table 12. Estimate of the climate benefit generated by the Project

Year	Area (ha)	Baseline net GHG removals (tCO_2e)	Leakage (tCO_2e)	Annual anthropogenic GHG removal (tCO_2e)			Net anthropogenic GHG removals (tCO_2e)
				Grassland (AR-AMS0001)	Cropland (AR-AMS0004)	Total	
2007	8	0	0	0	107	107	107
2008	8	0	0	0	104	104	211
2009	36	0	0	0	509	509	720
2010	177	0	0	843	1,931	2,774	3,494
2011	177	0	0	824	1,793	2,617	6,112
2012	177	0	0	817	1,882	2,699	8,811
2013	177	0	0	813	1,472	2,285	11,096
2014	177	0	0	-271	145	-126	10,970
2015	177	0	0	811	1,700	2,511	13,482
2016	177	0	0	809	1,863	2,672	16,154
2017	177	0	0	807	1,193	2,000	18,154
2018	177	0	0	-986	-998	-1,985	16,169
2019	177	0	0	807	1,859	2,666	18,835
2020	177	0	0	805	1,855	2,660	21,496
2021	177	0	0	804	1,852	2,656	24,151
2022	177	0	0	802	1,745	2,547	26,699
2023	177	0	0	801	1,847	2,648	29,347
2024	177	0	0	800	1,495	2,296	31,642
2025	177	0	0	799	1,514	2,313	33,955
2026	177	0	0	798	1,841	2,640	36,595
2027	177	0	0	798	1,554	2,351	38,946
2028	177	0	0	797	1,833	2,630	41,576
2029	177	0	0	796	876	1,672	43,247
	Total	0	0	13,275	29,972	41,576	

*The carbon sequestration in the last year (shaded) is not counted toward the total as the final verification to be conducted during this year will not include this full amount.

CL1 Net Positive Climate Impacts (Required)

CL.1.1 Estimate the net change in carbon stocks due to the project activities. The net change is equal to carbon stock changes with the project minus carbon stock changes without the project (G2). Alternatively, any methodology approved by the CDM Executive Board may be used. Define and defend assumptions about how project activities will alter carbon stocks over the duration of the project or the project accounting period.

The net change in carbon stocks due to the project activities is presented in Table 12. These calculations were done according to the approved A/R CDM methodologies, namely AR-AMS0001 and AR-AMS0004. The applicability of these methodologies to the project has been established in G2.2.

CL.1.2 Factor in the non-CO_2 gases CH_4 and N_2O to the net change calculations (estimated in CL.1.1.) if they are likely to account for more than 15% (in terms of CO2 equivalents) of the project's overall GHG impact.

Non-CO_2 GHGs are not likely to account for more than 15% of the project's overall GHG impact. Furthermore, the CDM Executive Board agreed at its 42nd meeting held during 24-26 September in Bonn, Germany that GHG emissions in A/R CDM project activities from (i) fertilizer application, (ii) removal of herbaceous vegetation, and (iii) transportation may be considered as insignificant and hence can be neglected in A/R baseline and monitoring methodologies (http://cdm.unfccc.int/EB/042/eb42rep.pdf; p.6).

CL.1.3 Demonstrate that the net climate impact of the project (including changes in carbon stocks, and non-CO_2 gases where appropriate) will give a positive result in terms of overall GHG benefits delivered.

The net climate impact of the project is positive, as the expected CO_2 removal by the project is 1,807 tCO_2/yr, or 41,576 tCO_2 over the 23 years crediting period.

CL2 Offsite Climate Impacts ("Leakage") (Required)

CL.2.1 Estimate potential offsite decreases in carbon stocks (increases in emissions or decreases in sequestration) due to project activities.

AR-AMS0001

Only possible source of leakage is deforestation due to displacement of grazing activity outside the project boundary. The time-average number of domesticated roaming animals displaced was estimated for each of the land compartments by multiplying two factors: time proportion of animal roaming when the animals are not fed in the farmers' backyards, and area proportion of the each land compartment to total area where the animals are allow roaming. The total time-average number of grazing animals was calculated as 2.84 (Table 13).

Table 13. Time-average number of grazing animals in each of the land compartments which are currently used for grazing animals

Lot ID	Barangay	Area (ha)	Time-average number of grazing animals (head / site)
R04	Sangbay, Nagtipunan	0.9	0.04
R18	Sangbay, Nagtipunan	1.1	0.23
R22	Sangbay, Nagtipunan	1.5	0.17
R23	Sangbay, Nagtipunan	3.4	0.17
R24	Sangbay, Nagtipunan	3.1	0.17
R32	San Salvador, Maddela	12.8	0.24
R33	Sangbay, Nagtipunan	2.4	0.03
R34	Sangbay, Nagtipunan	1.8	0.03
R42	Sangbay, Nagtipunan	1.0	0.12
R51	Cofcaville, Maddela	2.6	0.17
R52	Sangbay, Nagtipunan	2.7	0.03
R58	Sangbay, Nagtipunan	2.0	0.03
R59	Sangbay, Nagtipunan	2.0	0.08
R60	Cofcaville, Maddela	2.0	0.17
R61	Sangbay, Nagtipunan	2.0	0.10
R64	Sangbay, Nagtipunan	1.5	0.16
R65	Sangbay, Nagtipunan	1.5	0.17
R66	Cofcaville, Maddela	1.4	0.10
R71	Sangbay, Nagtipunan	1.3	0.09
R74	Sangbay, Nagtipunan	1.2	0.17
R82	Sangbay, Nagtipunan	1.0	0.04
R83	Sangbay, Nagtipunan	1.0	0.17
R87	Sangbay, Nagtipunan	0.8	0.17

Average grazing capacity of the project area per hectare was calculated as 0.59 head, and that for the total area under AR-AMS0001 was 29.76 head by applying equations 10.3, 10.4, 10.6, 10.8, 10.11, 10.13, 10.14, 10.15 and 10.16 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4. Parameters used in the calculation were summarized in Table 14.

Table 14. Parameters used for calculation of average grazing capacity of the project area

Variable	Unit	Value	Source
Type of animal	--	Adult male Buffalo	Interview
Weight	kg	450	Mean of 350-550 kg in Table 10A.3 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 (hereafter 2006 IPCC Guidelines)
Weight gain	kg/day	0	
Milk	kg/day	0	
Work	hours/day	1.37	
Pregnant	%	0	
DE	%	55	
Cfi	--	0.37	Table 10.4 of 2006 IPCC Guidelines
Ca		0.17	Table 10.5 of 2006 IPCC Guidelines
ANPP	t.d.m /ha /year	8.2	Table 1 of AR-AMS0001 Appendix D

It was demonstrated that the time-average number of grazing animals, 2.84, is less than 10% of the average grazing capacity of the project area, 2.98. Therefore, leakage is considered zero.

AR-AMS0004

Only possible source of leakage is deforestation due to displacement of cropping activity outside the project boundary. However, the cropping in the project boundary is not a main activity for supporting livelihood in this area. Moreover, corn and banana cultivations will be allowed in the project boundary for the first 5 years until trees grow. Therefore, displacement of cropland will not be expected, and the project will not trigger activities which could increase in greenhouse gas emissions outside the project boundary. Leakage is considered zero.

CL.2.2 Document how negative offsite impacts resulting from project activities will be mitigated and estimate the extent to which such impacts will be reduced. Estimate the extent to which the negative offsite impacts will be reduced adequately.

There is no leakage expected as a result of the Project.

CL.2.3 Subtract any likely project-related unmitigated negative offsite climate impacts from the climate benefits being claimed by the project. The total net effect, equal to the net increase in onsite carbon stocks (calculated in the third indicator in CL1) minus negative offsite climate impacts, must be positive

Based on CL1.3 and CL2.1, the total net effect of the project is positive.

CL3 Climate Impact Monitoring (Required)

CL.3.1 Describe the initial plan for how they will select carbon pools and non-CO2 GHGs to be monitored. State if the corresponding measurements and the sampling strategy (including monitoring frequency) are set in the monitoring plan. Show that all potential pools are included (aboveground biomass, litter, dead wood, belowground biomass and soil carbon). Pools to monitor must include any pools expected to decrease as a result of project activities. Describe if relevant non-CO2 gases are monitored if they account for more than 15% of the project's net climate impact expressed in terms of CO2 equivalents.

The actual net greenhouse gas removals by sinks will be estimated through monitoring the overall performance of the proposed project activity and monitoring the actual net GHG removals by sinks. In accordance with the decision 6/CMP.1, appendix B, paragraph 6, monitoring of the baseline is not required for small-scale A/R CDM project activity, and therefore, will not be carried on in this proposed project.

Monitoring the overall performance of the proposed project activity

a) Monitoring of the actual project boundary
The actual project boundary was determined before the start of the project, recorded in GIS system, and will be monitored periodically all through the crediting period.
b) Monitoring of the forest establishment
The forestation model (reforestation or agroforestry), planted species and planted year for each lot will be recorded. The survival rate of planted trees will be checked and re-planting will be conducted if the survival rate is lower than 80%.
c) Monitoring of the forest management
Natural and anthropogenic disturbances will be recorded by date, locations, species, area affected, and corrective measures implemented.

Monitoring the actual net GHG removals by sinks

a) Stratification
The *ex post* stratification shall be based on the forestation models and the planting years for the monitoring of carbon stock changes above- and below-ground biomass as shown in Table 15. GHG emissions from loss of existing vegetation due to implementation of the proposed project was determined before the start of the project, and therefore, the existing vegetation types shall not be taken into account for the *ex post* stratification.

Table 15. The ex post stratification S1-S6. Area surface and number of the lots (in parentheses) are shown by barangay.

Forest model	**Reforestation**			**Agroforestry**		
Year plantation	**2007**	**2009**	**2010**	**2007**	**2009**	**2010**
Stratum	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**
Cofcaville, Maddela	n.a.	8 ha (2)	18 ha (10)	n.a.	3 ha (1)	1 ha (2)
Divisoria Norte, Maddela	n.a.	1 ha (1)	n.a.	n.a.	n.a.	n.a.
Divisoria Sur, Maddela	5 ha (1)	n.a.	n.a.	3 ha (2)	n.a.	5 ha (3)
Dumabato Sur, Maddela	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
San Salvador, Maddela	n.a.	n.a	13 ha (1)	n.a.	n.a.	n.a.
Sta. Maria, Maddela	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sto Nino, Maddela	n.a.	10 ha (8)	20 ha (12)	n.a.	7 ha (10)	1 ha (2)
Sangbay, Nagtipunan	n.a.	n.a.	81 ha (48)	n.a.	n.a.	3 ha (3)
Total	5 ha (1)	19 ha (11)	131 ha (71)	3 ha (2)	10 ha (11)	9 (10)

b) Sampling plot number
The monitoring methodology uses permanent sample plots to monitor carbon stock changes in above- and below-ground biomass pools. To reach the targeted precision level of about ±10% of the mean at the 95% confidence level in a cost-effective manner, the number of plots needed in each stratum will be determined by applying the latest methodological tool "Calculation of the number of sample plots for measurements within A/R CDM project activities". However, for the strata S1, S4 and S6, in which numbers of the land lots are small, one sampling plot will be set in each land lot. For the other strata, preliminary 6 sampling plots will be set and used to calculate the number of sample plots required to satisfy the targeted precision level at the first monitoring.

c) Sampling plot size
Different sizes will be applied for the sampling plots in the reforestation strata (S1-S3) and those in the agroforestry strata (S4-S6) because of difference in the tree densities. It is recognized that measurements of 10-15 trees give sufficient precision to obtain average diameter and height of trees, and the sampling plot sizes shall be determined so that the plots include 15 trees inside. In the reforestation strata, in which trees will be planted in density of 1,111 plants per hectare and thinned to approximately 490 plants per hectare, 20 m x 20 m

sampling plots will be used, while in the agroforestry strata with 8 m x 8 m spacing, 35 m x 35 m sampling plots will be installed.

d) Plot location
GPS located permanent plots ensure the measuring and monitoring consistently over time. To avoid subjective choice of plot locations (plot centers, plot reference points, movement of plot centers to more "convenient" positions), the sampling plots shall be located randomly and also as evenly as possible.

e) Monitoring frequency
Monitoring will be started in 2012 after the project is registered, and conducted every 5 years. However, if the project participants will decide, monitoring would be carried out in shorter interval.

f) Measurement and estimation of the actual net GHG removals by sinks

Above-ground biomass

The carbon stocks, expressed in CO2-e, will be estimated through above mentioned random sampling procedures and using the equations (24) – (28) of AR-AMS0001 or the equations (7) – (11) of AR-AMS0004. The calculations shall be performed for each stratum.

Above-ground biomass at time *t* achieved by the proposed small-scale A/R CDM project activity shall be estimated through the following steps:

Step 1: Establish permanent sample plots and document their location in the first monitoring report;

Step 2: Measure the diameter at breast height (DBH) in the sample plots;

Step 3: Estimate the above-ground carbon stocks using measured DBH , allometric equations, wood density, and CF.

Below-ground biomass

Below-ground biomass at time *t* shall be estimated by applying the equations (27) or (28) of AR-AMS0001 or the equation (10) of AR-AMS0004 and root to shoot ratio.

Soil organic matter

For those strata under AR-AMS0004, soil organic carbon at time *t* shall be estimated by applying the equations (12) – (16) of AR-AMS0004 and monitoring area of each stratum. The default value of average annual increase in carbon stock in soil organic matter for agroforestry system and time from start of the project activity until a new equilibrium in carbon stock in soil organic matter, which are 0.5 t C ha^{-1} yr^{-1} and 20 years, respectively, will be used.

Quality control (QC) and quality assurance (QA) procedures
The major sources of uncertainties are those arising from field measurements and those from parameters applied. Monitoring shall be carried out in way of minimizing the former sources of uncertainty as described below, while conservative choice of the parameters with experts judgments have been done to control the latter. The major sources considered are the project area, tree density, DBH, allometric equation, BEF, wood density, root-shoot ratio and CF. To ensure the net anthropogenic GHG removals by sinks to be measured and monitored precisely, credibly, verifiably and transparently, a quality assurance and quality control (QA/QC) procedure will be implemented.

a) Quality assurance of field measurements
- A well-trained, experienced Team Leader of PEDAI will lead the Field-team members who will be trained by CIP for all procedures and the importance of collecting data as accurately as possible; a manual of procedures will be developed by CIP to serve as the training manual and as field guide by the Field team;
- During training course, field measurements will be checked by a qualified person from CIP to correct any errors in techniques;
- A document that shows that these steps have been followed shall be presented as a part of the project documents. The document will list all names of the field team and the project leader will certify that the team is trained;
- Any new staff is adequately trained.

b) Verification of field data collection
To verify that plots have been installed and the measurements taken correctly, 10% of plots will be randomly selected and re-measured their locations and DBH of trees independently. The re-measurement data will be compared with the original measurement data. Differences between measurement and re-measurement beyond 5% will be considered unacceptable, and will incur general re-measurements.

c) Verification of data entry and analysis
To minimize the possible errors in this process, the entry of field data will be reviewed by and compared with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing data will be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis.

d) Data maintenance and archiving
Data archiving will take both electronic and paper forms. Paper-based data sheets will be stored at least until the verified in the PEDAI office. At least one backup of all electronic data will be made on durable media such as CDs and stored in the CIP offices; this will take place weekly when there is active data usage. The archives will include:
- Copies of all original field measurement data, laboratory data, data analysis spreadsheets;
- Estimates of the carbon stock changes in all pools and non-CO2 GHG and corresponding calculation spreadsheets;
- GIS products;
- Copies of the measuring and monitoring reports.

CL4 Adapting To Climate Change & Climate Variability (1 Point)

CL.4.1 Identify likely regional climate change and climate variability impacts, using available studies.

CL.4.2 Demonstrate that the project has anticipated such potential impacts and that appropriate measures will be taken to minimize these negative impacts.

The Project does not intend to pursue demonstrating that it fulfills this criterion. However, re-creating or creating natural and agricultural ecosystems with high diversity should provide resilience to changes caused by climate change or climate variability.

CL5 Carbon Benefits Withheld from Regulatory Markets (1 Point)

CL.5.1 Demonstrate that at least 10% of the total carbon benefits generated by the project into regulated GHG markets will not be sold. Projects can sell these carbon benefits in a voluntary market or retire them.

The Project will market and retire all carbon benefits in the voluntary market through Voluntary Carbon Standard Registry. No carbon benefits from this project will enter into regulated GHG markets.

III. Community Section:

CM1 Net Positive Community Impacts (Required)

CM.1.1 Describe the appropriate methodologies used to estimate the net benefits to communities resulting from planned project activities. Include a credible estimate of net benefits changes in community wellbeing given project activities. This estimate must be based on clearly defined and defendable assumptions about how project activities will alter social and economic wellbeing over the duration of the project. Compare the "with project" scenario with the baseline scenario of social and economic wellbeing in the absence of the project. The difference (i.e., the net community benefit) must be positive.

Household interviews were conducted using a semi-structured questionnaire to evaluate socioeconomic impacts of the Project, as described in G.1.4.

The majority (76%) of the respondents was already aware of the agroforestry system. This was expected because agroforestry system had long been introduced in many parts of the country for many years. Many seminars and trainings related to agroforestry system were conducted in most parts of the country. Also, this strategy was one of the integral components of social forestry program launched by the government such as the Community Based Forest Management which has become the flagship program of the government towards sustainable forest management.

The majority (71%) of respondents expected agroforestry to be an additional or main source of income (Table 16). Results indicated that most of the farmers in the area believed that they would mainly get economic benefit from the agroforestry system. Aside from goods, the respondents were also able to identify that agroforestry system could provide environmental services. For instance, about 20% of the total respondents mentioned that agroforestry system help prevent occurrence of excessive soil erosion because trees or woody component of the system reduce the impact of raindrops to the soil. Likewise, there were respondents who said that forest or fruit trees improve fertility of the soil and that it could preserve water or make water supply more stable.

Despite these perceived benefits of agroforestry, barriers stand in the way of achieving them (see G.2). The lack of technical know-how and the lack of capital were the barriers that were most frequently identified by the respondents (see G.2.1). The project will create community benefits by removing some of these barriers; the project funding will remove the capital barrier and technical capacity building activities will remove the technical barriers.

The Project has integrated several activities to provide benefits to local communities, specifically in restoration of the watershed and creation of income from sale of agroforestry products. Spin-offs economic activities and benefits are also expected to be generated by the project that will spur sustainable economic development.

Compared to the baseline of persistent poverty, the creation of additional income source contributes positively to the community well-being. To prove this point, the project will undertake the periodic monitoring program to compare the economic situation of local community before and after the project. Specifically, as the government-mandated body, the Community, Environment and Natural Resources Officer (CENRO) of DENR will document the POs' activities and outputs pertaining to their organizational, social and economic development and the corresponding influence or impact towards the promotion of sustainable resource use and development. Lessons learned, issues and concerns will be put into quarterly summary reports.

The average annual income of participants has been recorded at PhP 112,995.46 per annum or a monthly average of PhP 9,416.00 (Table 16). This level of income could hardly support at adequate level the basic household requirements for a household of six members.

Table 16. Average annual income

BARANGAY	Average Annual Income	Number of Respondents
Cofcaville	96,786	14
San Bernabe	135,632	19
San Antonio	79,144	14
Divisoria Norte	162,666	9
Divisoria Sur	90,750	8

Source: Socio-economic survey (Appendix 2)

Introduction of the project is considered to provide livelihood options and additional sources of income for the participants and this should improve their socioeconomic condition.

The opportunities for better livelihood income are provided with adoption of agroforestry technologies in the project site (Table 17). On per-hectare basis, agroforestry is expected to perform better than corn and rice cultivation, and comparable to banana cultivation (Table 18).

Table 17. Benefits of agroforestry perceived by respondents (n = 498)

Item	Frequency	Percent
Additional/Source of income	355	71.29
Source of food	38	7.63
Prevent soil erosion	17	3.41
Protect the environment	11	2.21
Improve soil fertility	5	1.00
Multiple benefits	3	0.60
Ensured income	2	0.40
Source of fuelwood	1	0.20
Preserve water	1	0.20
No answer	65	13.05
TOTAL	**498**	**100.00**

Table 18. Non-discounted cost benefits analysis of existing land uses

LAND USE OPTION	COST/HA	TOTAL YIELD	NET BENEFIT	Non discounted BCR
CORN	20,440	30,000.00	9,560.00	1.47
RICE	12,750	22,750.00	10,000.00	1.78
BANANA	25,000	96,000.00	71,000.00	3.84
AGROFORESTRY	35,264	81,486.32	46,222.28	2.31

Source: Conservation International Philippines (Appendix 10).

Reforestation brings benefits that are largely shared by the community, not by the individual farmers who contribute their land lot to the project. The project, however, can help them retain the land tenure by fulfilling the requirement under ISF (20% of the land shall be forested). The project is also developing a revolving fund (see G7.4) which farmers can use to diversify their livelihood. The POs are negotiating with local executives on the possibility of tax exemption on their ISF lands that is under the reforestation component of the project; prospects are good that the tax exemption will be approved (Appendix 12).

Reforestation will also reduce soil loss (see G2.5), which helps retain the productivity of the land as well as reduces sedimentation in downstream areas for flood mitigation.

CM.1.2 Document local stakeholder participation in the project's planning. If the project occurs in an area with significant local stakeholders, the project must engage a diversity of stakeholders, including appropriate sub-groups, underrepresented groups and women living in the project vicinity. Describe how stakeholders in the project's area of influence will have an opportunity before the project design is finalized, to raise concerns about potential negative impacts, express desired outcomes and provide input on the project design. Project developers must document stakeholder dialogues and indicate if and how the project proposal was revised based on such input.

This project emerged from the attempt of developing a 1300-hectare AR-CDM / Biofuel CDM project. The current VCS/CCB project has been built on the basis of this previous development, and tailored to suit the funding opportunity.

A series of stakeholders' consultations were held by the Management team over a period of three years, starting with the initial consultations during the feasibility study phase in 2002 and in 2004, and succeeding consultations during the project design development phase from 2006 to 2009. The stakeholders who provided inputs to project design development and refinement include the Quirino Protected Landscape's Protected Area Management Board, the Local Government Units of Quirino at the barangay, municipal, and provincial levels, the local communities and peoples' organizations involved, the Department of Environment and Natural Resources at the community, provincial, regional and national levels, and some NGOs and the Quirino State University. The local consultation has been equally attended by all the sub-groups of community including women in the project vicinity.

The following is the chronology of major events of project planning and development through which stakeholders participated and provided inputs:

- Feasibility studies: 2002 and 2004 by CIP, CELB and ICRAF through funding from CI
- Formulation of PDD in 2006 to 2007 by CIP, CIJ, MRI, CELB and ICRAF through funding from the Global Environment Center of Japan resulting to producing the initial draft of 13,000 ha project
- PDD Refinement in March 2008 and finalization of project boundary (satellite image analysis and ground validation) in August 2008
- Presentation of the 20-hectare Pilot Reforestation and Agroforestry Project with the Peoples Organization of Maddela and Maddela Municipal Council in 2008.
- On-going implementation of pilot 20-hectare reforestation and agroforestry (2008-2009)
- Full PDD refinement and detailed planning for 177-ha project in June 2008 to April 2009, which includes finalization of project boundary (satellite image analysis and ground validation), drafting of the MOA involving all the project partners and donor (moreTrees)

In the selection of participating parcels to the Project, the owner's willingness to participate was reconfirmed. Those who were willing to participate indicated their preference towards reforestation or agroforestry. Both the project boundaries and proportion of reforestation / agroforestry changed, reflecting the local interest.

The DENR Region 02 clarified that People's Organizations had the ownership of carbon removal credits. To make it efficient to market the carbon credits via VCS and reinvest the revenue back to the Project, a series of consultations were held between CI and the People's Organizations, Local Government Unit of Maddela and Governor of Quirino Province. As the result, the carbon rights were agreed to be transferred to the donor, who will register the project with VCS Registry, market the credits and reinvest the revenue back to the project for expansion. This arrangement was entered into the Memorandum of Agreement.

CM.1.3 Formalize a clear process for handling unresolved conflicts and grievances that arise during project planning and implementation. Include a process for hearing, responding to and resolving community grievances within a reasonable time period. This grievance process must be publicized to local stakeholders. Describe how the project management will attempt to resolve all reasonable grievances raised, and provide a written response to grievances within 30 days. Document Grievances and project responses.

During the planning stage, all issues and concerns from the project participants were deliberated upon and resolved through multiple consultation meetings and workshops.

During project implementation, resolving conflicts/issues/concerns will be incorporated into the project operational guidelines and protocols. Conflict and grievance resolution will be guided by the detailed implementation and monitoring plans together with the arrangement specified in the Memorandum of Agreement (MOA) signed among the project participants. The MOA indicates that the Local government Unit of Maddela and the Barangay Council will lead in resolving conflicts such as those related to land tenure and land ownership by the local community during project implementation or any issues and concerns that may arise during project implementation. DENR will provide technical support to resolve such conflicts. PEDAI, the Partner-NGO, as well as CI will help facilitate these meetings and discussions as the project's lead implementors.

Additional mechanisms of resolving conflicts are already in place at the community level that include the "Katarungang Pambarangay" or the barangay justice system under the Local Government Code of 1991 [RA 7160, Book III, Chapter 7], and the Alternative Dispute Resolution Act of 2004 [RA 9285 or ADR Act].
The first stop of any conflict shall be the PEDAI or CI staff working on site, and the staff members will do all they can to resolve the reported conflict. If the conflict is beyond the scope at this level, it is escalated to more formal level of conflict resolution.

Conflict resolution internal to the project adopts the standards and procedures used by the regulatory agency of the government, in this case the DENR, where the first stage opts for amicable settlements of concerned parties through negotiation and/or mediation by AdHoc Committees created for the purpose. The DENR also employs legal officers who attend on problems and issues with legal implications, so that if concerned parties would not agree to settle outside the courts, unresolved issues are recommended to be filed in courts of law.

Civil conflicts are resolved following tiers of resolution channels. Firstly, parties in conflict meet before a barangay peace council who mediates and negotiates for settlement of the issues at hand. If the parties reconcile, conflicts get settled at that level. Otherwise, the case is sent to the municipal peace council. If the conflict is not resolved at this level, the municipal peace council will recommend the parties to go to the court, in this case, the trial court at the municipal level.

CM2 Offsite Community Impacts (Required)

CM.2.1 Identify potential negative offsite community impacts that the project is likely to cause.

Potential negative impacts to offsite communities include:

a) Migration and conflict
The Project could attract people from the outside to the project area. Migration of people from outside to take advantage of project opportunities (e.g., jobs) could deprive the communities of their origin of needed labor resources.

b) Price dampening due to oversupply of fruits
With fruit tree farms, there could be an over supply of certain fruits being marketed to offsite communities producing the same fruit products. Thus, oversupply will dampen prices in those markets and adversely affect farmer-producers in those areas.

CM.2.2 Describe how the project plans to mitigate these negative offsite social and economic impacts.

a) Migration
One way to avoid conflicts arising from migration is to ensure that local communities are given priority in employment opportunities involving PO under CBFM. This will discourage entry of people from the outside as well as strengthen local communities. Also, by involving DENR regional office, it is expected that the concept of project will spread and is pursued widely in other parts of the region where people shows such interests or demands.
b) Price dampening due to oversupply of fruits
Market study will be conducted to ensure that there is no oversupply of certain fruits in the surrounding markets. The possibility of marketing fruits to larger market, such as Manila, could also be explored to minimize over supply in local markets.

CM.2.3 Evaluate likely unmitigated negative offsite social and economic impacts against the social and economic benefits of the project within the project boundaries. Justify and demonstrate that the net social and economic effect of the project is positive.

The identified negative offsite social and economic impacts of the project can be mitigated as explained in CM 2.2. On the other hand, the Project is expected to bring positive impacts to the communities within the project area, as presented in CM 1.1. Thus, the project provides overall net positive community benefits.

CM3 Community Impact Monitoring (Required)

CM.3.1 Define the initial plan for how they will select community variables to be monitored, and the frequency of monitoring. Potential variables include income, health, roads, schools, food security, education and inequality. Include in the monitoring plan, community variables at risk of being negatively impacted by Project activities.

In the early design phase in 2006, a socio-economic questionnaire survey was conducted. It was responded by 498 people from the project area and its vicinity. The survey recorded information on land use, demography, occupation, types and sizes of agricultural operations, livelihood alternatives, etc. (Appendix 2). These survey items constituted candidate set of monitoring variables, from which monitoring variables have been selected and included in the monitoring plan for QFCP (Appendix 15).. Formal survey using this instrument as well as the monitoring/consultation as described below will be consolidated to provide rigorous assessment of project's community benefits. This assessment will be used as evidence for each project verification. CI and PEDAI, with support from project partners, will take the lead of this process.

As stipulated in the Revised Rules and Regulations for Implementation of Community-Based Forest Management Strategy (DENR Administrative Order No. 2004-29), participatory monitoring and evaluation will be conducted annually by a team composed of representatives from project partners (DENR, LGU, NGOs, POs) and other concerned sectors.

As the government-mandated body, the Community, Environment and Natural Resources Officer (CENRO) of DENR will document the POs' activities and outputs pertaining to their organizational, social and economic development and the corresponding influence or impact towards the promotion of sustainable resource use and development. Lessons learned, issues and concerns will be put into CENRO's quarterly summary reports.

The apprehension that internal participatory project monitoring could be bias can be counterchecked by parallel monitoring and evaluation activities to be conducted by external auditors.

CM4 Capacity Building (1 Point)

CM.4.1 Explain how the capacity building is structured to accommodate the needs of communities, not only of the project.

Capability building and enhancement principally cater to the needs of the project participants. The training-workshops deal on nursery technologies; plantation establishment and management; agroforestry; soil and water conservation technologies; organizing and financial management; project planning and management; and community livelihood and enterprise development. For each of these categories, Table 19 presents the topics, timing and duration of the sessions, and targeted audiences. Additional topics and/or sessions may be conducted as needs arise.

Table 19. Training topics and schedule for project partners and beneficiaries

CLASS	TOPIC	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				Duration (# of days)	Target Participants	No. of Pax
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
Community Empowerment	Leadership training and value formation																					5	all beneficiaries and partners (LGU, DENR, PEDAI and CI)	85
	Conflicts and conflict resolution																					2	all beneficiaries and partners (LGU, DENR, PEDAI and CI)	85
	Financial management and bookkeeping																					5	all beneficiaries	80
	Review on forest laws, rules and regulations																					2	all beneficiaries	80
	Paralegal training																					3	all beneficiaries	80
	Community-based biodiversity monitoring system																					3	PO Leaders and Barangay Tanods	40
	Cross Visit/ Educational Tour to successful reforestation and Agroforestry plantations																					4	all beneficiaries and partners (LGU, DENR, PEDAI and CI)	90
Project Planning and Management	Community profiling and mapping																					3	CIP, PEDAI, LGU and DENR	25
	Participatory project planning																					2	CIP, PEDAI, LGU and DENR	25
	Project implementation and management																					3	CIP, PEDAI, LGU and DENR	25
	Project monitoring and evaluation																					2	CIP, PEDAI, LGU and DENR	25
Community Livelihood and Enterprise Development	Product scanning and candidate livelihood/enterprise identification																					3	all beneficiaries	80
	Feasibility study for chosen product																					3	PO Leaders and secretaries	35
	Business plan and implementation																					3	PO Leaders and secretaries	35
Optional Class	Other topics will be added as need arises																							

Table 19. Training topics and schedule for project partners and beneficiaries (Continuation)

CLASS	TOPIC	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				Duration	Target	No. of
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	(# of days)	Participants	Pax
Nursery Technologies	Nursery establsihment and layout; Seed technologies (collection, extraction, storage and germination methods)																					3	all beneficiaries	80
	Water system installation and watering																					1	all beneficiaries	80
	Potting media preparation techniques																					1	all beneficiaries	80
	Sowing and propagation techniques																					1	all beneficiaries	80
	Seedling care and maintenance																					1	all beneficiaries	80
	Planting stock hardening																					1	all beneficiaries	80
Plantation Establishment and Management	Agroforestry systems and technologies;Site preparations for field planting; tree planting techniques and tools																					3	all beneficiaries	80
	Plantation maintenance and protection (weeding, replanting, tending operations, fire detection and control, fireline construction and firebreak establishment, trails and graded trails construction)																					4	all beneficiaries	80
	Planting survey, plan, maps and plantation record keeping																					2	PO Chairmen and Secretaries	20
	Fertilizer and mulching																					1	all beneficiaries	80
	Pest and diseases prevention and control																					1	all beneficiaries	80
	Thinning and pruning methods																					1	all beneficiaries	80
Soil and Water Conservation Technologies	Nature of erosion, factors of erosion, and erosion effects and impacts on water and other resources																					2	all beneficiaries and partners (LGU, DENR, PEDAI and CI)	85
	Monitoring soil erosion and water quantity, quality and regime ;Accelerated erosion and gully assessment and stabilization techniques																					3	All partners (LGU, DENR, PEDAI, and CI)	20
	Vegetative methods for slope stabilization ;Bio-engineering and structural measures																					3	All partners (LGU, DENR, PEDAI, and CI)	20

CM.4.2 Explain how the capacity building is targeted to a wide range of groups, not just elites.

The main target of the training is the members of the participating People's Organizations. Since the objective of the training is the empowerment of beneficiaries for the project's long-term success, the training will be open to all relevant persons, regardless of income level, social status or gender.

CM.4.3 Explain how the capacity building is targeted to women to increase their participation.

It is tradition in the Philippines that farming is a family affair; each and every able-bodied members of the family render service(s) and contribute labor required in the farm ranging from site preparation, planting, tending, fertilizing, protecting, harvesting and selling of products in the market. Both males and females equally participate not only in labor in agriculture, but also in information sharing, training, and decision making. Female participation is already there; that consultation and community meetings have been participated 50:50 mix attest to this fact. To ensure this active female engagement in the project in the future, the project will continue to invite female members of the community to participate in capacity-building sessions. Where female participation is particularly important, the announcement will include explicit languages to encourage female members to participate.

CM.4.4 Explain how the capacity building is aimed to increase community participation in project implementation.

The capacity-building activities are expected to generate understanding and appreciation of the project by the local communities. In turn, such appreciation will contribute and lead to wider community participation in project implementation.

First, knowing the roles and functions of each project components and how they are inter-related will lead to understanding and acceptance of the project. Also, it is a way of the project directly reaching out to the community.

Second, as increasing number of participants materializes, better livelihood and income though involvement in the project implementation and outreach, it is expected that the visibility and credibility of the project will rise within the community that encourages others to join.

CM5 Best Practices in Community Involvement (1 Point)

CM.5.1 Demonstrate that the project was developed with a strong knowledge of local customs and that, where relevant, project activities are compatible with local customs.

The project is designed based on community consultation meetings which highlighted project activities that are appropriate to the local setting in terms of its socio-economic, demographic, technical, cultural, institutional and political conditions. For instance, the consultations were conducted which recognized the authority, concern and participation of local government units' leaders throughout the duration of project planning.

Conservation International Philippines has been involved in conservation activities in the Sierra Madre Biodiversity Corridor, which include Quirino, since 1999. The experience and local knowledge acquired during the past activities have been integrated in the plan of the Project.

CM.5.2 Show that local stakeholders will fill all employment positions (including management) if the job requirements are met. Explain how stakeholders will be selected for positions and where relevant, must indicate how traditionally underrepresented stakeholders and women, will be given a fair chance to fill positions for which they can be trained.

Reforestation, agroforestry, community organization for planning, and community capacity building are four main components of the Project. Specific activities regarding reforestation and agroforestry include: nursery operations (facility development, seedling raising), planting (site preparation, seedling transportation, planting), maintenance (fertilizer application, weeding, replanting dead seedlings, patrol and monitoring), and infrastructure development (construction of graded trails and footpaths, fireline construction and maintenance). Community organization for planning component involves such activities as coordinating with Barangay officials, People's Organizations, Local Government Units; holding planning workshops with stakeholders at the onset; holding quarterly meetings with Barangay officials and People's Organizations; offering livelihood trainings to local stakeholders; and having meetings/workshops with PEDAI, Local Government Units, and DENR. Community capacity building component targets skills development for project implementation and awareness raising for environmental issues.

When hiring personnel, the Project place prime consideration to maximizing the efficiency and sustainability of the operations. PEDAI as project administrator and manager at the site level uses recruitment standard requiring minimum technical preparation by applicants wanting to work for the carbon project. Technical personnel who will be tasked to supervise agroforestry and reforestation activities – establishment, cultural and silvicultural management, maintenance and protection, etc. should have earned a forestry/agroforestry degree and/or agriculture major in horticulture degree. Preference shall be given to applicants with at least 3 years of solid experience in the relevant field, among others. GPS/GIS expertise will be a competitive advantage by applicants for technical work in the project. Earned training in climate change and related aspects will be preferred. Those that meet these criteria will not be discriminated against based on gender, age, or other attributes and social/cultural origins.

Establishment and development activities will be part of the task to be implemented by the farmer-participants using available household labor plus hired labor services as required to complete given activities in time. All these activities will be under the supervision and quality control of PEDAI. Parallel performance quality control will be exercised by CI to ensure compliance to standards set forth. Through PEDAI, the project aims to reach out its program activity to various groups of community and provide a fair chance of participation along with capacity building program and socio-economic development program offered by PEDAI and CI Philippines.

Capacity-building activities will be conducted parallel to project activities, particularly to provide to the local farmer-participants to acquire capacities for project management and protection/maintenance activities. Noteworthy will be the formation of project core groups from among the farmer-participants who will be enabled/empowered as to the technical and managerial aspects of developing agroforestry and reforestation projects so that in due time, they will "graduate" from being supervised by project intervenors in connection with project planning and implementation. These local core groups will compose the "para-technical teams" who will take care of sharing agroforestry/reforestation best management practices as they have learnt and experienced to prospective and incoming participants to the carbon project.

Given that there are much more areas to be reforested and sustainably managed beyond the initial parcels targeted by the project (within and outside the project boundaries), expansion of activities is an important consideration. If personnel are available to take over the CI's or PEDAI's role partially or entirely and manage the project effectively, CI and PEDAI can devote its resource to other sites. At the same time, if persons who "graduate" from the project after capacity training and experience can replicate the project activities elsewhere toward the common goal of achieving the triple benefits, and CI will support such actions.

CM.5.3 Show that the project will inform workers about their rights, and that the project complies with international rules on worker rights.

CI and PEDAI consistently adopt standard policies for recruitment and selection of personnel and provide remunerations commensurate to the level of expertise required from employed personnel. Standard rights, privileges and benefits due to employed personnel are also provided with guidelines prescribed by agencies such as the Civil Service Commission (CSC) and the Department of Labor and Employment (DOLE).
The project recognizes the following relevant laws and regulations as relevant to covering worker's rights in the Philippines.

- Labor Code of the Philippines, more precisely Book I-VII governing employees. [This Code is the Presidential Decree No. 442 – as amended. A Decree Instituting A Labor Code, Thereby Revising And Consolidating Labor And Social Laws To Afford Protection To Labor, Promote Employment And Human Resources Development And Ensure Industrial Peace Based On Social Justice.]
- Omnibus Rules Implementing The Labor Code [or Rules To Implement The Labor Code.]
- Local Minimum Wage Law set by Regional Tripartite Wages and Productivity Board, DOLE Region 02

The project communicates to the workers their rights in several occasions, first during the application and interview as part of the recruitment process, and periodically during the engagement period. CI and PEDAI apply uniformly their policies on human resources development, which complies with the Philippines' labor law and its implementing rules. For instance, the project will only enter into labor contracts that comply with existing national laws or even international rules that clarify the rights and obligations of both contracting parties.

This is checked and verified through external auditing to which CI and PEDAI submit themselves annually.

CM.5.4 Comprehensively assess situations and occupations that pose a substantial risk to worker safety. A plan must be in place to inform workers of risks and to explain how to minimize such risks. Where worker safety cannot be guaranteed, project proponents must show how the risks will be minimized using best work practices.

Project activities were thoroughly assessed for worker risks. The following activities were identified as potential risk for field workers, and respective mitigation measures have been devised.

1. the use of pointed or sharp tools and equipment required to perform digging and cutting operations in the nursery as well as planting, weeding and tending, and cultural treatments in plantations

Mitigation measures
Standard procedures that will ensure workers' safety and will avoid potential laceration or cutting accidents will be imparted via instructions administered to all workers prior to the conduct of the relevant operations. Requirements for handling tools and equipment after use will also include the practice of properly keeping them in designated tool room of the nursery bunkhouse or workers' homes. Training workshops will instruct the standards for safe equipment operations and avoidance of accidents in all work activities.

2. the use of pesticides and other chemical-based materials for cultural treatments, diseases control and/or weeding out applications

Mitigation measures
The workers will be required to follow the accompanying instructions on proper product handling and use. The training workshops will have the proper use of pesticides and other chemical-based materials as one of the topics.

3. firefighting operations

Mitigation measures
Firefighting activities expose workers to potential burning accidents which can be fatal. Inasmuch as firefighting requires special skills to be effectively employed, workers will be appropriately trained during training-workshops on plantation management and protection.

Properly trained workers will constitute the basic line of defense to mitigate the risks of fire accidents during firefighting carried out in order to protect plantations.

Other activities are considered to be low risk. This assessment is based on the fact that all workers of the reforestation and agroforestry components are local farmers who are fully knowledgeable of the area's climate and necessary precautionary measures for working on the field. Should the project identify new job/occupational hazards later on, the project will disseminate relevant information at regular meetings, as part of the hiring process, or in the process of starting different project components.

IV. Biodiversity Section:

The Sierra Madre Biodiversity Corridor, covering approximately 1.7 Million hectares, is one of the most biologically important areas in the Philippines. It includes 15% of the remaining closed canopy dipterocarp forests in country as well as 47% of the remaining mossy forests. Aside from the diverse habitat types, the corridor is also home to the endangered Philippine eagle and Philippine crocodile.

Part of the Sierra Madre Biodiversity Corridor is the Northern Sierra Madre Natural Park, the largest protected area under the National Integrated Protected Area System (NIPAS) of the country. The Park is one of the few areas in Asia that contain a high concentration of threatened species. A total of 70 globally threatened or near-threatened species of wildlife have been recorded in the Park. In addition, it harbors the largest remaining lowland forest in the Philippines.

There are no systematic studies on the threats to the natural forests and the biodiversity resources of the target project area. However, experience in the Northern Sierra Madre Natural Park in nearby Isabela province shows that the main causes of forest destruction are logging (large and small-scale), shifting cultivation, agricultural development, land tenure issues, and land speculations (NORDECO/DENR, 1998). Interviews with local people reveal that the same causes are operating in the project area.

Shrubland and grassland areas, which are main parts of the project area together with cropland, are the end result of deforestation and decades of upland farming. They are usually of small trees and grasses such as *Imperata cylindrical* (*cogon* in the Philippines and Satan's tail in the US) and *Themeda sachharum* (*talahib* in the Philippines). They have low soil fertility and high erosion rates. For years, the government has been trying to rehabilitate them through reforestation activities. However, government efforts have had little success due to several technical and socio-economic factors. One of these is that lack of incentives by the various stakeholders to keep the trees alive which in turn is partly due to the lack of participation of local people.

The Sierra Madre mountain range is also an important watershed, providing water for power, domestic use and irrigation. Reforestation and consequence poverty reduction will result to the maintenance and expansion of tree cover in the watershed which in turn will cause a more stable water supply in the long run.

In addition, reforestation of barren lands will significantly reduce the rate of soil erosion and degradation in the watershed. The soil conservation benefits of tree plantations and agro-forestry systems are well-documented in the Philippines (Cruz, 1992; Lasco, 1987).

B1 Net Positive Biodiversity Impacts (Required)

B.1.1 Use appropriate methodologies (e.g., key species habitat analysis, connectivity analysis) to estimate changes in biodiversity as a result of the project. Base this estimate on clearly defined and defendable assumptions. Compare the "with project" scenario with the baseline "without project" biodiversity scenario completed in G2. The difference (i.e., the net biodiversity benefit) must be positive.

The project site was once covered with continuous forest until 1970s, and then the forest cover rapidly declined (Figure 3). Hunting, habitat loss and fragmentation are identified as the major causes of biodiversity loss, as seen in assessment of the threatened species. Recovering the forest using native tree species means restoring the habitat conditions for the assemblages of species, which may be indicated by the recovery of threatened species. On this basis, the project will bring positive biodiversity benefit in comparison to the baseline scenario presented in G2. The lists of species observed in the intact ecosystems in the region, as presented in Appendix 13, serve as the pool of species that may recolonize the project area when habitat conditions improve. Table 20 summarizes the biodiversity benefits of the project.

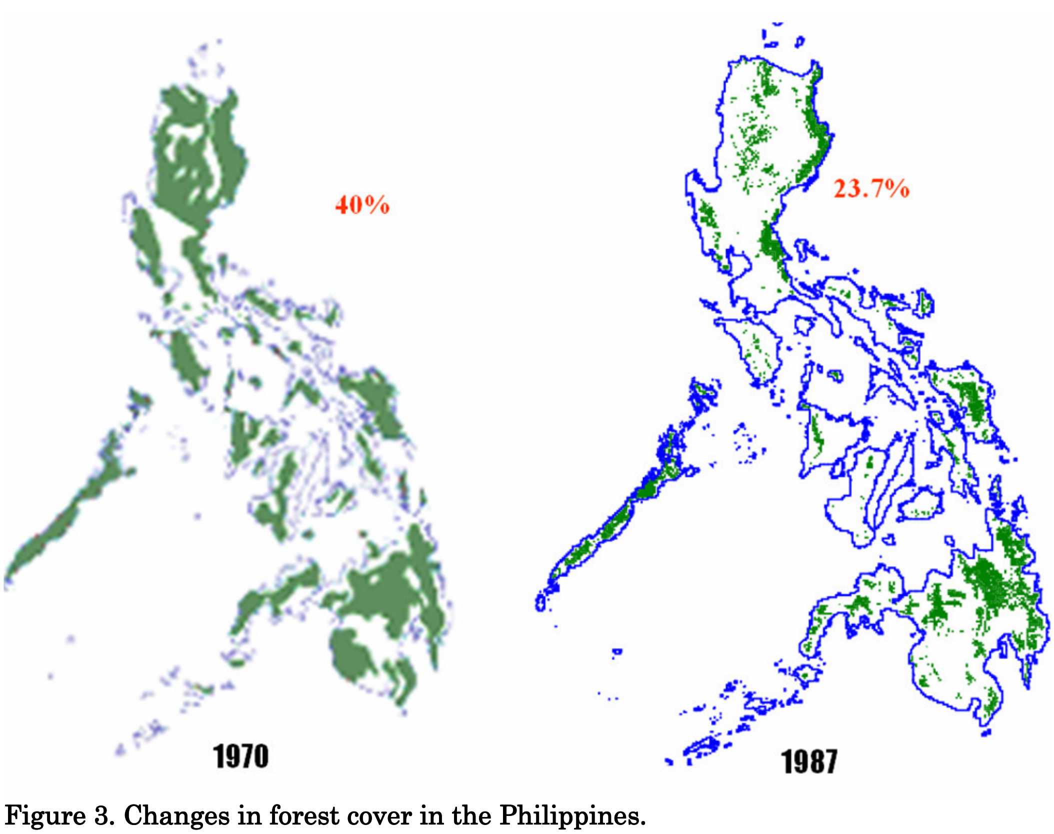


Figure 3. Changes in forest cover in the Philippines.
Drastic deforestation occurred in 1970s and 80s.

Table 20. Net biodiversity benefits projected under 'with-project' scenario.

Without-project scenario	With-project scenario	Net effect
Diversity of forest dependent species, many of which are endemic, will remain the same or possibly decrease	Reforestation will increase area of cover and forage for the forest dependent species; encourage recolonization from remaining forest patches in the vicinity	Positive
The loss of the remaining patches of native forest leading to local disappearance of seed-dispersing wildlife that would otherwise help natural forest regeneration as well as refuges and habitat of the identified threatened and endemic species	Remnant, fragmented forest patches will be connected with new planted forest, forming continuous larger patch of forest. Wide range of species being threatened by loss of forest, from Philippine eagle, to Ashy ground thrush and Pygmy forest frog, will benefit from this change.	Positive
Population of threatened tree species continue to decline	Project will increase the population of threatened tree species by using their seedlings in reforestation	Positive
Agriculture dominates the landscape	Natural habitat increases in the landscape	Positive
Increase in disturbed sites are prone to negative impact of invasion by non-native, invasive species of plants and animals	Forest will provide more stable conditions, making it harder for pioneer-type invasive alien species to become established.	Positive

B.1.2 Describe possible adverse effects of non-native species on the area's environment, including impacts on native species and disease introduction or facilitation. If these impacts have a substantial bearing on biodiversity or other environmental outcomes, the project proponents must justify the necessity of using non-native species over native species.

The project will plant only species that are found in the forest of this region. The seedlings to be planted will be raised locally, which minimizes the risk of introduction or facilitation of new diseases. Thus, no adverse impacts of non-native species are expected for this project.

B.1.3 Identify all IUCN Red List threatened species and species deemed threatened on nationally recognized lists that may be found within the project boundary. Project proponents must document how project activities will not be detrimental in any way to these species.

Tables 21 and 22 provide the list of IUCN Red List species and match category under the Philippines' National Red List that have been observed in Quirino Protected Landscape adjacent to the Project area. They may be found within the project boundary as well, and it is one of the Project's objectives to provide better habitat conditions for these species through forest restoration.

Table 21. List of threatened species of fauna within the Quirino Protected Landscape (CR Critically Endangered, EN= Endangered; VU=Vulnerable, OTS=Other Threatened species, OWS=Other Wildlife Species)

Species	IUCN	National Red List*
Mammals		
Sus philippensis	VU	VU
Rusa marianus	VU	VU
Birds		
Oriolus isabellae	CR	OWS
Spizaetus philippensis	VU	VU
Bubo philippensis	VU	VU
Ceyx melanurus	VU	VU
Pitta kochi	VU	VU
Ptilinopus marchei	VU	VU
Hypothymis coelestis	VU	VU
Reptiles		
Varanus olivaceus	VU	VU
Pelochelys cantorii	EN	EN
Amphibians		
Kaloula kalingensis	VU	
Platymantis sierramadrensis	VU	

* DENR- Department Administrative Order 15-2004

Table 22. List of threatened species of flora found within Quirino Protected Landscape. (CR Critically Endangered, EN= Endangered; VU=Vulnerable, OTS=Other Threatened species, OWS=Other Wildlife Species)

Species	IUCN	National Red List*
Mitrephora fragrans	VU	VU
Agathis philippinensis	VU	VU
Terminalia nitens	VU	
Dillenia philippinensis	VU	OWS
Dipterocarpus validus	CR	
Hopea acuminata	CR	CR
Shorea contorta	CR	VU
Shorea guiso	CR	
Shorea negrosensis	CR	VU
Shorea palosapis	CR	
Shorea polysperma	CR	VU
Macaranga caudatifolia	VU	OWS
Macaranga grandifolia	VU	
Lithocarpus ovalis	VU	OTS
Pterocarpus indicus	VU	CR
Aglaia costata	VU	OTS
Horsfieldia ardisiifolia	VU	
Guioa discolor	EN	EN
Palaquium bataanense	VU	

* DENR- Department Administrative Order 2007-1

B.1.4 Identify all species to be used by the project and show that no known invasive species will be used.

Tree species to be used for planting have been determined by consultation of the farmers and expert judgment of local DENR, CIP and LGU taking into consideration of soil and climate conditions, the value of associated forest products, biodiversity enhancement and carbon sequestration rates. The chosen species are:

For reforestation:

1. Narra (*Pterocarpus indicus*)
2. Molave: (*Vitex parviflora*)
3. Dao (*Dracontomelon dao*)
4. Tuai (*Bischofia javanic*a)
5. Palosapis (*Shorea palosapis*)
6. Balakat-gubat (*Sapium luzonicum*)
7. Kalantas (*Toona kalantas*)
8. Mahogany *(Swietenia macrophylla)*

For agroforestry:

1. Citrus family (Citrus spp)
2. Lanzones (*Lansium domesticum)*
3. Rambutan (*Nephelium lappaceum)*

Furthermore, other indigenous species present in the nearby forest areas will also be collected from the wild and used for reforestation. Collection of seeds and wildlings by the local communities will be encouraged and will be raised in established nurseries for future use as reforestation planting materials. Increasing the diversity of indigenous species to be planted will supplement the number of seedlings needed by the project.

The following provide description of the species to be used for reforestation and agroforestry. None of these are known invasive species.

SPECIES FOR REFORESTATION

1. Narra (*Pterocarpus indicus*)

Narra attains the height of 35 meters with a diameter up to 200 centimeters. It is a deciduous tree with a fluked trunk and somewhat pronounced buttresses, usually with a wide spreading crown and sometimes with lower bunches dropping and touching the ground. Narra is adapted to flat, coastal plains behind mangrove swamps, sites along streams in the low hills near costs or inland valleys and primary and secondary forest. It is generality found in calcareous soils or thus not deficient in calcium. It prefers moist sandy loan or clay loam soil. The tree is used as shade for abaca crops in Bicol regions and for coffee crops in Mindanao. It is planted along roads and in yards. The value of its wood, it is a plantation species for sawn wood.

Seed collection: There are 1200 to 1300 seeds per kilogram and 140 seeds per liter. Seeds are collected during the months of February, March and April in the forest. Seed pods can be picked up from the ground underneath the trees and can be stock in open container.

Establishment: Seeds (in winged spots) can be sown in a flood bed (lowered bed) for germination. Germination averages 24% to 40% 4 to 15 days after planting then pricked off to a pot and tended to grow for 3 to 4 months at the nursery before out planting.

2. Molave (*Vitex parviflora*)

Molave is a medium to large tree, which can attain heights of 20 to 30 m. and diameters of 1 to 1.5m. It has an open, widely spreading crown. Tall trees have pronounced buttresses. On less favorable sites where the forest has been cut, the tree is small to medium sized with very ragged shape and crooked, short bole. The tree is deciduous, dropping some or all leaves during droughts. Fruits are small, globular drupes, 5 to 10 mm. in diameter and purple to black when ripe. They contain storey seed about 5 to 6 mm. in diameter. The fibrous bark is smooth or thinly flaked and grayish ochre. When cut the bark is yellow with darker yellow rings, turning brown on exposure.

Molave grows best on limestone, litho and volcanic soils but occurs elsewhere. It is suitable for very dry and rocky sites with a southern exposure. It occurs in regions with distinct dry seasons (6 to 7 months) and in some places with close to desert conditions. It grows best in areas with rainfall that is evenly distributed.

Seed Collection: Flowering occurs at 5 to 6 years or age in May to October in Laguna, October to December in Cebu. Seeds can be stored for up to 1 year if fruit pulp is thoroughly removed and seed well dried. There are approximately 10,000 to 11,000-dried seeds/liter and 19,000 per kg.

Establishment: Molave is directly seeded on 1 by 1 m. spacing. Fruits are planted in a cleaned area 2 or 3 or more per hole, 2 cm. or less deep. Or cleaned seeds can be broadcast after grass and weeds are cut short or burned. In nursery beds, seeds maybe planted 1 cm. by 15 cm. apart germination occurs in about 10 days.

3. Dao (*Dracontomelon dao*)

Evergreen tree commonly 12-18 m in height, withdense, rounded head, smooth branches, and milky sap. Leaves alternate, long-petioled, trifoliolate (3 leaflets); leaflets shiny, bronze-toned, oval-elliptic, 15-20 cm long, with margins small toothed. Flowers tiny, without petals, greenish-yellow, in manyflowered clusters (racemes) at leaf axils; male and female flowers on separate plants (dioecious). Fruit pea-sized, berrylike, fleshy, to 9 mm in diameter, brown or reddish or blue-black, 3-celled.

Fast-growing from seed or cuttings, thriving best in moist soil. Leaves deciduous in times of drought. Also root suckers. Limited to areas with average minimum temperatures of 1.6 to -1.1°C. Flowers in spring. Fruits copiously in Florida, with seeds dispersed by birds. Seedlings can grow in sun or shade and adapt quickly if light conditions change.

4. Tuai (*Bischofia javanica*)

Widely distributed Indo-Malayan species extending into the Philippines Korea, and Polynesia. Common along streams at low and medium altitudes. May reach a height of 30 m but bole seldom attaining a length of 7.5 m; trunk diameters of 90 cm and more are common, reaching 150 cm; without buttresses.

Economic Importance: The wood of *B. javanica* is red, heavy, hard, and fine grained, making it useful material for building flooring and furniture components. Good quality Kraft and soda pulp were prepared from this wood. The fruits are used in winemaking. Containing 30-54 percent oil, the edible seeds are used as a source of lubricant. The bark is a source of red dye. The roots are used medicinally.

5. Palosapis (*Shorea palosapis*)

Also called Philippine Mahogany or White Lauan. A species of the Dipterocarpaceae family. It is endemic to the Philippines. It is threatened by habitat loss. Commonly 30 to 45 m in height sometimes reaching 60 m; 90 to 150 cm in diameter; boles are well formed and with or without buttresses depending on species.

6. Balakat-gubat (*Sapium luzonicum*)

Found in primary and disturbed Dipterocarp forest, bamboo forest, secondary forest, mixed deciduous forest, also along streams and on hills and slopes; in Selangor (Malaya) it is very common and forms a distinctive forest community of the late succession with *Endospermum malaccense*, poor in Dipterocarps. Soil: brown and yellow clay and loam, sandy loam, over limestone, granitic and volcanic bedrock. Altitude 15--1,800 m. Flowers collected in Dec.--Sep.; fruits collected in Jan.--Oct. The flowers with a sweet smell.

7. Kalantas (*Toona kalantas*)

An endemic species found in primary forest at low and medium altitudes in the Batan Islands, Cagayan to Sorsogon Provinces in Luzon; Mindoro, Samar, Negros, Leyte, Cebu and Mindanao, Philippines. A large, forest tree. The leaves are alternate, oddly pinnate, and 30 to 50 cm long or longer. The leaflets are smooth or hairy along the nerves below, oblong or broadly lanceolate, about 12 cm long, and 5 cm wide. The panicles are profuse, lax, and equaling or shorter than the leaves. The fruit is 3 to 4 cm long, with a 5-ridged central column. The seeds are distinctly but unequally winged at each side.

8. Mahogany (*Swietennia macrophylla*)

Big leafed mahogany is a large tree with normal height of 30 to 40 meters and girth of 3 to 4 meters. It can attain a 60 meter height and 9-meter girth. The trunk has buttresses at the base and a straight cylindrical bole. A deciduous tree shed its leaves in February and March. Fruits are long (12 to 16--cm.) conical capsules 5 to 7 cm. wide, each containing numerous oblong winged seeds 3 cm. long. The dark brown bark is smooth when young, ridges and flakes form later.

Mahogany is native to Central America, down to Northern Peru and Brazil and to the Antilles. It was introduced in the Philippines in 1914 and is a common reforestation species. Big leafed mahogany adapts to a variety of soils but has a distinct preference for well-drained, sandy clay slopes. It does well on rather shallow, as well as deep alluvial soils. Big leafed mahogany is found in areas having temperatures ranging from 11ºC to 32ºC; seedlings require shading to become established, and then outgrow the competition to dominate the canopy. Shoot boners are a serious problem in the Philippines even on good sites.

Big leafed mahogany is used in various multi-storey system in the Philippines. At Mt. Makiling, Laguna, it is used as a shade for coffee and cacao. In Benguet Tugi (Diocorea esculenta), pineapple, ginger and banana are grown under the mahogany. Elsewhere the tree is used in taungya system.

Seed collection: Seeds are available in January and February in Laguna and December through February in the Ilocos and Isabela. Remove seed from pods for storage. There are approximately 1,600 to 2,300 winged seeds/kg or 96 winged seeds /liters. Without wings there are 3,500 seeds/kg or 200 seeds/liters. Seeds begin to lose viability after 2 or 3 months but may be kept for up to a year if mixed with sawdust and kept in airtight containers.

Establishment: Up to 95% germination is reported. Larger seeds germinate better and produce bigger seedlings than small seeds: Direct seedlings gives good results only on rich soil in a very humid climate and only if shading is available, as the seedlings cannot tolerate direct sunlight. In the field, plant seeds 8cm. deep. In nurseries, the seeds are sown in rows 10cm. apart. Break off seed wings, plant with rounded tip down, completely cover with soil or leave the broken wing partially uncovered. Keep the soil moist but no water logged. Germination occurs in 14 to 28 days. The shade can be reduced progressively when the seedlings are 4 months old. Outplant when 6 to 8 months old (60 to 70 cm high) as stumped, balled or bare rooted seedlings. For small planting, trees 2 to 4 m. tall may be used. The seedlings do not tolerate being planted in the open: some shade is necessary during the first 5 years. Out planting on 2 m. center is recommended.

SPECIES FOR AGROFORESTRY

1. Pomelo: (*Citrus decumana*)

The pomelo tree is 5 to 10 m. high. The branches have solitary spines, but scales and scars are lacking. The tree prefers well-drained clay loam to sandy loam rich in organic matter, with a pH of 5.8 to 6.5. Trees bear fruit 3 to 5 years after planting. One crop is produced per year. Cleaned seed must be planted immediately after collection. Seed viability is rapidly in storage. There are approximately 57 seeds per fruit.

Amoy mantan, Sunwiluk and Siamese are the commercial pomelo varieties grown.

Establishment: Clear, plow and harrow the area if possible. Prepare the holes for planting. Plant at the onset of rainy season. Young trees are usually budded, but a seedling plants are also used.

Other species of Citrus:

Other species of citrus that are commonly grown commercially: calamansi, mandarin and orange. Calamansi has no recognized horticultural varieties. Ladu, cincum and ponkan are the leading mandarin orange varieties. The orange is cultivated over thousands of years now. It is supposed to originate from South- and indo-China. The clergyman Pierre Clement crossed a mandarin and an orange and this luckily crossing was a seedless mandarin with a looser skin thus easier to peel: the clementine. (beginning of the 20th century). The satsuma is a special crossing from Japan.

Citrus is known to thrive in both tropical and sub tropical climates. Places with well-distributed rainfall are best although those with distinct wet and dry seasons are equally suitable, especially if irrigation can be provided during the dry season. For best production, the soil should be deep, clay loam or sandy loam in texture for easy drained, slightly acidic (pH 5.5- 6.5) and rich in organic matters.

2. Lanzones (*Lansium domesticum*)

A medium to large tree, cultivated trees usually 5-10 m tall, while seedling trees can reach 27 m or more in height. The trunk is generally straight and the branched relatively open. The leaves are alternate and compound, around 23-51 cm long, with 5-7 leaflets. The perfect flowers are small and white, and borne on cauliflorous spikes 10-31 cm long that emerge from older branches. Fruits are spheroid, ellipsoid, or ovoid, around 2.5-5 cm in diameter, and occur in clusters of 4-40. The yellowish peel is easily removed to reveal whitish translucent, aromatic, juicy pulp divided into 5-6 segments. The flavor is reminiscent of sweet grapefruit. Fruits usually contain 1-3 greenish seeds.

Lanzones may be propagated by seeds, cuttings, airlayers or grafting. Seeds must be planted fresh, as they lose viability rapidly if allowed to dry out. Germination occurs in 2-3 weeks, and the seedlings are slow growing. Trees may be grafted at about 1 year of age, or when the trunk is about the diameter of a pencil. They can be grafted by cleft, side veneer, bud, or approach. Young trees should have 50% shade for the first 2-3 years. Langsat trees prefer moist, fertile soil and high relative humidity for best growth. Since they are slow growing, they are often interplanted with other fruit trees. They require tropical conditions, and will grow from sea level to 730 m elevation. Seedling trees may take 10-30 years or more to fruit, while grafts or airlayers can fruit in 5-6 years with good care. A mature tree can produce from 41-308 kg of fruit per year.

3. Rambutan (*Nephelium lappaceum*)

The tree reaches 15-25 m in height, has a straight trunk to 60 cm wide, and a dense, usually spreading crown. The evergreen leaves are alternate, pinnately compound, 7-30 cm long, with reddish rachis, hairy when young, and 1 to 4 pairs of leaflets, subopposite or alternate, elliptic to oblong-elliptic, or rather obovate, sometimes oblique at the base; slightly leathery; yellowish-green to dark-green and somewhat dull on the upper surface, yellowish or bluish-green beneath; 5-20 cm long, 2.5-11 cm wide, the 6 to 15 pairs of principal veins prominent on the underside. The small, petalless flowers, of three kinds: males, hermaphrodite functioning as males, and hermaphrodite functioning as females, are borne in axillary or pseudo-terminal, much branched, hairy panicles.

The fruit is ovoid, or ellipsoid, pinkish-red, bright-or deep-red, orange-red, maroon or dark-purple, yellowish-red, or all yellow or orange-yellow; 3.4-8 cm long. Its thin, leathery rind is covered with tubercles from each of which extends a soft, fleshy, red, pinkish, or yellow spine 0.5-2 cm long, the tips deciduous in some types. The somewhat hairlike covering is responsible for the common name of the fruit, which is based on the Malay word "rambut", meaning "hair". Within is the white or rose-tinted, translucent, juicy, acid, subacid or sweet flesh, 0.4-0.8 cm thick, adhering more or less to the ovoid or oblong, somewhat flattened seed, which is 2.5-3.4 cm long and 1-1.5 cm wide. There may be 1 or 2 small undeveloped fruits nestled close to the stem of a mature fruit.

B.1.5 Guarantee that no genetically modified organisms will be used to generate carbon credits.

No GMOs will be used by this Project.

B2 Offsite Biodiversity Impacts (Required)

The project area for reforestation and agroforestry components are under the land category of forestland of DENR which needs rehabilitation. There are no potential negative offsite biodiversity impacts of the project.

B.2.1 Identify potential negative offsite biodiversity impacts that the project is likely to cause.

One potential negative offsite biodiversity impact of the project that is considered can arise from the collection of wildlings from forests located outside the project site. If not done properly by the community collectors, the negative effect of collecting wildlings would result to reducing available in situ reproductions outside of the project boundary that may delay or hinder the capacity of these forest sources to naturally regenerate themselves. Although the project will make arrangement with the project participants that they can raise planting materials, the main objective is to capacitate the community in the skills of seedling production using indigenous species for future livelihood opportunities as the use of indigenous species is the current direction in the reforestation strategy in the country. At the same time, collecting wildlings and raising it in the nursery can also augment seedling production in the project nurseries especially during the first year of reforestation if the need arises. However, we only need 28,886 seedlings of various indigenous species of trees and these are all readily available or purchased from outside nurseries within the province.

B.2.2 Describe how the project plans to mitigate these negative offsite biodiversity impacts.

No negative offsite biodiversity impacts have been identified which needs to be mitigated.

B.2.3 Evaluate likely unmitigated negative offsite biodiversity impacts against the biodiversity benefits of the project within the project boundaries. Justify and demonstrate that the net effect of the project on biodiversity is positive.

The project is seen to generate net positive impact to biodiversity.

Using indigenous and non-invasive species of plants for reforestation, the project promotes better the natural habitat for biodiversity than using fast growing exotic species. Wildling collection even helps accelerate forest regeneration process by helping the forest disperse its wildlings. In addition, the project also provides additional protection to the area allowing the natural succession and regeneration process to occur and eventually provides refuge to wildlife species. Furthermore, connecting forest fragments through reforestation and managed agroforestry farm landscapes will also help hasten the regeneration process as local wildlife species such as frugivorous birds and bats that help in seed dispersal will be able to move from one fragment to the other thus restoring the natural habitat of the endemic species.

By providing the favored habitat for a diverse species of insectivorous birds and bats, these species will serve as biological control for many insect pests by helping control insect population in the area and prevent them from causing damages to forest and fruit tree species. (This also helps the community in the agroforestry productions.)

B3 Biodiversity Impact Monitoring (Required)

B.3.1 Describe the initial plan for selecting biodiversity variables to be monitored. Potential variables include species abundance and diversity, landscape connectivity, forest fragmentation, habitat area and diversity, etc. Clarify the frequency of monitoring. Include in the monitoring plan, biodiversity variables at risk of being negatively impacted by project activities.

The DENR-adopted Biodiversity Monitoring System (BMS; Appendix 14) will be used in the project. BMS is a field based monitoring system aimed to identify trends of biodiversity at a given time. It involves simple, cost-effective, and standardized methods (such as field diaries, focus group discussion, transect surveys, photo documentation) in monitoring the trends in population of indicator/priority species and land uses in protected areas; systematically generate up-to-date information necessary for effective and efficient management of protected areas. By design, the BMS involves local communities and other stakeholders in the generation of information, which is expected to be not only cost effective way of monitoring, but also to contribute to more sound conservation outcome (Danielsen, 2007). The biodiversity monitoring plan of the project, based on BMS, is provided in Appendix 14, and briefly described below.

The three sites surveyed to provide the baseline biodiversity information within the project area (see G1.6) will be re-surveyed once a year to monitor changes in the species composition, abundance and richness in the birds and bats.

Local community members will also be trained, as part of capacity building activities, to use the methodologies of Biodiversity Monitoring System (or BMS, including Field Diary, Transect, Focus Group Discussion and Photo Documentation). BMS was developed as participatory monitoring methodology, and has been approved and endorsed by the government for monitoring in protected areas.

The backbone of the BMS is the regular collection of data on natural biological resources and their utilization to determine trends in numbers and use of the natural resources. The intention of the BMS is to improve the information available to decision makers in order to ensure that the area is maintained in accordance with the management objectives and that biodiversity is being conserved (NORDECO & DENR, 2001).

The first step in carrying out the BMS is the identification of the resource uses and species to be monitored together with the local communities. This will help facilitate the monitoring activities as communities frequently observed these species or are resources commonly being used by the community. The four BMS methods are Focus Group Discussion, Field Diary, Photo documentation and Transect Walk. A summary of information gained from all four methods can supplement and support each other. Description of the different methods mentioned below is lifted from the BMS Resource Book for Trainers.

Focus Group Discussion
The objective of the focus group discussion is to generate data from the community on the trends in use of natural resources in the area, trends in status of selected resources, number of household benefiting from the use of resources. The information is largely based on the communities own perception but with continuous data gathering and number of participants in the discussion can provide a picture of the general trends. The method is conducted every quarter with the volunteer community monitoring group identified in each of the selected barangays.

Field Diary
The Field Diary method comprises standard recording of routine observations on resource use, habitats and wildlife following a simple data sheet during regular patrols, or whenever the areas/sites are visited. This will encourage people to be observant of changes in the use of the natural resources, threats and abundance of species identified at the beginning of the BMS establishment. Data recorded in the diary includes people encountered and their activities such as fuel wood gathering, charcoal and if possible include quantity, use, market price etc.

Photo Documentation
Fix-point photography from the ground level will be conducted quarterly. It will monitor major changes in the vegetation of the area. The monitoring frequency will be reduced to once a year after significant changes are not observed quarterly. This method requires people with working knowledge on the operations of a camera. In this case, the DENR can provide the technical support for the project together with local communities.

Transect Walk
The transect walk is similar to the field diary method. However, the transect line will be established permanently and at least 2 kilometers in length and will be traversed by the same person every quarter in order for the data to be comparable. This can be done by DENR staff as the lead person together with the community members to train them in identifying species encountered. Data collected in this method includes number of people, species of wildlife and their number.

B4 Native Species Use (1 Point)

B.4.1 Show that the project will only use species that are native to the region, or justify that any non-native species used by the project are superior to native species for generating concrete biodiversity benefits.

B.1.4 provides the descriptions of the species used by the Project. All the species except mahogany (*Swietenia macrophylla*) are native to the region. While it is not truly a native species, Mahogany has been used for reforestation projects and because of its capacity to adopt to the local conditions it has acclimatized itself. Close to a century after its introduction to the country, it has become widely used throughout the country (including the Project site), and has become integrated in the local natural landscape especially for reforestation, tree farming/wood production with its excellent quality as straight boled fit for use as house post. Being locally adopted and relatively fast growing this species readily provides tree cover serving as nurse tree and improving microclimate for indigenous species to get established. Mahogany may bring such positive biodiversity benefits.

The project will not count carbon removal by mahogany in carbon accounting. There is strong interest in the communities for planting mahogany for economic reasons. The project will provide mahogany seedlings, but instruct farmers to plant them outside the 177 ha. Thus, carbon sequestration by mahogany will not be included in VCS calculations, but mahogany planting is a part of the project; thus described in this CCB PDD. Farmers are not providing their entire farm lots to the project, so extra areas for mahogany are available if the farmers choose to plant them.

B5 Water & Soil Resource Enhancement (1 Point)

Both the reforestation and agroforestry components have been designed with the primary objective of helping restore the forest cover of the Cagayan River watershed in the Sierra Madre, reducing soil erosion and conserving soil fertility in the uplands and providing a source of potable water for local communities.

B.5.1 Identify project activities that are likely to enhance water and soil resources.

Soil and water conservation are promoted by the project principally through the major project components of reforestation and agroforestry. With the planting of trees in the reforestation and agroforestry, the plants will retain water and soil through the water and soil holding capacity of their root systems. Their canopies will serve to cushion the direct impact of rainfall to soil erosion. With the adoption of contour planting in agroforestry including practices such as hedge rows soil erosion is further minimized (Mercado et al., 1999; 2005).

B.5.2 Credibly demonstrate that these activities are likely to improve water and soil resource compared to the baseline, using justifiable assumptions about cause and effect, and relevant studies.

All the ISF farms fall under the public domain classified as forest lands primarily managed for watershed protection and rehabilitation. They are managed secondarily for agricultural production. These land parcels are classified uplands where slopes range from 18%-35%. In higher elevations, ISF parcels have slopes greater than 35% up to 50%.

The dominant agricultural practices however use conventional lowland crop technologies. They are cultivated to bananas, corn, or upland rice. Through years since the mid-80s, ISF farms generally suffered from accelerated soil erosion and loss of productive topsoil. Sustaining high productivity in these areas has become a growing concern. Soil and water resources underwent rapid deterioration.

The rates of erosion and soil loss in these areas surpass by about tenfold the critical threshold rate of 12 tons/ha/yr. Reported soil losses in grassland/pasture range from 79.60-210.72 tons/ha/yr; and in agricultural production at 112.80 tons/ha/yr (Francisco(1994) citing ENRAP (1991) and David (n.d.)). Another study reported upland cultivated with crops yielded soil loss of 414tons/ha/yr for banana plantations (Veracion and Lopez, 1979). In terms of nutrient losses, Kim and Dixon (1986) reported 16.70 kg/ha/yr for N; 3.60 kg/ha/yr for P; 14.60 kg/ha/yr for K; 10.60 kg/ha/yr for Ca; 1.60 kg/ha/yr for Mg; and 75.40 kg/ha/yr for organic matter when the rate of soil erosion was 40.35tons/ha/yr.

According to the Universal Soil Loss Equation (see G2.5), shortening of slope will have direct effect in reducing soil loss. The establishment of forest or agroforest though the project will create effective barriers to surface run-off, shortening the slope.

A study on reforestation site similar to this project documented that this is indeed the case (NPC Watershed Rehabilitation R&D; www.napocor.gov.ph accessed on April 30, 2010). The reforestation of critical watersheds by National Power Corporation (NPC) resulted in the reduction of sedimentation and soil erosion to 1.84-19.2tons/ha/yr with an estimated 14.4-28.17tons/ha/yr soil deposits. The study also showed that improvement and stabilization of hydrologic regime occurred. Inside the NPC plantation there was rainfall interception of about 42-47 % with the rate of entry of water from 10.91–16.21cm/hr.

Linked inseparably with the land, water resources are adversely affected in terms of quantity, quality and regime from damaged soil hydrologic properties, sedimentation and pollution of water bodies. From these impacts, the adverse consequences of damage to water resources extend off-site to downstream areas. Sedimentation occurs all along the waterway down to reservoirs, natural water bodies and even croplands. It affects water quality and often degrades downstream lands where it is deposited (Wischmeier, 1976). Reduced soil loss from the project site is expected to improve the situation.

References

Alviola, P.A. and M.R. Duya. 2003. Biodiversity of Sierra Madre Mountain Range: Cagayan, Quirino and Quezon Province. Conservation International Philippines. October 2003.

Brown, R. M., A. C. Diesmos, & M. V. Duya. 2007. A new Luperosaurus (Squamata: Gekkonidae) from the sierra madre of Luzon island, Philippines. The Raffles Bulletin of Zoology 55: 167-174.

Comia, R. A. 1999. Soil and Nutrient Conservation Oriented Practices in the Philippines. (472). FFTC. Taipei City, Taiwan. 1-11p.

Conservation International Philippines. 2007. Assessment Report of Aglipay Caves , Quirino Province. May 2007.

Conservation International Philippines. 2004. Resource Basic Inventory of Terrestrial Vertebrates in the Lowland Forest of Quirino, Philippines. July 2004.

Conservation International Philippines. 2002. Resource Basic Inventory of the Proposed Quirino Protected Landscape: Kilometer 18, Barangay Disimungal, Municipality of Nagtipunan, Province of Quirino. June 2002.

Conservation International Philippines. 2003. Resource Basic Inventory of Terrestrial Vertebrates in Mt. Lataan, Barangay Disimungal, Municipality of Nagtipunan, Province of Quirino: Preliminary Report. March 2003.

Conservation International Philippines, DENR-PAWB and Haribon Foundation. 2006. Priority Sites for Conservation in the Philippines: KBAs. Quezon City, Philippines, 24 pp

Cruz, R. V. O. 1992. Soil erosion prediction in a geographic information system (GIS) Environment. Pterocarpus. 7(1): 1-12.

DENR Administrative Order No. 2000- 13. 2000. Guidelines On The Implementation Of The Biodiversity Monitoring System (Bms) In Protected Areas

DENR- Department Administrative Order 2007-1. Establishing the National List of Threatened Philippine Plants and Their Categories, and the List of Other Wildlife Species. Available at: http://www.pawb.gov.ph/PAWB_Policies/2007/DAO%202007-01.pdf.

DENR-Department Administrative Order 15-2004. Establishing The List of Terrestrial Threatened Species And Their Categories, And the List of Other Wildlife Species Pursuant to Republic Act No. 9147,Otherwise known as the Wildlife Resources Conservation And Protection Act of 2001. Available at: http://www.pawb.gov.ph/PAWB_Policies/2004/DAO%202004-15.pdf.

DENR Region 02. 2008. Quirino Protected Landscape Management Plan. May 2008 Draft.

Danielsen, F. et al. (2007) Increasing conservation management action by involving local people in natural resource monitoring. Ambio. 36: 566-570.

Diesmos, Arvin C., Rafe M. Brown, Angel C. Alcala and Rogelio V. Sison. 2008. Status and distribution of nonmarine turtles of the Philippines. Chelonian Conservation and Biology. 7 (2): 157-177

Duya, M.R.M., P.A. Alviola, M.V. Duya, D.S. Balete and L.R. Heaney. 2007. Report on a Survey of Mammals of the Sierra Madre Range, Luzon Island, Philippines. Banwa Volume 4, Number 1.

Foster, R.B., N.C. Hernández E., E.K. Kakudidi, and R.J. Bunham. 1995. A variable transect method for rapid assessment of tropical plant communities. The Field Museum, Unpublished Working Paper. Chicago, IL.

Francisco, H. 1994. Upland soil resources of the Philippines: resource assessment and accounting for soil depreciation. Environment and Natural Resource Accounting Project (ENRAP) Report. Quezon City, Philippines: DENR-IRG-REECS.

ICRAF 2006. Carbon Stocks Assessment of Land Uses in the Proposed Site of the Carbon Sequestration Project in the Sierra Madre, Philippines. Laguna, Philippines. p.66.

IUCN. 2008. Redlist of Threatened species. Available at http://www.iucnredlist.org.

Kim, S.H. and Dixon, J.A. 1986. Economic valuation of environmental quality aspects of upland agricultural projects in Korea. In: Dixon, J.A., Hufshmidt, M.M. (Eds.), Economic valuation Techniques for the Environment: A Case Study Workbook. Johns Hopkins University Press, Baltimore, MD.

Lasco, R.D. 1987. A comparative study of two agroforestry systems in Pagkalinawan, Jalajala, Rizal, Occasional Paper No. 10 in Social Forestry.

Mercado, A. R. Jr, D. P. Garrity and D. Catacutan. 1999. Technical and Institutional Innovations to Conservation Farming and Agroforestry: Components of Sustainable Watershed Management. Upland NGO Assistance Committee Lakbay- Aral held at ICRAF–Philippines, Claveria Research Site, MOSCAT Campus, Claveria, Misamis Oriental, Philippines on April 14-17, 1999.

Mercado, A. R. Jr, D. C. Catacutan, M. Stark, M. A. C. Laotoco, R. Lasco, and M. R. N. Banaticla. 2005. Enhancing Adoption of Soil Conservation Practices through Technical and Institutional Innovations: NVS and Landcare. presented at the Symposium on Sustainable Agricultural Development of Marginal Upland Areas in the Philippines, sponsored by BSWM-JICA, January 19-20, 2005 at Lopez Hall, Bureau of Soils and Water Management, Diliman, Quezon City, Philippines.

NEDA Region 02. 2006. Cagayan Valley Statistical Yearbook 2005

NORDECO and DENR.1998. Integrating Conservation and Development in Protected Area Management in Northern Sierra Madre Natural Park, the Philippines. DENR. Manila and. NORDECO. Copenhagen. 207 pp.

NORDECO & DENR 2001 NORDECO & DENR. (2001). Biodiversity monitoring system manual for protected areas (2nd Ed). DENR, Manila, and NORDECO, Copenhagen.

Ong, P.S., Afuang, L.E., and Rosell-ambal R.G. (eds). 2002. Philippines biodiversity conservation priorities: A second Iteration of the National Biodiversity Strategy and Action Plan. Department of Environment and Natural Resources- Protected Areas and Wildlife Bureau, Conservation International Philippines, Biodiversity Conservation Program- University of the Philippines Center for Integrative and development Studies, and Foundation for the Philippine Environment, Quezon City, Philippines.

Rico E. L. and R.A. Altamirano, 2007. Assessment Report of Aglipay Caves, Quirino Province. May 2007.

USDA (1978). Predicting Rainfall Erosion Losses. Agriculture Handbook Number 537, available at: http://www.ars.usda.gov/SP2UserFiles/ad_hoc/36021500USLEDatabase/AH_537.pdf

Wischmeier, W. H., 1976. Use and misuse of the Universal Soil Loss Equation. Journal of Soil and Water Conservation: 31(1) 5-9.

CARBON STOCKS ASSESSMENT OF LAND USES IN THE PROPOSED SITE OF THE CARBON SEQUESTRATION PROJECT IN THE SIERRA MADRE, PHILIPPINES

Technical Report

World Agroforestry Centre (ICRAF) Philippines

1.0 INTRODUCTION

Climate change is one of the primary concerns of humanity today. The IPCC Third Assessment Report (TAR) concludes that there is strong evidence that human activities have affected the world's climate (IPCC WG 1, 2001). The rise in global temperatures has been attributed to emissions of greenhouse gases (GHG), notably CO_2.

There is considerable interest on the role of terrestrial ecosystems in the global carbon cycle. The world's tropical forests covering 17.6 M km^2 contain 428 Gt C[2] in vegetation and soils. It is estimated that about 60 Gt C is exchanged between terrestrial ecosystems and the atmosphere every year, with a net terrestrial uptake of 0.7 ±1.0 Gt C. However, LULUCF activities, mainly tropical deforestation, are also significant net sources of CO_2, accounting for 1.6 Gt C/yr of anthropogenic emissions (Houghton *et al*., 1996; Watson *et al*., 2000).

Tropical forests have the largest potential to mitigate climate change amongst the world's forests through conservation of existing carbon pools (e.g. reduced impact logging), expansion of carbon sinks (e.g. reforestation, agroforestry), and substitution of wood products for fossil fuels (IPCC WG III, 2001; Watson *et al*., 2000; Brown *et al*., 1996). In tropical Asia, it is estimated that forestation, agroforestry, regeneration and avoided deforestation activities have the potential to sequester 7.50, 2.03, 3.8-7.7, and 3.3-5.8 Pg C between 1995-2050 (Brown *et al*., 1996). For the Philippines, in general, the most likely candidate areas for climate mitigation projects are those that need to be permanently forested for legal, ecological or social reasons. These include critical watersheds, forest reserves, and forest lands under the National Integrated Protected Areas System (NIPAS) including those with 50% slope and 1,000 m asl altitude (Lasco et al, . 2004).

The Clean Development Mechanism (CDM) is one of three flexibility mechanisms established to meet the goals of the Kyoto Protocol. The CDM aims to assist Annex 1 Parties[3] in achieving

---

[2] Some units of measure commonly used in climate change literature: 1 Gt (gigaton)= 1 billion metric tons or 10^9 tons; 1 Mg= 1 metric ton or 10^6 g.

[3] industrialized countries that have pledged to reduce their greenhouse gas emissions by the year 2000 to 1990 levels

compliance with their GHG emission limitations and reduction commitments by supporting projects in developing countries that meet the latter's sustainable development objectives.

The CDM offers many opportunities for financing sustainable development projects in developing countries that could generate Certificates of Emission Reduction (CERs). It specifically presents opportunities for a developing country to host projects that rehabilitate degraded lands, among others. Eligible participants of the CDM are individuals, groups of individuals, private companies, and NGOs that belong to a country that is a Party to the Kyoto Protocol. In the CDM project cycle, the first step is the preparation of a Project Design Document (PDD), which will have to be approved at the national and international level (Lasco et al, 2004).

This study is part of ICRAF Philippines' tasks in developing a feasibility study for a climate change mitigation- through carbon sequestration project within the Sierra Madre Biodiversity Corridor (SMBC), Quirino-Nueva Vizcaya Section, Philippines. Above- and belowground carbon stocks of existing land uses in the proposed project site were determined using field- and laboratory methods. Basic data on carbon storage were used in assessing potential carbon sequestration benefits of proposed project interventions (such as reforestation and agroforestry development in denuded grassland areas). The assessment is elaborated in the Project Design Document.

2.0 METHODOLOGY

2.1 Site Description

The project area is located in the eastern triangle portion of the province of Quirino (Figure 1). Quirino lies in the upper portion of the Cagayan River basin and is bounded on the north by Isabela, on the east and southeast by Aurora and on the west and southwest by Nueva Vizcaya. In general, the province of Quirino is mountainous. About 80% of the total land area of the province is covered by mountains and highlands.

Specifically, the project area is within the town of Maddela. It is approximately situated between N $16^0$15'00" and E $121^0$40'00" longitude and between N$16^0$27'30" and E $121^0$52'30" latitude.

In terms of climate, the area falls under climatic Type IV. Mean annual temperature is 26.6^0C, with May as the warmest month. The area is generally dry from December and May, and rainy from September to November. Quirino Province is exposed to the southwest monsoon and is frequently visited by cyclonic storms.

Soils in the area come in various types. In lowland areas, soil types include the Maligaya clay loam, Quinga clay loam, and Quinga silt loam. In gently sloping areas, San Manuel silt loam dominates the area. Bolinao clay loam and Cauayan clay loam are found in slightly sloping to rolling areas. In steep areas are Rugao clay and Rugao sandy loam , while in very steep slopes, soil types include Luisiana clay loam, Luisiana Anna complex, undifferentiated mountain soils, and Faraon clay.

The population of Quirino Province as of the year 1995 census is 131,119, with a density of roughly 43 persons per square kilometer of land, and population growth rate of 2.81%. In comparison, in the town of Maddela where the project area is located, the total population is recorded at 28,645, which is 22% of the total population of Quirino. Sixty-nine percent of the town population lives in rural areas. Population density is 44 persons per square kilometer while population growth rate is a little bit lower than that of the province at 2.54%.

Agriculture is the main industry in Quirino Province, with rice and corn as major crops. The province supplies agricultural products to neighboring provinces and Metro Manila. In Maddela, around 79% of the total households are engaged in agricultural activities while only 21% are engaged in fishing and other economic activities such as small scale industries like furniture making, basketry, rattan craft and dried flower production.

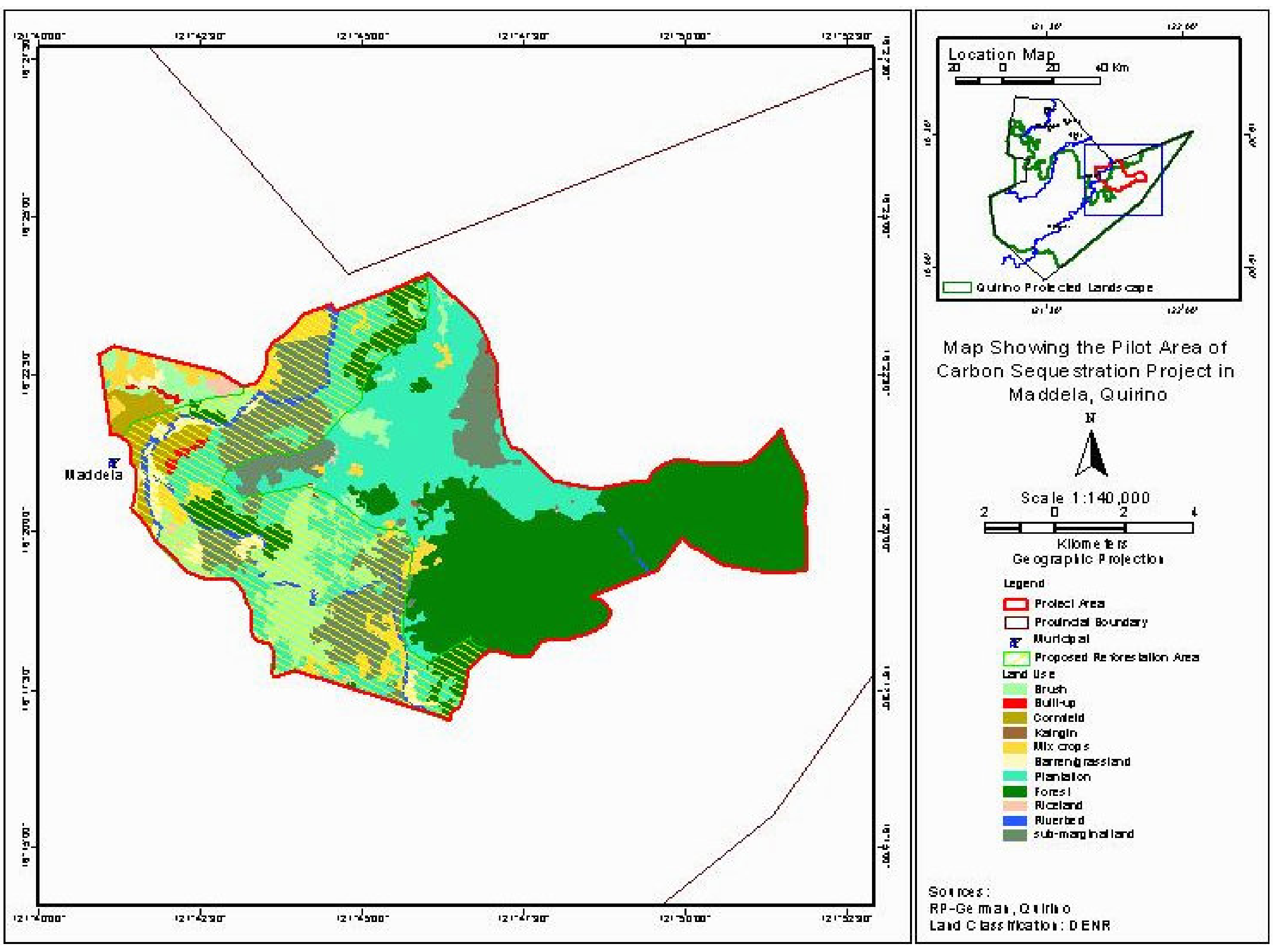


Figure 1. Proposed site of the carbon sequestration project in Maddela, Quirino (updated: August 2004) (source: Conservation International Philippines)

A total of 9 barangays/areas were covered in the field measurements for carbon stocks assessment. These are: San Salvador, San Bernabe, Cofcaville, Divisoria Sur, San Pedro, Villa Agullana, Villa Gracia, Del Pilar (Cabarroguis), and Malabing (Kasibu, Nueva Vizcaya).

Ground assessment for biomass and carbon storage of the different land uses within the project site was conducted from October to November 2004. Among the land uses evaluated were a gmelina plantation located in Cabarroguis, Quirino; banana-gmelina based agroforestry area in Villa Gracia Maddela, Quirino; ricefield, cornfield and grasslands areas of other selected barangays in Maddela, and a fruit orchard in Kasibu, Malabing Nueva Vizcaya.

The community-owned gmelina plantation is found in Barangay Del Pilar in Cabarroguis and was established in 1989 but replanted in 1997 and 1999 with a total area of about 70 hectares. The development of plantations in the area was through a community-based collaborative funded project entitled, "Debt for Nature Swap Initiative Project (DNSIP)" of the Republic of the Philippines and Germany in Quirino province. The species planted were mostly *Gmelina arborea* with ages ranging from 5 to 15 years old. The plantation area was observed to be diminishing due to illegal cutting and agricultural development.

The agroforestry farm assessed in this study was a former gmelina plantation that was established in 1989 under the regular reforestation program of the DENR. Currently, the area is already dominated by banana and other fruit bearing trees such as citrus, jackfruit and mango. Woody tree species are also naturally growing within the area.

The fruit orchard sampled in this study is composed of citrus and rambutan with different years of establishment(1987, 1995, and 1997).

The grasslands and brushlands surveyed are located in areas where soil is compacted or stony and cultivation is practically difficult. The most abundant grassland species are *Imperata cylindrica* (cogon) and *Saccharum spontaneum* (talahib) which indicates that the areas have undergone repeated burning.

2.2 Measurement of Carbon Stocks

The field methods that were employed in measuring the different C pools for each land use were adapted from the methods presented in MacDicken (1997) and Hariah et al (2001), and Lasco (1999). The C stock in the following pools were measured:

1. aboveground biomass - the tree- and understorey layer and the crops planted
2. dead wood biomass - coarse woody debris (dead trees and palms with minimum dbh of 5 cm) and standing litter (fallen leaves, twigs and branches, fruits and flowers on the forest floor)
3. soil organic carbon- up to 30 cm depth

Biomass density is expressed in terms of dry matter per unit area (Mg/ha) and is determined by getting the dry weights of the vegetation. Dry matter is then converted to the equivalent amount of carbon by multiplying by 45%, which is the average carbon content of plant tissue samples taken from different areas in the Philippines (Lasco et al, 2001). The total carbon stock of each land use is determined by summing the contribution of the different C pools.

2.2.1 Tree Plantation, Agroforestry and Fruit Orchard

The field sampling method used in the tree plantation, agroforestry and fruit orchard was a nested sampling design adapted from Hairiah *et al*., (2001). The following describes the procedures for measuring the aboveground C pools: live trees and palms, understorey vegetation, coarse woody debris, litter and soil.

Within the sampling area of each land use, 5m x 40 m (200 m^2) were established. Each plot was constructed by running a 40-m central transect line, and establishing 2.5- m perpendicular lines on both sides. A diagram of the sampling plot is shown in Figure 2.

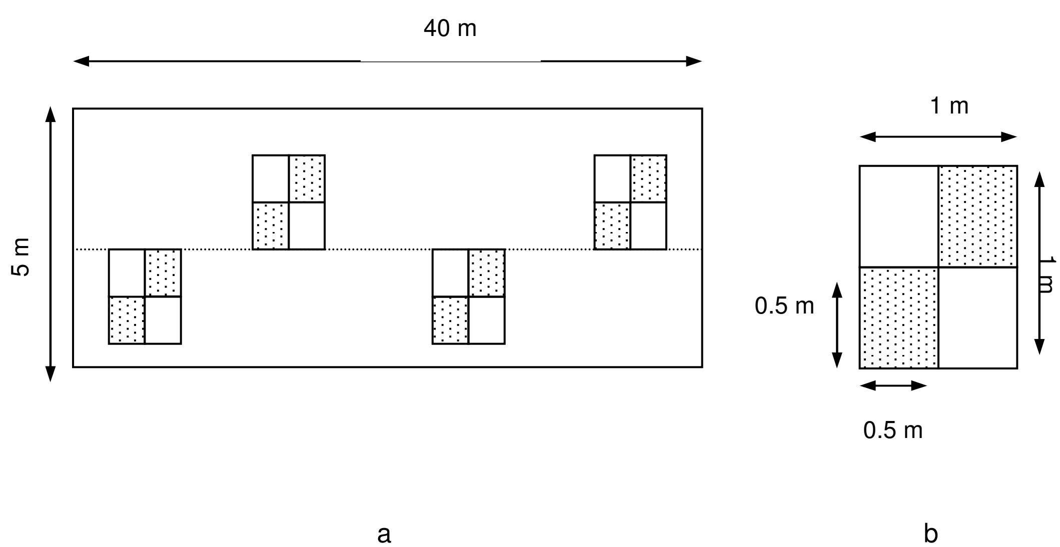


Figure 2. a. The main 200- m^2 plot for sampling trees. Within the plot are randomly located sampling quadrats for understorey vegetation, litter and soil.

b. Sampling quadrat for understorey vegetation (1m x 1 m) and litter and soil (0.5 m x 0.5 m).; The shaded quadrats are for sampling litter. For each main plot, there are four samples for understorey vegetation and eight samples for litterand and soil. Source: Hairiah et al, 2001.

Within each plot, all trees live or dead with minimum dbh of 5 cm were identified by their local names and measured with a diameter tape. For a shrub or small tree branching below breast height, only the branches of the tree with minimum dbh of 5 cm were measured. An equivalent diameter for the low-branching tree was calculated by getting the square root of the sum of the squared diameters of the branches $\left(\text{diameter of tree} = \sqrt{\Sigma D^2}\right)$.

Fallen trees found in the plot were also identified and measured. The length of each fallen tree was measured with a meter tape, with length taken as the entire portion of the trunk that was enclosed by the plot. The diameter of the fallen tree was measured at the midpoint of this enclosed portion.

The direct measurement of tree biomass involves the destructive sampling of a representative number of samples and getting the dry weights of the tree components. An indirect, non-destructive method is the application of biomass regression equations that relate measurable tree parameters such as diameter, height and wood density to a tree's total biomass. Biomass of individual trees of woody species was computed using the allometric equations by Magcale-Macandog and Delgado (2002):

$B = 0.0679D^{2.496}$ (generic equation for woody species)

$B = 0.5617D^{1.9874}$ for *Gmelina arborea*

where

B = total aboveground biomass of tree (kg)
D = dbh (cm)

For banana, the allometric equation developed by Arifin (2002) was used (as cited in Hairiah et al, 2001):

$B = 0.030\ D^{2.13}$

where

B = total aboveground biomass (kg)
D = stem diameter (cm)

For dead, branched the same allometric equations are used. For unbranched cylindrical structures, an equation based on cylinder volume is used :

$$\text{Biomass} = \pi\, D^2\ h\quad \rho / 40$$

where, biomass is expressed in kg, h = length (m), D = tree diameter (cm) and ρ = specific gravity (g cm^{-3}) of wood. The latter is estimated as 0.5 g cm^{-3} as default value, but can be round 0.8 for dense hardwoods, around 0.3 for very light species, and generally decreases during decomposition of dead wood laying on the soil surface.

The individual tree biomass values computed using the biomass regression equations were summed to give the total tree biomass stored in the sampled area. Multiplying the total tree biomass with the average C content of wood (default value of 45%) gives the equivalent C stock.

For sampling understorey biomass and the litter layer, a quadrat measuring 1m x 1 m and sub-divided into four equal sections was used. These quadrats were placed randomly in each quarter of the length of the central line in the 200 m^2 plot (Figure 2b). All herbs and woody plants with diameters less than 5 cm found inside the quadrat were clipped using pruning shears. The total fresh weight was immediately determined using a portable weighing scale. Subsamples of about 300 g were put in labeled plastic bags and transported to the laboratory. The subsamples were oven-dried until constant weight was achieved.

Coarse or standing litter is defined as any tree necromass with less than 5 cm diameter and/or 50 cm length, undecomposed plant materials or crop residues, and all unburned leaves and branches. Litter was collected from the soil surface in each of two randomly chosen 0.5 m x 0.5 m quadrats within the understorey quadrat (see Figure 2b). As with the understorey vegetation, the total fresh weights of the litter samples were immediately taken and subsamples were collected for oven-drying in the laboratory at 80^{o}C until constant weight was reached.

The biomass/necromass and equivalent C stored in the understorey vegetation and litter were calculated using the following equations:

$$\text{Total dry weight } \left(\text{kg/m}^2\right) = \frac{\text{Total fresh weight (kg)} \times \text{Subsample dry weight (g)}}{\text{Subsample fresh weight (g)} \times \text{Area of quadrat } (\text{m}^2)}$$

Biomass/Necromass dry weight (Mg/ha) = 10 x Total dry weight (kg/m^2)
C stock = Biomass/Necromass dry weight (Mg/ha) x 45% C content/100

Soil was sampled in the same 0.5 m x 0.5 m quadrat where the litter layer was collected. Two types of soil samples were collected: *disturbed* soil samples for chemical analysis and *undisturbed* soil samples for 'bulk density' (specific gravity) analysis. These two parameters are essential to convert soil dry weights into carbon density.

Composite soil samples for chemical analysis were collected within the 0.5m x 0.5m plots where the fine litter samples were collected, using a standard depth of 30cm from the soil surface. These samples were put in labeled plastic bags and transported to the laboratory and analyzed for organic matter content using the Walkley-Black method (PCARR, 1981)

Soil bulk density was determined by choosing an undisturbed spot near the quadrat, removing the litter from the surface and carefully pushing into the soil a metal cylinder of known volume to a depth of 10-20 cm to represent the upper 0-30 cm soil layer. The extracted soil core was carefully put in a labeled plastic bag. The collected bags of undisturbed soil cores were immediately sealed for later processing. The samples were immediately weighed in the laboratory and dried in an oven for 48 hours at ±102°C. The dry weights were recorded.

Bulk density was computed using the formula:

$$\text{Bulk Density (g/cm}^3\text{)} = \text{Dry weight of soil (g) / Volume of cylinder (cm}^3\text{)}$$

The dry weight of soil and the equivalent C stock was determined using the following formulae:

$$\text{Soil mass at specified depth (Mg)} = \text{Bulk density at specified depth (Mg/m}^3\text{)} \times 10{,}000\ \text{m}^2 \times \text{depth (m)}$$

$$\text{Soil C at specified depth (Mg)} = \text{Soil mass at specified depth (Mg)} \times \text{\% organic C at specified depth}/100$$

2.2.2 Brushland Areas

For the brushland area, the point-centered quarter method (MacDicken, 1997) was used to estimate the biomass density of woody trees. Data collection was carried out by establishing a line transect in the sampling area, within which sampling points were established at 100-m intervals. An imaginary line perpendicular to the transect divided each sampling point into quarters. In each quarter, the distance from the sampling point to the nearest tree encountered was recorded. Species name, diameter at breast height, and height of the tree were determined. Only trees with a minimum diameter of 5 cm were included in the computation for tree biomass.

The same biomass regression equations shown previously were used to estimate individual tree biomass. The individual tree biomass values were then summed to give the total tree biomass, from which the equivalent carbon stock and density were calculated. The understorey vegetation,standing litter crop, and soil were sampled using the 1 x 1 m nested quadrat described earlier (Figure 2b). The quadrats were randomly located within quarters of the transect lines. The procedures for sampling these other carbon pools were the same as those described in previous sections.

2.2.3 Grasslands, Ricefield and Cornfield

To determine aboveground biomass of grasslands, ricefields and cornfields, transect lines were laid out on the ground and sampling points marked at every 10-m interval. At the center of each sampling point, a quadrat measuring 1m x 1m was laid out and all aboveground plant parts growing within its boundaries were clipped. Fresh weights of the samples collected were immediately measured in the field and subsamples were set aside for oven drying for dry matter determination. following the methods described above. Soil organic carbon storage was also

3.0 RESULTS AND DISCUSSION

3.1 Profile of the Land Uses Studied

Table 1 shows the profile of the tree plantation, agroforestry, brushland and fruit orchard sampled in the study. In the large plots (20 m x 100 m) established in the tree plantation area, diameter of trees ranges from 30 cm to 93 cm. However, on the average, diameter of trees is 39.47 cm only because about 90% of the trees inside the plots have diameter ranging from 30-40 cm and only 10% have really big diameter. In terms of their height, merchantable height ranges from 1.5 to 14 meters while total height is in the range of 4-27 meters. While the area sampled is a *Gmelina arborea* plantation, there are few trees present in the area that are of different species. These are: tangisang bayawak, sablot and mahogany.

In the 5 m x 40 m plots, average diameter and merchantable height of the trees are 15.68 cm and 5.40 meters, respectively. The average diameter is quite small because only trees below 30 cm are measured in the small plots. The diameter range of trees is 8-31 cm while merchantable height ranges from 3 to 13 m.

In the agroforestry farm, species present include: *gmelina* , banana, balete, narra, tangisang bayawak, binunga, lamyo, dita, tibig, is-is, anubing, ligas, tanglin, and Gubas. The sizes of the trees present in the large plot are medium as manifested by their diameter measurements The biggest tree measures 55 cm while the smallest tree has diameter of 30 cm. In the small plot, the diameter of trees ranges from 6 meters to 28 meters. In terms of merchantable height, trees in large plot have an average of 4.85 meters while trees in small plot have an average of 3.26 meters.

In the fruit orchard, species sampled are Japanese citrus, rambutan and ponkan. These fruit trees are the most common species found in northern Luzon particularly in the province of Nueva Vizcaya, the nearby province of Quirino. Trees sampled have fairly small diameter with an average of 13.22 cm and diameter range of 5-37 cm.

Typical to brushland areas in the Philippines, trees present in the brushlands of Quirino have very small diameter. The sizes of trees present range from 8 cm to 36 cm or an average of 17.84 cm. Species present in the area are ambalag, himbabao, ipil-ipil, hauili and dita.

3.2 Biomass Density of Land Uses

Of the land uses studied, the gmelina plantation exhibits the highest biomass density while cornfield contains the lowest (Figure 3). Gmelina plantation has an aboveground biomass density of 240.65 Mg/ha while cornfield has 5.03 Mg/ha. The result from this study is relatively higher compared to those obtained from gmelina plantations in Leyte (187.57 Mg/ha) by ENFOR (1999) and in Mindanao (133 Mg/ha) by Kahawara *et al.* (1981).

Agroforestry area on the other hand, contains 92 Mg/ha, about one third of the total aboveground biomass of the gmelina plantation. Other land uses investigated have the following biomass densities: fruit orchard – 40 Mg/ha; brushland –30 Mg/ha; grassland – 7 Mg/ha; and rice farm – 8 Mg/ha (Figure 3).

In the gmelina plantation, around 87% of the total biomass is contributed by trees. The remaining 23% is shared by the other pools namely, understorey, litter and coarse woody debris.In the agroforestry area, trees comprise 81% of the total aboveground biomass, with banana, the other major crop in the area contributing only 9%, and litter and understorey making up 6% and 3%, respectively. In the fruit orchard, the contribution of each pool to total aboveground biomass are: trees –93.38%; litter –5.48%, and understorey – 1.11%.In brushland areas where the trees are fairly small, trees also make up 80% of the total aboveground biomass,with the litter and understorey pools contributing less.

Results gathered are consistent with the outcome of the studies previously conducted in various ecosytems .Guillermo (1998) found that in a secondary forest in Mt. Makiling Forest Reserve in Laguna, Philippines, trees generated 79% of the total biomass while Lasco *et al.,* (1998) in a study of a natural forest in the PNOC Geothermal Reserve in Leyte obtained 93% as the share of the trees in the total biomass. Other studies show the same pattern of trees making up the bulk of total aboveground biomass: 82% from mossy forest in Mt. Makiling Forest Reserve, Laguna (Lasco *et al*, 1999); 90% from a multistorey agroforestry system in Mt. Makiling Forest Reserve, Laguna (Zamora, 1999); 90% from mossy forest in Pagbilao, Quezon (Lasco *et al*, 2000); 82% from a pine forest in Baguio City (Lasco, *et al*, 2000); 85% from a tree plantation in Nueva Ecija (Lasco, *et al*, 2000); 81% from the secondary forest in the Subic Bay Metropolitan Authority, Subic, Zambales (Lasco, *et al*, 2001); 91% from a secondary forest in the Mt. Makiling Forest Reserve, Laguna (Lasco, *et al*, 2001);78% from an old growth forest in Atimonan, Quezon (Lasco, *et al*, 2001);98% from a secondary forest in Agusan del Sur (Lasco *et al*, 2000); 82% from dipterocarp plantations and 85% from mahogany plantations in the Mt. Makiling Forest Reserve (Racelis, 2000); 99% from a secondary forest in Mt. Makiling Forest Reserve (Juarez, 2001); and 89% from secondary forests in Isabela (Pulhin, 2003).

Table 1. Stand profiles of the land uses studied.

Land Use	Plot Size	Number of Plots	Species	Dbh (cm)		Merchantable Height (m)		Total Height (m)	
				Range	Ave.	Range	Ave.	Range	Ave.
Tree plantation	20 m x 100 m	10	Gmelina	30-93	39.47	1.5-14	6.88	4-27	18.49
	5 m x 40 m	10	Gmelina	8-30	15.68	3-13	5.40	8-25	11.98
Agroforestry	20 m x 100 m	5	Gmelina, Banana, Balete, Narra, Tangisang Bayawak, Binunga, Lamyo, Dita	30-55	36.35	2-16	4.85	4-21	10.30
	5 m x 40 m	5	Gmelina, Banana, Narra, Tibig, Is-is, Anubing, Ligas, Tanglin, Gubas	6-28	12.85	1-15	3.26	1.8-21	5.77
Fruit orchard	5 m x 40 m	5	Japanese citrus, Rambutan, Ponkan	5-37	13.22				
Brushland	(plotless)	3 sampling points	Ambalag, Himababao, Banato, Alim, Ipil-ipil, Hauili, Dita	8-36	17.84				

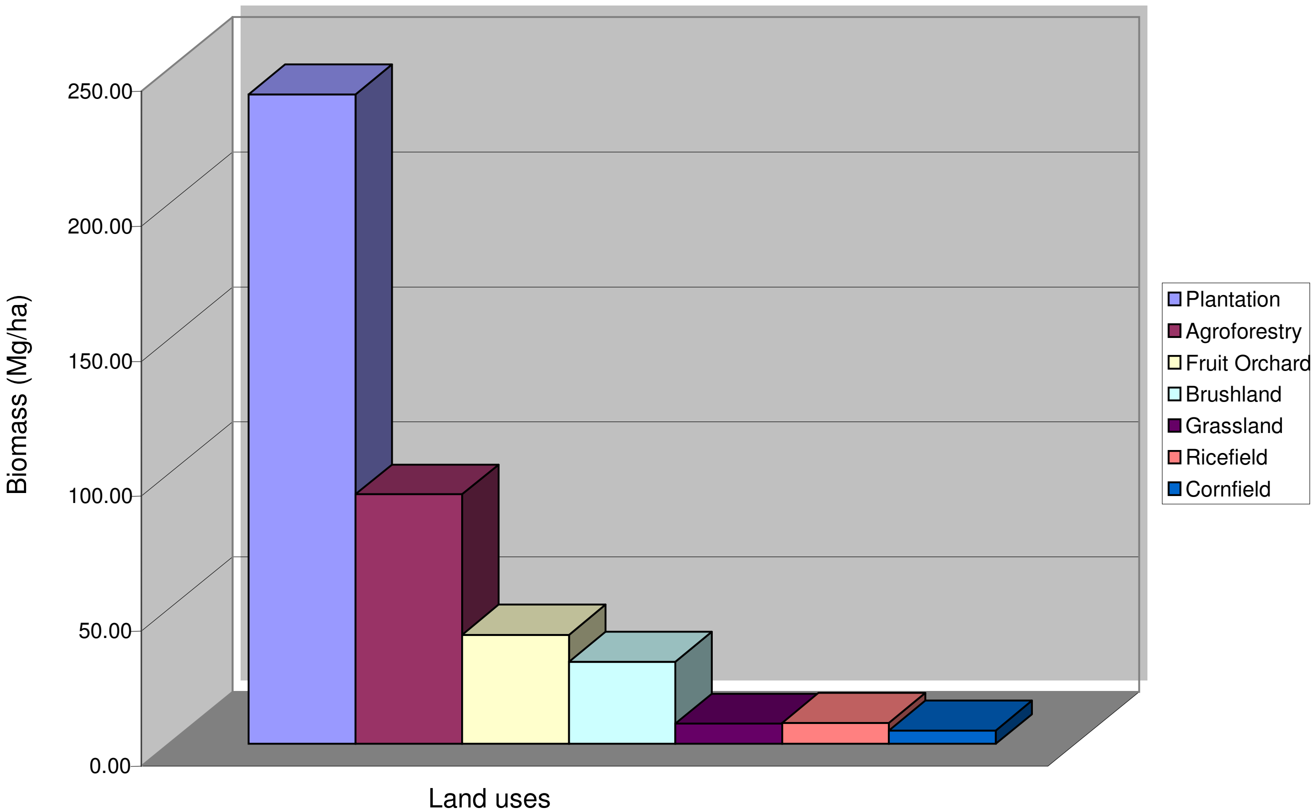


Figure 3. Aboveground biomass densities of the different land uses in the proposed project site.

Aboveground carbon densities for the different land uses follow the same trend obtained for biomass densities. For instance, gmelina plantation exhibits an aboveground carbon density of 108.29 Mg/ha while agroforestry and fruit orchard have densities of 41.66 Mg/ha and 18.23 Mg/ha, respectively. Other land uses studied have the following total carbon densities: brushland – 13.72 Mg/ha; grassland – 3.41 Mg/ha; ricefield – 3.51 Mg/ha; and cornfield – 2.26 Mg/ha. The results obtained from this study are consistent with the results of the studies previously cited.

Aside from the biomass, soil is also a significant sink and source of carbon (Bouwman, 1989; as cited by Lugo and Brown (1993). It has the longest residence time among organic C pools in the forest (Lugo and Brown, 1993). The soil component can also contain as much carbon as vegetation (Watson et al, 2000); Results of this study indicate that soil carbon density in the different land uses ranges from 42 Mg/ha to 82 Mg/ha (Table 2).

Table 2. Soil organic carbon storage in the land uses within the project site.

Land Use	Soil Organic Carbon (Mg/ha)
Fruit Orchard	82.00
Brushland	77.44
Agroforestry	76.41
Plantation	62.83
Confield	48.60
Grassland	44.48
Ricefield	42.75

3.3 Total Carbon Density of Land Uses

Figure 4 shows the carbon in biomass and soil of the various land uses studied. Based on the results of the study conducted, carbon density of the various land uses is in the following order: gmelina plantation > agroforestry > fruit orchard > brushland > cornfield > grassland > ricefield.

In almost all land uses investigated, a large percentage (about 65-95%) of the total carbon density is found in the soil. For instance, in agroforestry, 65% of the total carbon density is contributed by the soil while the combined carbon in trees, litter and understorey comprise the remaining 35% of the total carbon. The share of soil carbon in total carbon density is even larger in fruit orchard, brushland, grassland, ricefield and cornfield (Table 3). Results are consistent with the findings of previous studies conducted. In 1999, Lasco *et al* found that 59 % of the total carbon stored in the secondary forests in Leyte is stored in the soils while Guillermo (1998) and Aguiero (2002) found that carbon stored in the soils of secondary forests in Mt. Makiling Forest Reserve in Laguna were 52% and 57% of total carbon storage, respectively.

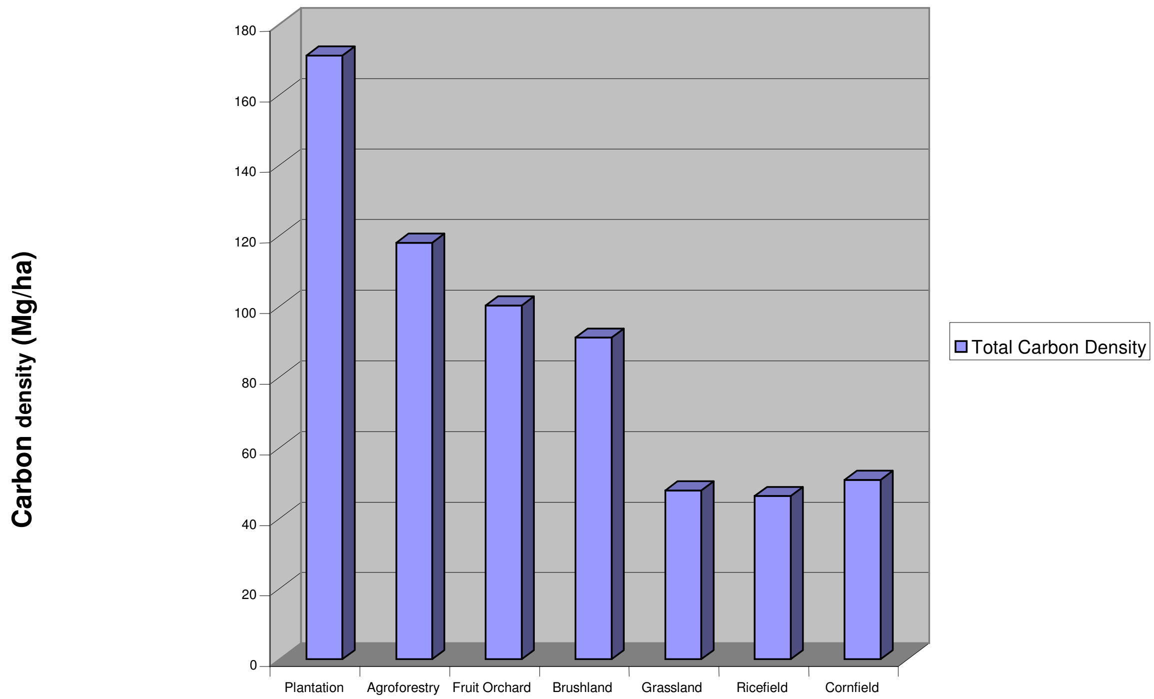


Figure 5. Total carbon density of the various land uses.

Table 3. Carbon in biomass and soil organic carbon of various land uses.

Land-Use	Carbon Stored in Aboveground Biomass (Mg/ha)	Soil Organic Carbon* (Mg/ha)	Total CarbonDensity	Contribution of Aboveground Pool in Total Storage (%)	Contribution of Belowground Pool in Total Storage (%)
Plantation	108.29	62.83	171.12	63.28	36.72
Agroforestry	41.66	76.41	118.07	35.28	64.72
Fruit Orchard	18.23	82.00	100.23	18.19	81.81
Brushland	13.72	77.44	91.16	15.05	84.95
Grassland	3.41	44.48	47.89	7.13	92.87
Ricefield	3.51	42.75	46.26	7.60	92.40
Cornfield	2.26	48.60	50.86	4.45	95.55

*to a depth of 30 cm

4.0 SUMMARY AND CONCLUSION

Biomass and carbon stocks of different land uses within the proposed site of a carbon sequestration project in Maddela, Quirino, in the Sierra Madre Biodiversity Corridor , Philippines were determined using a combination of field and laboratory methods. The assessment shows that carbon storage in the different land uses is in the following descending order: gmelina plantation (171 Mg C/ha) > agroforestry (118 Mg C/ha)> fruit orchard (100 Mg C/ha)> brushland (91 Mg C/ha) > cornfield (51 Mg C/ha) > grassland (48 Mg C/ha)> ricefield (46 Mg C/ha). In all land uses investigated except gmelina plantation, a large percentage (about 65-95%) of the total carbon density is found in the soil. The data collected from this assessment were used as basic input in determining the potential carbon benefits of alternative land-uses to denuded grassland and brushland areas in the proposed project site, for the development of a Project Design Document.

5.0 REFERENCES

Aguiero, M.M. 2002. Carbon stock assessment of a tropical secondary forest in the Makiling Forest Reserve. Undergraduate Thesis. College of Forestry and Natural Resources, UPLB.

Brown, S., Sathaye, J., Cannel, M., and Kauppi, P. 1996. Management of forests for mitigation of greenhouse gas emissions. In R.T. Watson, M.C. Zinyowera, and R.H. Moss (eds), Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge and New York, Cambridge University Press, pp. 775-797.

Guillermo, I.Q. 1998. Carbon dioxide sequestration potential of a secondary tropical forest in the Mt. Makiling Forest Reserve, Philippines. Undergraduate Thesis. College of Forestry and Natural Resources, UPLB.

Hairiah, K., Sitompul, S.M., Van Noordwijk, M. and Palm, C.. 2001. Methods for sampling carbon stocks above and below ground. ASB Lecture Series Note 4B. International Center for Research in Agroforestry, Bogor, Indonesia. 23pp.

Houghton, J.T., Meira Filho, L.G., Lim, B., Treanton, K., Mamaty, I., Bonduki, Y., Griggs, D.J. and Callander, B.A. (eds). 1997.Greenhouse Gas Inventory Workbook, Intergovernmental Panel on Climate Change (IPCC), Organization for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA), Paris, France, pp. 5.1-5.54.

IPCC Working Group I. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T.,Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881pp.

IPCC Working Group III. 2001. Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T.,Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Juarez, J.C. 2001. Carbon stocks assessment of a tropical secondary forest in the Makiling Botanic Gardens. Undergraduate Thesis. College of Forestry and Natural Resources, UPLB, College, Laguna.

Lasco, R.D., Lales, J.S., Arnuevo, M.T. , Guillermo, I.Q., De Jesus, A.C. Medrano, R. Bajar, O.F., and Mendoza, C.V. 2002. Carbon dioxide storage and sequestration of land cover in the Leyte Geothermal Reservation. Renewable Energy 25: 307-315.

Lugo, A.E. and ,Brown, S. 1993. Management of tropical soils as sinks or sources of atmospheric carbon. Plant and Soil 149:27-41.

MacDicken, K.G. 1997. A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects. Winrock International Institute for Agricultural Development. 87 p.

Sales, R. 1998. Carbon dioxide sequestration potential of multistory agroforestry systems in Mt. Makiling. Undergraduate Thesis. College of Forestry and Natural Resources, U.P. Los Baños, College, Laguna.

Watson, R.T., Noble, I.R., Bolin, B., Ravindranath, N.H. Verardo, D.J. and Dokken, D.J. .eds. 2000. Land Use, Land-Use Change and Forestry. IPCC Special Report. Edinburgh:

Cambridge University Press.
Zamora, D.A. 1999. Carbon dioxide Storage Potential of Multistorey Agroforestry Systems in Mt.Makiling. M.S. Thesis. College of Forestry and Natural Resources, U.P. Los Baños, College, Laguna.

Appendix Table 1.1. Biomass of the trees in sample plot 1 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	31.3	6	10	526.93
2	Gmelina	40.5		4	879.35
3	Gmelina	35	3	12.5	657.94
4	Gmelina	33.4	2	13	599.51
5	Gmelina	51.4	2	17.5	1412.12
6	Gmelina	31.4	7	11	530.28
7	Gmelina	31	6	12.5	516.94
8	Gmelina	49	1.5	15	1284.10
9	Gmelina	37.6	2	14	758.63
10	Gmelina	46	8	16	1132.58
11	Gmelina	32.5	3	11	567.83
12	Gmelina	35.8	3	12	688.16
13	Gmelina	30	8	16	484.32
14	Gmelina	33.5	5	10	603.08
15	Gmelina	40	6	10.5	857.90
16	Gmelina	30	9	12	484.32
17	Gmelina	35.5	7	13	676.75
18	Gmelina	34	5	16	621.11
19	Gmelina	35.7	5	12	684.35
20	Gmelina	33	3	11	585.33
21	Gmelina	90.8	5	14	4375.26
22	Gmelina	41	6	17	901.05
23	Gmelina	46	6	15	1132.58
24	Gmelina	44	7	20	1036.82
25	Gmelina	43	6	15	990.51
26	Gmelina	30.3	6	14	494.00
27	Gmelina	41.5	2	15	923.02
28	Gmelina	33.9	8	16	617.48

Appendix Table 1.2. Biomass of the trees in sample plot 1 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	22.8	10	12	280.71
2	Gmelina	11.7	4	10	74.54
3	Gmelina	11	4	7	65.94

Appendix Table 2.1 Biomass of the trees in sample plot 2 of the tree plantation.
Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	33.6	7	15	606.67
2	Gmelina	32.3	7	14.5	560.91
3	Gmelina	30.6	5	12	503.76
4	Gmelina	32	4	13	550.60
5	Gmelina	46	5	16	1132.58
6	Gmelina	32.2	4	16	557.46
7	Gmelina	32.3	4	16	560.91
8	Gmelina	31	3	17	516.94
9	Gmelina	30	3	15	484.32
10	Gmelina	38	9	15	774.76
11	Gmelina	31	5	16	516.94
12	Gmelina	44.6	1.5	15.5	1065.11
13	Gmelina	48.2	5	17	1242.77
14	Gmelina	39	2	16	815.80
15	Gmelina	35.2	9	17	665.43
16	Gmelina	38	7	7	774.76
17	Gmelina	45.4	5	12	1103.41
18	Gmelina	33.6	6	18	606.67
19	Gmelina	41.5	5	17	923.02
20	Gmelina	30	4	17	484.32
21	Gmelina	35.3	8	18	669.19
22	Gmelina	37.4	4	14	750.64
23	Gmelina	30	10	17	484.32

Appendix Table 2.2. Biomass of the trees in sample plot 2 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Ipil-ipil	11	3	9	26.99
2	Gmelina	17.2	5	12	160.32
3	Gmelina	7	4	7	26.86
4	Gmelina	14	6	12	106.49
5	Gmelina	6.2	2	6	21.10
6	Gmelina	12	5	11.5	78.39
7	Gmelina	27.7	9	15	413.32
8	Gmelina	6.5	1.5	5	23.18
9	Gmelina	6.5	4	7	23.18
10	Gmelina	27	10	15.5	392.82
11	Binunga	10.3	7	10	57.87
12	Gmelina	6.55	3	6	23.53
13	Gmelina	9.5	5	11	49.28

Appendix Table 3.1. Biomass of the trees in sample plot 3 of the tree plantation.
Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	39.7	6	16	845.16
2	Gmelina	40.3	6	17	870.74
3	Gmelina	32	4	17	550.60
4	Gmelina	36.5	7	18	715.16
5	Gmelina	30.5	5	15	500.50
6	Gmelina	35	3	17	657.94
7	Gmelina	41.7	4	18	931.89
8	Gmelina	32.5	7	17	567.83
9	Gmelina	41	6	15	901.05
10	Gmelina	42.2	4	18	954.22
11	Gmelina	36.5	4	17	715.16
12	Gmelina	37.3	7	16.5	746.65
13	Gmelina	35	7.5	19	657.94
14	Gmelina	44	5	17	1036.82
15	Gmelina	36	9	17	695.82
16	Gmelina	42	8	15	945.26
17	Gmelina	48	4	16	1232.55
18	Gmelina	30.5	5	18	500.50
19	Gmelina	32.5	6	16.5	567.83
20	Gmelina	42	6	17	945.26
21	Gmelina	37.4	4	19	750.64
22	Gmelina	36.5	7	19	715.16
23	Gmelina	34	8	21	621.11
24	Gmelina	36	9	18	695.82
25	Gmelina	30	9	20	484.32
26	Gmelina	34	8	22	621.11
27	Gmelina	37.4	7	23	750.64
28	Gmelina	32	6	20	550.60
29	Gmelina	37.4	9	17	750.64
30	Gmelina	41.4	7	21	918.61
31	Gmelina	34.1	10	20	624.74
32	Gmelina	42.5	9	17	967.75
33	Gmelina	32.4	4	19	564.37
34	Gmelina	38	9	20	774.76
35	Gmelina	35.2	10	20	665.43
36	Gmelina	35.5	11	22	676.75
37	Gmelina	40.5	9	22	879.35
38	Gmelina	36.3	8	23	707.40

Appendix Table 3.2. Biomass of the trees in sample plot 3 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	7	5	7	26.86
2	Gmelina	17.8	4	17	171.63
3	Gmelina	22.8	13	19	280.71
4	Gmelina	9.9	6	8	53.48
5	Gmelina	28.5	10	21	437.38
6	Gmelina	16.6	6	12	149.40
7	Gmelina	6.2	5	9	21.10
8	Gmelina	12.5	8	13	85.02
9	Gmelina	29.1	6	16	455.87
10	Gmelina	25.3	4	25	345.20
11	Gmelina	10.9	9	12	64.76
12	Gmelina	7.5	5	10	30.80
13	Gmelina	17.2	10	21	160.32

Appendix Table 4.1. Biomass of the trees in sample plot 4 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	38.5	7	10	795.15
2	Gmelina	30.5	5	19	500.50
3	Gmelina	32.2	9	21	557.46
4	Gmelina	46.8	7	23	1172.06
5	Gmelina	50.2	5	22	1347.36
6	Gmelina	43	12	20	990.51
7	Gmelina	30.5	6	22	500.50
8	Gmelina	41	7	23	901.05
9	Gmelina	35.6	9	21	680.54
10	Gmelina	30	7	20	484.32
11	Gmelina	35.5	6	19	676.75
12	Gmelina	33.7	11	24	610.26
13	Gmelina	37	2	23	734.77
14	Gmelina	30.4	10	20	497.24
15	Gmelina	30.3	6	19	494.00
16	Gmelina	37	10	21	734.77
17	Gmelina	32	14	18	550.60
18	Gmelina	37.5	7	23	754.63
19	Gmelina	34.5	10	22	639.39
20	Gmelina	47	5	26	1182.04
21	Gmelina	33	9	21	585.33
22	Gmelina	56.8	11	20	1722.25
23	Gmelina	34	5	25	621.11
24	Gmelina	38.5	6	19	795.15
25	Gmelina	34.7	9	27	646.78
26	Gmelina	48	5	22	1232.55
27	Gmelina	40.2	10	20	866.45
28	Gmelina	33	11	22	585.33
29	Gmelina	36.5	10	24	715.16
30	Gmelina	33.1	13	21	588.86
31	Gmelina	39.2	13	20	824.14
32	Gmelina	32	9	23	550.60
33	Gmelina	37.5	14	23	754.63
34	Gmelina	32.5	12	21	567.83
35	Gmelina	31.5	7	20	533.64

Appendix Table 4.2. Biomass of the trees in sample plot 4 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	10.2	7	13	56.75
2	Gmelina	9.2	7	10	46.23
3	Gmelina	12.2	7	12	81.01
4	Gmelina	6.4	2	8	22.48
5	Gmelina	10	2	9	54.56

Appendix Table 5.1 Biomass of the trees in sample plot 5 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	43	12	18	990.51
2	Gmelina	37	9	17	734.77
3	Gmelina	33	8	17	585.33
4	Gmelina	35.5	6	20	676.75
5	Gmelina	40.3	10	19.5	870.74
6	Gmelina	41	9	18	901.05
7	Gmelina	33.8	11	19	613.87
8	Gmelina	37	11	18	734.77
9	Gmelina	44.38	10	22	1054.91
10	Gmelina	40.6	14	20	883.67
11	Gmelina	37.6	8	21	758.63
12	Gmelina	35.5	10	20	676.75
13	Gmelina	38	12	21	774.76
14	Gmelina	40	3	19	857.90
15	Gmelina	44	12	22	1036.82
16	Gmelina	31	11	20	516.94
17	Gmelina	44.5	4	16	1060.36
18	Gmelina	50	9	17	1336.71
19	Gmelina	35	7	22	657.94

20	Gmelina	45	6	21	1084.17
21	Gmelina	46	6	18	1132.58
22	Gmelina	41.4	7	17	918.61
23	Gmelina	48.3	4	12	1247.90
24	Gmelina	30.9	14	20	513.63
25	Gmelina	50.6	2	19	1368.78
26	Gmelina	34	7	18	621.11
27	Gmelina	30	12	21	484.32
28	Gmelina	32.7	12	20	574.80
29	Gmelina	30.6	8	20	503.76
30	Gmelina	49	8	19	1284.10

Appendix Table 5.2. Biomass of the trees in sample plot 5 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1.	Gmelina	22.5	9	15	273.42
2.	Gmelina	27	11	17	392.82
3.	Gmelina	7.7	5	9	32.46
4.	Gmelina	6.2	3	7	21.10
5.	Gmelina	28	10	18	422.27
6.	Gmelina	17	8	15	156.64
7.	Gmelina	30.87	3	20	512.66
8.	Gmelina	6.3	3	7	21.78
9.	Banana	8	1.3	1.5	35.02
10.	Banana	26	4	6	364.44
11.	Banana	17.5	3	5.5	165.93
12.	Gmelina	20.5	7	16	227.24
13.	Gmelina	26	9	23	364.44

Appendix Table 6.1 Biomass of the trees in sample plot 6 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1.	Gmelina	45	12	20	1084.17
2.	Gmelina	50.31	6	15	1353.31
3.	Gmelina	69.4	2	22	2564.62
4.	Gmelina	47.8	8	19	1222.36
5.	Gmelina	44.7	8	19	1069.86
6.	Gmelina	61	4	22	1984.58
7.	Gmelina	37	8	16	734.77
8.	Gmelina	35	9	21	657.94
9.	Gmelina	42.5	6	22	967.75
10.	Gmelina	57	3	20	1734.32
11.	Gmelina	54	4	20	1557.63
12.	Gmelina	36.2	8	18.5	703.53
13.	Gmelina	35.5	5	19	676.75
14.	Gmelina	47.8	8	22	1222.36
15.	Gmelina	34	6	20	621.11
16.	Gmelina	36	5	22	695.82
17.	Gmelina	51.5	6	20	1417.59
18.	Gmelina	32	6	18	550.60
19.	Gmelina	47.3	8	17	1197.08
20.	Gmelina	42	7	16.5	945.26
21.	Gmelina	60	2	20	1920.45
22.	Gmelina	31.5	7	18	533.64
23.	Gmelina	30.1	6	18	487.54
24.	Gmelina	46.6	9	21	1162.13
25.	Gmelina	41	6	20	901.05
26.	Gmelina	42	2	13	945.26
27.					

Appendix Table 6.2. Biomass of the trees in sample plot 6 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	9.6	2	9	**50.31**

Appendix Table 7.1 Biomass of the trees in sample plot 7 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	40.9	4	21	896.69
2	Gmelina	33.7	4	16	610.26
3	Gmelina	42.2	9	20	954.22
4	Gmelina	33	10	22	585.33
5	Gmelina	38.6	6	20	799.26
6	Tangisang Bayawak	42	7	20	777.38
7	Gmelina	42.3	7	19	958.72
8	Gmelina	39	10	21	815.80
9	Gmelina	50.19	7	18.5	1346.85
10	Gmelina	31	14	18	516.94
11	Mahogany	34	9	21	458.36
12	Gmelina	55.5	9	18.5	1644.80
13	Gmelina	31.7	5	23	540.39
14	Gmelina	38	10	23	774.76
15	Gmelina	36.94	4	16	732.57
16	Gmelina	48.5	3	20	1258.19
17	Gmelina	32	9	22	550.60
18	Mahogany	93	5	9	5671.74

Appendix Table 7.2. Biomass of the trees in sample plot 7 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	8	4	7	35.02
2	Gmelina	5.5	1	5	16.63
3	Gmelina	7	2	9	26.86
4	Gmelina	25	5	20	337.11
5	Gmelina	14	6	13	106.49
6	Gmelina	11	9	15	65.94
7	Gmelina	7	2	7	26.86
8	Gmelina	15.2	9	15	125.40
9	Gmelina	17	4	13	156.64
10	Gmelina	16	10	18	138.86
11	Gmelina	7	2	9	26.86
12	Gmelina	7.5	7	11	30.80
13	Gmelina	21	7	15	238.39
14	Gmelina	6.7	2	4	24.62

Appendix Table 8.1 Biomass of the trees in sample plot 8 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1.	Gmelina	40.8	5	18	892.34
2.	Gmelina	39	8	20	815.80
3.	Gmelina	32.2	4	17.5	557.46
4.	Gmelina	30	5	18	484.32
5.	Gmelina	40.3	6	19	870.74
6.	Gmelina	40.5	9	21	879.35
7.	Gmelina	37	1.5	20	734.77
8.	Gmelina	34	4	18	621.11
9.	Gmelina	32	5.5	20	550.60
10.	Gmelina	35	5	17	657.94
11.	Gmelina	37	3	19	734.77
12.	Gmelina	32.5	4	7	567.83
13.	Gmelina	40	10	22	857.90
14.	Gmelina	36	5	23	695.82
15.	Gmelina	51.5	2	20	1417.59
16.	Gmelina	33	3	17	585.33
17.	Gmelina	38.4	2	18	791.05
18.	Gmelina	34	4	17	621.11
19.	Gmelina	41	14	20	901.05
20.	Gmelina	30	7	19	484.32
21.	Gmelina	30	2	15	484.32

Appendix Table 8.2. Biomass of the trees in sample plot 8 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1.	Gmelina	25.06	8	19	338.72
2.	Gmelina	26	12	19	364.44
3.	Gmelina	11	4	8	65.94
4.	Gmelina	20	6	20	216.36

Appendix Table 9.1 Biomass of the trees in sample plot 9 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	48	7	18	1232.55
2	Gmelina	54.45	10	25	1583.64
3	Sablot	51	11	22	1263.09
4	Gmelina	42.8	10	23	981.38
5	Gmelina	43.6	10	22	1018.17
6	Gmelina	40.5	5	20	879.35
7	Gmelina	45	12	22	1084.17
8	Gmelina	32	4	19	550.60
9	Gmelina	43.7	12	24	1022.82
10	Gmelina	47.01	12	19	1182.57
11	Gmelina	47.4	9	20	1202.12
12	Gmelina	33	7	18	585.33
13	Gmelina	44.5	10	20	1060.36
14	Gmelina	40.3	5	21	870.74
15	Gmelina	34.7	5	19	646.78
16	Gmelina	42.5	11	22	967.75
17	Gmelina	35.2	9	19	665.43
18	Gmelina	33.3	13	18	595.95
19	Gmelina	42.6	9	19	972.28
20	Gmelina	37.3	10	18	746.65
21	Sablot	48.5	6	17	1258.19
22	Gmelina	43	2	19	990.51
23	Gmelina	51.7	9	22	1428.55
24	Gmelina	50.5	4	18	1363.41
25	Gmelina	39.6	3	13	840.94
26	Gmelina	39.5	10	20	836.72
27	Tangisang Bayawak	56.5	5	20	1631.66
28	Sablot	42	6	10	777.38
29	Gmelina	50.99	8	18	1389.84
30	Gmelina	43	3	19	990.51
31	Gmelina	40.3	9	21	870.74
32	Gmelina	33.3	8	20	595.95
33	Gmelina	32	11	20	550.60
34	Gmelina	34	13	20	621.11
35	Gmelina	60.5	3	21	1952.38
36	Gmelina	37	8	20	734.77
37	Gmelina	43	9	19	990.51

Appendix Table 9.2. Biomass of the trees in sample plot 9 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	28.9	3	19	449.67
2	Gmelina	25	3	15	337.11
3	Gmelina	11	6	11	65.94
4	Gmelina	19	8	15	195.39

Appendix Table 10.1 Biomass of the trees in sample plot 10 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 20 m x 100m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1.	Gmelina	63.02	6	20	2117.18
2.	Gmelina	34.5	6	19	639.39
3.	Gmelina	33.5	5	21	603.08
4.	Gmelina	42.5	8	15	967.75
5.	Gmelina	38	9	20	774.76
6.	Gmelina	40.5	8	17	879.35
7.	Gmelina	33	5	24	585.33
8.	Gmelina	40.5	10	21	879.35
9.	Gmelina	48.5	5	16	1258.19
10.	Gmelina	46.9	6	19	1177.05
11.	Gmelina	51	9	18.5	1390.37
12.	Gmelina	38.5	6	18	795.15
13.	Gmelina	36	7	19	695.82
14.	Gmelina	43.18	5	21	998.63
15.	Gmelina	50.77	3	17	1378.15
16.	Gmelina	45.87	2.5	20	1126.46
17.	Gmelina	49.49	4	20	1309.74
18.	Gmelina	49.4	5	22	1305.02
19.	Gmelina	49	2	22	1284.10
20.	Gmelina	30.6	6	17	503.76
21.	Gmelina	56.9	7	24	1728.28

22.	Gmelina	35	4	21	657.94
23.	Gmelina	34.5	7	20	639.39
24.	Gmelina	35	4	24	657.94
25.	Gmelina	45.9	6	21	1127.69

Appendix Table 10.2. Biomass of the trees in sample plot 10 of the tree plantation.

Location: Cabarroguis, Quirino
Area: 70 has
Year Planted: 1990
Plot Size: 5m x 40m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass (kg/tree)
1	Gmelina	7	2	9	26.86
2	Gmelina	16	4	12	138.86
3	Gmelina	6	3	8	19.77
4	Gmelina	6	1.5	6	19.77
5	Gmelina	8	1.5	11	35.02
6	Gmelina	7	2	8	26.86
7	Gmelina	28	4	20	422.27
9	Gmelina	17	5	6	156.64
10	Gmelina	13	7	15	91.91

Appendix Table 11. Biomass of the trees in sample plot 1 of the fruit orchard.

Malabing, Kasibu, Nueva Viscaya
Fruit Orchard
Area: 9.7 has
Year Planted: 1987-1995
Plot Size: 5m x 40 m

Tree No.	Species	DBH (cm)	Biomass (kg/tree)
1	Japanese Citrus	13.06	41.43
2	Japanese Citrus	12.01	33.61
3	Japanese Citrus	12.55	37.50
4	Japanese Citrus	10.51	24.09
5	Japanese Citrus	20.43	126.56
6	Japanese Citrus	15.99	68.66
7	Japanese Citrus	17.54	86.49
8	Japanese Citrus	13.20	42.54
9	Japanese Citrus	14.70	55.65
10	Japanese Citrus	19.81	117.19

Appendix Table 12. Biomass of the trees in sample plot 2 of the fruit orchard.

Location: Malabing, Kasibu, Nueva Viscaya
Area: 9.7 has
Year Planted: 1987-1995
Plot Size: 5m x 40 m

Tree No.	Species	DBH (cm)	Biomass (kg/tree)
1	Japanese Citrus	10.26	22.68
2	Japanese Citrus	12.12	34.38
3	Japanese Citrus	12.79	39.32
4	Japanese Citrus	11.88	32.70
5	Japanese Citrus	12.68	38.48
6	Japanese Citrus	10.22	22.46
7	Japanese Citrus	15.60	64.55
8	Japanese Citrus	17.75	89.10
9	Japanese Citrus	13.78	47.36
10	Japanese Citrus	9.54	18.92
11	Japanese Citrus	13.95	48.83
12	Japanese Citrus	15.89	67.59
13	Japanese Citrus	14.36	52.50
14	Japanese Citrus	15.55	64.04
15	Japanese Citrus	12.90	40.17
16	Japanese Citrus	14.87	57.27
17	Japanese Citrus	13.76	47.19
18	Japanese Citrus	14.53	54.06
19	Japanese Citrus	7.35	9.87
20	Japanese Citrus	5.99	5.92
21	Japanese Citrus	12.82	39.55
22	Japanese Citrus	15.73	65.90
23	Japanese Citrus	13.79	47.45

Appendix Table 12. Biomass of the trees in sample plot 3 of the fruit orchard.

Location: Malabing, Kasibu, Nueva Viscaya
Area: 9.7 has
Year Planted: 1987-1995
Plot Size: 5m x 40 m

Tree No.	Species	DBH2 (cm)	Biomass (kg/tree)
1	Rambutan	24.89	207.18
2	Rambutan	37.24	566.38

3	Rambutan	11.89	32.77
4	Rambutan	29.67	321.20
5	Rambutan	22.82	166.81

Appendix Table 13. Biomass of the trees in sample plot 4 of the fruit orchard.

Location: Malabing, Kasibu, Nueva Viscaya
Area: 9.7 has
Year Planted: 1987-1995
Plot Size: 5m x 40 m

Tree No.	Species	DBH2 (cm)	Biomass (kg/tree)
1	Ponkan	6.65	7.68
2	Ponkan	8.01	12.23
3	Ponkan	14.12	50.33
4	Ponkan	13.99	49.18
5	Ponkan	8.01	12.23
6	Ponkan	8.59	14.56
7	Ponkan	5.27	4.30
8	Ponkan	9.59	19.16
9	Ponkan	10.66	24.95
10	Ponkan	5.13	4.02
11	Ponkan	11.28	28.74
12	Ponkan	11.47	29.96

Appendix Table 13. Biomass of the trees in sample plot 4 of the fruit orchard.

Location: Malabing, Kasibu, Nueva Viscaya
Area: 9.7 has
Year Planted: 1987-1995
Plot Size: 5m x 40 m

Tree No.	Species	DBH2 (cm)	Biomass (kg/tree)
1	Ponkan	9.44	18.42
2	Ponkan	15.20	60.50
3	Ponkan	11.82	32.29
4	Ponkan	15.05	59.02
5	Ponkan	8.75	15.24
6	Ponkan	12.85	39.78
7	Ponkan	12.34	35.96
8	Ponkan	14.15	50.60
9	Ponkan	9.84	20.44

10	Ponkan	15.58	64.35
11	Ponkan	8.39	13.73
12	Ponkan	15.83	66.95
13	Ponkan	8.04	12.34
14	Ponkan	11.75	31.82
15	Ponkan	7.37	9.93
16	Ponkan	11.84	32.43
17	Ponkan	10.58	24.49

Appendix Table 14. Biomass of the trees in brushland area.

Location: Brgy. San Bernabe Maddela, Quirino
Elev.: 161m
N16 21' 48.0" E121 42' 35.4

Sampling point	Quadrant	Species	DBH (cm)	Point to plant Dist. (m)	Biomass (kg/tree)
I	1	Ambalag	16.8	13.3	77.67
	2	Himbabao	36.2	26	527.72
	3	Banato	16.5	9	74.25
	4	Alim	14.3	14.8	51.95
II	1	Ipil-ipil	11	4	26.99
	2	Meliaceae spp.	20.5	2.3	127.65
	3	Meliaceae spp.	11	1.3	26.99
	4	Meliaceae spp.	15.8	1.3	66.64
III	1	Hauili	28.3	23.3	285.45
	2	Dita	22.2	23.8	155.73
	3	Ipil-ipil	13	15.6	40.95
	4	Ipil-ipil	8.5	16.6	14.18

Appendix Table 14.1. Biomass of the trees in sample plot 1 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 20 m x 100 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	Biomass-trees (kg/tree)
1	Gmelina	39.8	5	14		849.40
2	Gmelina	47.42	6	9		1203.37
3	Banana	33.8	3	11	54.16	
4	Balete (Ficus spp.)	42.7	4	8		810.17
5	Gmelina	31.6	5	10		537.01
6	Gmelina	36.3	2	11		707.40
7	Gmelina	30.1	5	11		487.54
8	Narra	32.7	5	10		415.79
9	Narra	42.7	6	12		810.17
10	Narra	36	3.5	10		528.77
11	Banana	32.2	4	8	48.85	
12	Gmelina	33.2	5	11		592.40
13	Gmelina	34.5	2	13		639.39
14	Banana	31.6	4	8	46.93	
15	Gmelina	33.7	4	10		610.26
16	Gmelina	31.2	7	14		523.59
17	Gmelina	37	8	16		734.77
18	Gmelina	31.2	2	5		523.59
19	Balete (Ficus spp.)	32.9	11	7		422.18
20	Gmelina	41.7	3	8		931.89
21	Gmelina	43.4	4	10		1008.91
22	Gmelina	35.9	4	12		691.99
23	Gmelina	32	3	8		550.60
24	Banana	33.5	6.5	11	53.15	
25	Gmelina	30.4	5	8		497.24
26	Gmelina	32.5	3.2	10		567.83
27	Gmelina	41.6	5	10		927.45
28	Gmelina	44.2	6	10		1046.20

Appendix Table 14.2. Biomass of the trees in sample plot 1 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 5 m x 40 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1	Narra	21				137.42
2	Gmelina	10				54.56
3	Tibig	14				49.87
4	Is-is	9				16.52
5	Anubing	6				6.00
6	Banana	13	2.5	4	7.08	
7	Banana	11	2.7	3	4.96	
8	Banana	13	2	3	7.08	
9	Gmelina	8				35.02

Appendix Table 15.1 Biomass of the trees in sample plot 2 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 20 m x 100 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	BIOMASS-trees (kg/tree)
1	Gmelina	31.3	5	10	526.93
2	Gmelina	35.5	12	20	676.75
3	Gmelina	36.7	10	14.5	722.97
4	Gmelina	31.5	7	14	533.64
5	Tangisang Bayawak	30.1	11	15	338.01
6	Narra	30.7	7.5	12	44.13
7	Gmelina	49.5	8	15	1310.28
8	Gmelina	38.4	16	21	791.05
9	Gmelina	39	10	16	815.80

Appendix Table 15.2. Biomass of the trees in sample plot 2 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 5 m x 40 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)
2	Banana	7.5	2	3	2.19
3	Banana	8.5	2	5	2.86
4	Banana	17.1	5	10	12.69
5	Banana	10.6	3	5	4.58
6	Banana	10.2	2	5	4.22
7	Banana	10	3	6	4.05
8	Banana	10	2.5	6	4.05
9	Banana	10	3	6	4.05
10	Banana	10.6	5	10	4.58
13	Banana	10.7	3	6	4.67

Appendix Table 16.1. Biomass of the trees in sample plot 3 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 20 m x100 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1.	Banana	34.4	5	8	56.23	
2.	Banana	34	5	10	54.85	
3.	Banana	34.9	2	8	57.99	
4.	Banana	31.4	3	7	46.30	
5.	Binunga	43.5	12	16		848.66
6.	Banana	35	3	8	58.34	
7.	Banana	36	3	10	61.95	
8.	Banana	32.5	3	7	49.82	
9.	Banana	32	4	8	48.20	
10.	Banana	33	3	7.2	51.47	
11.	Banana	32.5	4	8	49.82	
12.	Banana	35.6	2.8	10	60.49	
13.	Banana	31	2.4	7	45.05	
14.	Banana	35.5	2	8	60.13	
15.	Banana	37	4	9	65.67	
16.	Banana	35	4	8	58.34	
17.	Banana	35	3.7	7	58.34	
18.	Banana	32.3	2	7.5	49.17	
19.	Banana	35	3	9	58.34	
20.	Banana	31.5	3	6	46.61	
21.	Banana	40	3	6	77.54	
22.	Gmelina	46	5	12		1132.58
23.	Banana	31	3	7	45.05	
24.	Gmelina	35.7	5	11		684.35
25.	Gmelina	36.5	4	11		715.16
26.	Binunga	33	5	14		425.40
27.	Gmelina	30.5	3	8		500.50
28.	Gmelina	32.4	3	10		564.37
29.	Gmelina	37.5	7	10		754.63
30.	Narra	34	2.5	11		458.36

Appendix Table 16.2 Biomass of the trees in sample plot 3 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 5 m x 40 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1.	Banana	20	4	6	17.71	
2.	Banana	20.2	6	9	18.09	
3.	Banana	13.7	5	7	7.91	
4.	Banana	10.4	5	8	4.40	
5.	Gmelina	14.4	10	14		112.62
6.	Banana	10.5	5	7	4.49	
7.	Banana	10.4	4	6	4.40	
8.	Binunga	9.3	6	7		17.94
9.	Gmelina	28.1	12	15		425.27
10.	Tangisang Bayawak	10.5	9	11		24.29
11.	Banana	8	2	3	2.52	
12.	Banana	8.5	2	4	2.86	
13.	Binunga	20.1	6	11		123.17
14.	Banana	14	5	8	8.29	
15.	Ligas	9	7	10		16.52
16.	Banana	14	4	7	8.29	
17.	Banana	11.5	4	8	5.45	5.45
18.	Banana	12	4	8	5.97	5.97
19.	Binunga	17	10	14		
20.	Banana	10	4	7	4.05	
21.	Binunga	12	8	12		33.92
22.	Banana	11.3	3.5	6	5.25	
23.	Tibig	10.5	7	10		24.29
24.	Banana	10.5	4	6		4.49
25.	Tanglin	8	6	8		12.31
26.	Tanglin	10	6	9		21.50
27.	Tanglin	7	3	7		8.82
28.	Narra	20.7	8	13		132.57

Appendix Table 17.1. Biomass of the trees in sample plot 4 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 20 m x 100 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1.	Gmelina	33	5	10		585.33
2.	Narra	32.6	6	9		412.62
3.	Narra	43.9	4.2	11		868.30
4.	Banana	32.6	5	10	50.15	
5.	Banana	31.5	3	7	46.61	
6.	Banana	30.8	3.5	7	44.44	
7.	Banana	34.5	3.2	8	56.58	
8.	Banana	34	3.2	8.5	54.85	
9.	Banana	35	3.6	9	58.34	
10.	Gmelina	49.5	4	11		1310.28
11.	Gmelina	31.5	4	5		533.64
12.	Tangisang Bayawak	52	8	12		1325.92
13.	Gmelina	36	5.5	11		695.82
14.	Gmelina	54.79	4	10		1603.11
15.	Lamyo	50	6	12		1202.08
16.	Dita	31.5	15	16		378.69
17.	Narra	37.5	5	10		585.58

Appendix Table 17.2. Biomass of the trees in sample plot 4 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 5 m x 40 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1	Banana	21	4	8	19.65	
2	Banana	18	3	7	14.15	
3	Banana	20	5	9	17.71	
4	Banana	12	4	6	5.97	
5	Banana	22	4.5	7.5	21.70	
7	Banana	12	2.5	4	5.97	
8	Banana	8	1	2.5	2.52	
9	Banana	7	1	3	1.89	
10	Banana	20	4.5	7	17.71	
11	Banana	10	1.5	3	4.05	
13	Gmelina	10.5	1.5	7		60.12
14	Banana	11	3	8	4.96	
15	Banana	12	3	7.5	5.97	
16	Banana	12.5	2	5	6.51	
17	Tangisang Bayawak	9.5	3	5		18.92
18	Banana	18	5	9	14.15	
19	Banana	15	4	9	9.60	
20	Banana	14.5	3.5	8	8.93	
21	Gubas	51	15	21		1263.09
25	Banana	12.5	2	5	6.51	6.51
26	Banana	22	4	8	21.70	

Appendix Table 17.2. Biomass of the trees in sample plot 5 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 20 m x 100 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1.	Gmelina	34.8	4	12		650.49
2.	Gmelina	32	2	4		550.60
3.	Gmelina	50	4	10	124.72	
4.	Gmelina	36.2	5	9	62.69	
5.	Gmelina	34.5	7	10	56.58	
6.	Gmelina	44	2	12	94.99	
7.	Gmelina	35.4	4.2	12		672.97
8.	Gmelina	30.9	5.2	11.5		513.63
9.	Gmelina	42.5	4	10.5		967.75
10.	Gmelina	37	3	10.5		734.77
11.	Gmelina	36.5	4.2	10		715.16
12.	Gmelina	41	5	12		901.05
13.	Banana	31.5	3	8	46.61	
14.	Banana	31.5	3	6	46.61	
15.	Gmelina	40.1	3.5	11		862.17
16.	Narra	36	3	12		528.77
17.	Gmelina	39.5	5	13		836.72
18.	Gmelina	40.6	7	16.5		883.67
19.	Gmelina	47	5	13		1182.04

Appendix Table 17.2. Biomass of the trees in sample plot 5 of agroforestry area.

Location: Brgy. Villa Gracia, Maddela, Quirino
Area: 10 has
Year Planted: 1989
Plot Size: 5 m x 40 m

Tree No.	Species	DBH (cm)	MH (m)	TH (m)	Biomass-banana (kg/tree)	BIOMASS-trees (kg/tree)
1	Banana	18.9	1.5	2.5	15.70	
2	Banana	20	2	3	17.71	
3	Banana	15.4	2.2	4	10.15	
4	Banana	14	1.5	4.8	8.29	
6	Banana	10.3	1.4	3.5	4.31	
8	Banana	7	1.2	2		1.89
9	Banana	6.5	1	1.8	1.62	
10	Banana	6.7	1.2	2.1	1.72	
11	Gmelina	10.4	2.5	7		58.99
12	Banana	9.4	1.5	2	3.55	
13	Banana	15.3	1.9	4	10.01	
14	Banana	7	1.2	2	1.89	
15	Banana	7.1	1.6	3	1.95	
16	Banana	12.3	1.4	4.5	6.29	
17	Gmelina	7.6	1.6	3		31.63
18	Banana	8	1.5	2	2.52	
19	Banana	13	2	3.4	7.08	
20	Banana	13	2.1	3.5	7.08	
21	Banana	12	2.4	3	5.97	
22	Banana	7.9	1.2	3	2.45	
23	Banana	13.3	2	2	7.43	
24	Banana	8	1	1.9	2.52	
25	Banana	12.7	1.3	2.2	6.73	
26	Banana	18	1.2	2.3	14.15	
27	Banana	8.3	1	1.8	2.72	
28	Banana	14.4	2	4	8.80	
29	Banana	11.7	1.2	2.1	5.65	
30	Banana	7	1	2	1.89	
31	Banana	11.4	1.4	3.5	5.35	
32	Banana	11.2	1.3	3	5.15	
33	Banana	10	1.2	2	4.05	
34	Banana	20.5	2.5	6	18.67	
35	Banana	20	2	6	17.71	
36	Banana	19.7	2.5	5.2	17.15	
37	Banana	13.5	2.2	5.1	7.67	
38	Alim	6.5	1.2	3		7.32

39	Banana	16.4	1.2	5.2	11.61	
40	Banana	15	1.5	4	9.60	
41	Banana	7.3	1.2	3	2.07	
42	Banana	10	1.5	3.2	4.05	
43	Banana	19.5	2.3	6	16.78	
44	Banana	9	1.2	2	3.23	
45	Banana	11	1.3	3.5	4.96	

Appendix Table 18. Biomass of the understorey samples in various land uses studied.

Area	Plot	Sample	TFW (g)	SSFW (g)	ODW_{avg} (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
Brushland	I	1	850.00	300.00	78.13	221.38	221.38	2.21
		2	1650.00	300.00	112.23	617.28	617.28	6.17
		3	1400.00	300.00	105.83	493.89	493.89	4.94
		4	1450.00	300.00	119.87	579.36	579.36	5.79
	II	5	450.00	300.00	129.87	194.80	194.80	1.95
		6	175.00	175.00	74.77	74.77	74.77	0.75
		7	500.00	300.00	98.03	163.39	163.39	1.63
		8	800.00	300.00	104.10	277.60	277.60	2.78
	III	9	1600.00	300.00	74.80	398.93	398.93	3.99
		10	1750.00	300.00	111.50	650.42	650.42	6.50
		11	2600.00	300.00	91.17	790.11	790.11	7.90
		12	2050.00	300.00	80.20	548.03	548.03	5.48
Plantation	I	1	500.00	300.00	89.87	149.78	149.78	1.50
		2	900.00	300.00	90.80	272.40	272.40	2.72
		3	400.00	400.00	131.07	131.07	131.07	1.31
		4	375.00	300.00	131.43	164.29	164.29	1.64
	II	5	450.00	300.00	108.60	162.90	162.90	1.63
		6	1675.00	300.00	73.43	410.00	410.00	4.10
		7	1200.00	300.00	72.43	289.73	289.73	2.90
		8	300.00	300.00	79.93	79.93	79.93	0.80
	III	9	500.00	300.00	80.00	133.33	133.33	1.33
		10	1000.00	300.00	74.23	247.44	247.44	2.47
		11	1100.00	300.00	91.17	334.28	334.28	3.34
		12	750.00	300.00	80.37	200.92	200.92	2.01
	IV	13	2950.00	300.00	85.73	843.04	843.04	8.43
		14	5500.00	300.00	60.40	1107.33	1107.33	11.07

		15	2250.00	300.00	64.03	480.25	480.25	4.80
		16	450.00	300.00	87.90	131.85	131.85	1.32
	V	17	300.00	300.00	89.57	89.57	89.57	0.90
		18	450.00	300.00	104.33	156.50	156.50	1.57
		19	5750.00	300.00	85.20	1633.00	1633.00	16.33
		20	1050.00	300.00	99.20	347.20	347.20	3.47
	VI	21	850.00	300.00	78.33	221.94	221.94	2.22
		22	1150.00	300.00	66.80	256.07	256.07	2.56
		23	1250.00	300.00	91.73	382.22	382.22	3.82
		24	1000.00	300.00	62.73	209.11	209.11	2.09

Appendix Table 18 Continued…

Area	**Plot**	**Sample**	**TFW (g)**	**SSFW (g)**	**ODW_{avg} (g)**	**ODWt (g)**	**Biomass (g/m^2)**	**Biomass (ton/ha)**
	VII	25	2200.00	300.00	107.10	785.40	785.40	7.85
		26	900.00	300.00	97.93	293.80	293.80	2.94
		27	700.00	300.00	91.17	212.72	212.72	2.13
		28	500.00	300.00	69.30	115.50	115.50	1.16
	VIII	29	250.00	250.00	104.93	104.93	104.93	1.05
		30	700.00	300.00	97.33	227.11	227.11	2.27
		31	950.00	300.00	116.03	367.44	367.44	3.67
		32	450.00	300.00	98.20	147.30	147.30	1.47
	IX	33	550.00	300.00	52.87	96.92	96.92	0.97
		34	450.00	300.00	70.87	106.30	106.30	1.06
		35	750.00	300.00	66.53	166.33	166.33	1.66
		36	300.00	300.00	54.97	54.97	54.97	0.55
	X	37	750.00	300.00	85.30	213.25	213.25	2.13
		38	200.00	200.00	71.73	71.73	71.73	0.72
		39	75.00	75.00	33.57	33.57	33.57	0.34
		40	250.00	250.00	76.93	76.93	76.93	0.77
Agroforestry	I	1	7350.00	500.00	67.00	984.90	984.90	9.85
		2	5600.00	500.00	119.60	1339.52	1339.52	13.40
		3	400.00	250.00	41.37	66.19	66.19	0.66
		4	1000.00	500.00	95.57	191.13	191.13	1.91
	II	5	1250.00	300.00	137.87	574.44	574.44	5.74
		6	300.00	300.00	96.87	96.87	96.87	0.97
		7	200.00	200.00	31.33	31.33	31.33	0.31
		8	250.00	250.00	60.20	60.20	60.20	0.60

	III	9	250.00	250.00	58.77	58.77	58.77	0.59
		10	350.00	250.00	52.18	73.05	73.05	0.73
		11	1800.00	250.00	76.09	547.87	547.87	5.48
		12	1900.00	250.00	70.55	536.15	536.15	5.36
	IV	13	550.00	250.00	47.86	105.30	105.30	1.05
		14	900.00	250.00	46.06	165.82	165.82	1.66
		15	275.00	275.00	82.14	82.14	82.14	0.82
		16	300.00	300.00	71.88	71.88	71.88	0.72
	V	17	1550.00	250.00	43.65	270.63	270.63	2.71
		18	1550.00	250.00	68.11	422.28	422.28	4.22
		19	1100.00	250.00	78.45	345.18	345.18	3.45
		20	550.00	250.00	53.82	118.40	118.40	1.18

Appendix Table 18 Continued…

Area	**Plot**	**Sample**	**TFW (g)**	**SSFW (g)**	**ODW_{avg} (g)**	**ODWt (g)**	**Biomass (g/m^2)**	**Biomass (ton/ha)**
Fruit Orchard	I	1	0.00	0.00	0.00	0.00	0	0
		2	0.00	0.00	0.00	0.00	0	0
		3	0.00	0.00	0.00	0.00	0	0
		4	0.00	0.00	0.00	0.00	0	0
	II	5	0.00	0.00	0.00	0.00	0	0
		6	0.00	0.00	0.00	0.00	0	0
		7	0.00	0.00	0.00	0.00	0	0
		8	0.00	0.00	0.00	0.00	0	0
	III	9	100.00	100.00	21.50	21.50	21.50	0.22
		10	100.00	100.00	30.43	30.43	30.43	0.30
		11	150.00	150.00	27.83	27.83	27.83	0.28
		12	350.00	350.00	106.07	106.07	106.07	1.06
	IV	13	550.00	300.00	58.50	107.25	107.25	1.07
		14	150.00	150.00	63.07	63.07	63.07	0.63
		15	125.00	125.00	48.23	48.23	48.23	0.48
		16	350.00	350.00	126.07	126.07	126.07	1.26
	V	17	300.00	300.00	121.03	121.03	121.03	1.21
		18	200.00	200.00	60.23	60.23	60.23	0.60
		19	175.00	175.00	53.17	53.17	53.17	0.53

		20	600.00	300.00	69.13	138.27	138.27	1.38

Appendix Table 19. Biomass of the litter samples in various land uses studied.

Area	Plot	Sample	TFW (g)	SSFW (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
Brushland	I	L1	0.00	0.00	0.00	0.00	0.00
		L2	0.00	0.00	0.00	0.00	0.00
		L3	0.00	0.00	0.00	0.00	0.00
		L4	0.00	0.00	0.00	0.00	0.00
	II	L5	225.00	225.00	141.47	565.87	5.66
		L6	200.00	200.00	154.37	617.47	6.17
		L7	150.00	150.00	104.87	419.47	4.19
		L8	200.00	200.00	122.97	491.87	4.92
	III	L9	0.00	0.00	0.00	0.00	0.00
		L10	0.00	0.00	0.00	0.00	0.00
		L11	0.00	0.00	0.00	0.00	0.00
		L12	0.00	0.00	0.00	0.00	0.00
Plantation	I	L1	350.00	350.00	181.30	725.20	7.25
		L2	350.00	350.00	187.40	749.60	7.50
		L3	250.00	250.00	141.83	567.33	5.67
		L4	250.00	250.00	141.20	564.80	5.65
		L5	100.00	100.00	56.60	226.40	2.26
		L6	140.00	140.00	87.87	351.47	3.51
		L7	175.00	175.00	113.40	453.60	4.54
		L8	225.00	225.00	114.50	458.00	4.58
	II	L1	250.00	250.00	108.93	435.72	4.36
		L2	350.00	350.00	202.37	809.47	8.09
		L3	350.00	350.00	147.40	589.60	5.90
		L4	150.00	150.00	96.13	384.53	3.85
		L5	250.00	250.00	114.17	456.67	4.57
		L6	250.00	250.00	109.13	436.53	4.37
		L7	550.00	550.00	256.60	1026.40	10.26
		L8	400.00	400.00	191.13	764.53	7.65
	III	L1	300.00	300.00	127.30	509.20	5.09
		L2	650.00	650.00	264.70	1058.80	10.59
		L3	500.00	500.00	256.43	1025.73	10.26
		L4	550.00	550.00	249.33	997.33	9.97
		L5	550.00	550.00	278.90	1115.60	11.16

Area	Plot	Sample	TFW (g)	SSFW (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
		L6	650.00	650.00	315.47	1261.87	12.62
		L7	350.00	350.00	137.73	550.93	5.51
		L8	250.00	250.00	111.80	447.20	4.47
	IV	L1	250.00	250.00	114.03	456.13	4.56
		L2	250.00	250.00	136.33	545.33	5.45
		L3	200.00	200.00	110.77	443.07	4.43
		L4	500.00	500.00	285.63	1142.53	11.43
		L5	240.00	240.00	113.63	454.53	4.55
		L6	250.00	250.00	120.23	480.93	4.81
		L7	200.00	200.00	118.13	472.53	4.73
		L8	300.00	300.00	165.33	661.33	6.61
	V	L1	250.00	250.00	139.83	559.33	5.59
		L2	250.00	250.00	138.20	552.80	5.53
		L3	450.00	450.00	240.33	961.33	9.61
		L4	500.00	500.00	300.63	1202.53	12.03
		L5	500.00	500.00	280.50	1122.00	11.22
		L6	400.00	400.00	217.13	868.53	8.69
		L7	300.00	300.00	160.60	642.40	6.42
		L8	1250.00	1250.00	587.03	2348.13	23.48
	VI	L1	400.00	400.00	78.83	315.32	3.15
		L2	400.00	400.00	178.57	714.27	7.14
		L3	850.00	850.00	451.30	1805.20	18.05
		L4	850.00	850.00	308.80	1235.20	12.35
		L5	200.00	200.00	137.40	549.60	5.50
		L6	250.00	250.00	141.87	567.47	5.67
		L7	800.00	800.00	424.80	1699.20	16.99
		L8	600.00	600.00	357.00	1428.00	14.28
	VII	L1	500.00	500.00	260.80	1043.20	10.43
		L2	500.00	500.00	283.73	1134.93	11.35
		L3	450.00	450.00	299.37	1197.47	11.97
		L4	650.00	650.00	380.33	1521.33	15.21
		L5	250.00	250.00	172.77	691.07	6.91
		L6	300.00	300.00	175.53	702.13	7.02
		L7	350.00	350.00	179.73	718.93	7.19
		L8	500.00	500.00	190.50	762.00	7.62
	VIII	L1	850.00	850.00	359.33	1437.33	14.37
		L2	200.00	200.00	131.33	525.33	5.25

Area	Plot	Sample	TFW (g)	SSFW (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
		L3	225.00	225.00	159.30	637.20	6.37
		L4	250.00	250.00	149.83	599.33	5.99
		L5	400.00	400.00	247.27	989.07	9.89
		L6	650.00	650.00	418.67	1674.67	16.75
		L7	200.00	200.00	152.30	609.20	6.09
		L8	650.00	650.00	412.70	1650.80	16.51
	IX	L1	150.00	150.00	117.27	469.07	4.69
		L2	200.00	200.00	151.27	605.07	6.05
		L3	200.00	200.00	157.60	630.40	6.30
		L4	125.00	125.00	106.40	425.60	4.26
		L5	50.00	50.00	48.50	194.00	1.94
		L6	50.00	50.00	51.13	204.53	2.05
		L7	400.00	400.00	305.40	1221.60	12.22
		L8	350.00	350.00	298.23	1192.93	11.93
	X	L1	300.00	300.00	185.60	742.40	7.42
		L2	450.00	450.00	241.33	965.33	9.65
		L3	300.00	300.00	186.00	744.00	7.44
		L4	350.00	350.00	223.40	893.60	8.94
		L5	450.00	450.00	348.03	1392.13	13.92
		L6	400.00	400.00	260.00	1040.00	10.40
		L7	250.00	250.00	157.60	630.40	6.30
		L8	400.00	400.00	265.33	1061.33	10.61
Agroforestry	I	L1	250.00	250.00	104.47	417.87	4.18
		L2	450.00	450.00	236.87	947.47	9.47
		L3	250.00	250.00	116.60	466.40	4.66
		L4	200.00	200.00	98.40	393.60	3.94
		L5	300.00	300.00	93.37	373.47	3.73
		L6	250.00	250.00	112.57	450.27	4.50
		L7	250.00	250.00	143.70	574.80	5.75
		L8	200.00	200.00	136.57	546.27	5.46
	II	L1	250.00	250.00	100.77	403.07	4.03
		L2	250.00	250.00	128.10	512.40	5.12
		L3	300.00	300.00	139.10	556.40	5.56
		L4	200.00	200.00	209.73	838.93	8.39
		L5	150.00	150.00	93.30	373.20	3.73
		L6	350.00	350.00	202.67	810.67	8.11
		L7	300.00	300.00	134.43	537.73	5.38
		L8	350.00	350.00	151.50	606.00	6.06
	III	L1	250.00	250.00	155.25	621.00	6.21
		L2	350.00	350.00	239.32	957.27	9.57
		L3	375.00	375.00	200.91	803.63	8.04

Area	Plot	Sample	TFW (g)	SSFW (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
		L4	325.00	325.00	148.27	593.09	5.93
		L5	200.00	200.00	129.24	516.95	5.17
		L6	225.00	225.00	164.84	659.35	6.59
		L7	500.00	500.00	270.88	1083.51	10.84
		L8	325.00	325.00	165.34	661.36	6.61
	IV	L1	150.00	150.00	79.09	316.35	3.16
		L2	250.00	250.00	114.92	459.68	4.60
		L3	150.00	150.00	97.10	388.41	3.88
		L4	175.00	175.00	78.05	312.21	3.12
		L5	300.00	300.00	249.62	998.47	9.98
		L6	150.00	150.00	115.73	462.92	4.63
		L7	225.00	225.00	214.30	857.19	8.57
		L8	225.00	225.00	208.96	835.84	8.36
	V	L1	350.00	350.00	134.48	537.93	5.38
		L2	400.00	400.00	201.80	807.21	8.07
		L3	350.00	350.00	170.01	680.03	6.80
		L4	200.00	200.00	107.83	431.31	4.31
		L5	150.00	150.00	115.96	463.85	4.64
		L6	150.00	150.00	92.09	368.37	3.68
		L7	250.00	250.00	89.00	356.00	3.56
		L8	150.00	150.00	93.92	375.67	3.76
Fruit Orchard	I	FOMS L1	75.00	75.00	40.43	161.73	1.62
		FOMS L2	25.00	25.00	23.73	94.93	0.95
		FOMS L3	175.00	175.00	71.03	284.13	2.84
		FOMS L4	150.00	150.00	72.33	289.33	2.89
		FOMS L5	50.00	50.00	34.67	138.67	1.39
		FOMS L6	50.00	50.00	36.77	147.07	1.47
		FOMS L7	100.00	100.00	49.60	198.40	1.98
		FOMS L8	50.00	50.00	32.23	128.93	1.29
	II	FOMS L1	50.00	50.00	33.60	134.40	1.34
		FOMS L2	0.00	0.00	0.00	0.00	0.00
		FOMS L3	0.00	0.00	0.00	0.00	0.00
		FOMS L4	0.00	0.00	0.00	0.00	0.00
		FOMS L5	0.00	0.00	0.00	0.00	0.00
		FOMS L6	0.00	0.00	0.00	0.00	0.00
		FOMS L7	0.00	0.00	0.00	0.00	0.00
		FOMS L8	0.00	0.00	0.00	0.00	0.00
	III	FOMS L1	300.00	300.00	142.20	568.80	5.69
		FOMS L2	750.00	750.00	292.20	1168.80	11.69
		FOMS L3	500.00	500.00	189.57	758.27	7.58

Area	Plot	Sample	TFW (g)	SSFW (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
		FOMS L4	400.00	400.00	181.57	726.27	7.26
		FOMS L5	250.00	250.00	130.43	521.73	5.22
		FOMS L6	600.00	600.00	212.20	848.80	8.49
		FOMS L7	325.00	325.00	136.20	544.80	5.45
		FOMS L8	350.00	350.00	168.37	673.47	6.73
	IV	FOMS L1	50.00	50.00	20.03	80.13	0.80
		FOMS L2	100.00	100.00	53.33	213.33	2.13
		FOMS L3	125.00	125.00	89.90	359.60	3.60
		FOMS L4	50.00	50.00	19.67	78.67	0.79
		FOMS L5	0.00	0.00	0.00	0.00	0.00
		FOMS L6	0.00	0.00	0.00	0.00	0.00
		FOMS L7	100.00	100.00	35.80	143.20	1.43
		FOMS L8	50.00	50.00	30.77	123.07	1.23
	V	FOMS L1	100.00	100.00	56.57	226.27	2.26
		FOMS L2	50.00	50.00	19.17	76.67	0.77
		FOMS L3	75.00	75.00	25.40	101.60	1.02
		FOMS L4	50.00	50.00	26.77	107.07	1.07
		FOMS L5	0.00	0.00	0.00	0.00	0.00
		FOMS L6	0.00	0.00	0.00	0.00	0.00
		FOMS L7	0.00	0.00	0.00	0.00	0.00
		FOMS L8	0.00	0.00	0.00	0.00	0.00

Appendix Table 20. Biomass density of grassland areas.

AREA	Plot	Sample	TFW (g)	SSFW (g)	ODW_{avg} (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
San Bernabe	**I**	1	800.00	300.00	94.10	250.93	250.93	2.51
		2	1550.00	300.00	121.80	629.30	629.30	6.29
		3	1650.00	300.00	104.67	575.67	575.67	5.76
		4	1600.00	300.00	143.13	763.38	763.38	7.63
	II	5	2200.00	300.00	91.10	668.07	668.07	6.68
		6	2550.00	300.00	97.97	832.72	832.72	8.33
		7	1200.00	300.00	100.13	400.53	400.53	4.01
		8	1050.00	300.00	101.83	356.42	356.42	3.56
Cofcaville	**III**	9	1400.00	300.00	135.73	633.42	633.42	6.33
		10	1050.00	300.00	136.60	478.10	478.10	4.78
		11	1250.00	300.00	126.68	527.85	527.85	5.28
		12	1400.00	300.00	119.43	557.36	557.36	5.57
	IV	13	1600.00	300.00	250.17	1334.22	1334.22	13.34
		14	1250.00	300.00	119.63	498.47	498.47	4.98
		15	1700.00	300.00	173.73	984.49	984.49	9.84
		16	1350.00	300.00	148.23	667.05	667.05	6.67
Divisoria Sur	**V**	17	1500.00	300.00	112.20	561.00	561.00	5.61
		18	3000.00	300.00	111.70	1117.00	1117.00	11.17
		19	2150.00	300.00	126.40	905.87	905.87	9.06
		20	3500.00	300.00	127.37	1485.94	1485.94	14.86
	VI	21	2200.00	300.00	119.20	874.13	874.13	8.74
		22	2950.00	300.00	141.47	1391.09	1391.09	13.91
		23	2300.00	300.00	121.53	931.76	931.76	9.32
		24	2150.00	300.00	132.90	952.45	952.45	9.52
San Pedro	**VII**	25	1600.00	300.00	62.07	331.02	331.02	3.31
		26	1800.00	300.00	48.43	290.60	290.60	2.91
		27	1600.00	300.00	54.20	289.07	289.07	2.89
		28	1800.00	300.00	57.40	344.40	344.40	3.44
	VIII	29	300.00	300.00	131.07	131.07	131.07	1.31
		30	950.00	300.00	94.13	298.09	298.09	2.98
		31	850.00	300.00	88.87	251.79	251.79	2.52

AREA	Plot	Sample	TFW (g)	SSFW (g)	ODW_{avg} (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)
		32	1250.00	300.00	74.23	309.31	309.31	3.09
San Salvador	**IX**	33	2050.00	300.00	110.67	756.22	756.22	7.56
		34	1700.00	300.00	131.77	746.68	746.68	7.47
		35	1600.00	300.00	97.47	519.82	519.82	5.20
		36	2850.00	300.00	153.10	1454.45	1454.45	14.54
	X	37	1050.00	300.00	152.17	532.58	532.58	5.33
		38	2000.00	3000.00	163.77	109.18	109.18	1.09
		39	750.00	300.00	152.87	382.17	382.17	3.82
		40	1600.00	300.00	154.87	825.96	825.96	8.26
Villa Agullana	**XI**	41	3500.00	300.00	150.57	1756.61	1756.61	17.57
		42	2500.00	300.00	172.00	1433.33	1433.33	14.33
		43	2500.00	300.00	212.47	1770.56	1770.56	17.71
		44	2100.00	300.00	171.40	1199.80	1199.80	12.00
	XII	45	2000.00	300.00	213.27	1421.78	1421.78	14.22
		46	2000.00	300.00	189.37	1262.44	1262.44	12.62
		47	1300.00	300.00	191.17	828.39	828.39	8.28
		48	1400.00	300.00	170.40	795.20	795.20	7.95

Appendix Table 20. Biomass density of rice farms.

Area	Plot	Sample	TFW (g)	SSFW (g)	ODW_{avg} (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)	Total Carbon (ton/ha)
San Bernabe	**I**	1	1050	300	73.60	257.60	257.60	2.58	1.16
		2	1500	300	87.87	439.33	439.33	4.39	1.98
		3	1300	300	79.47	344.36	344.36	3.44	1.55
		4	2500	300	80.57	671.39	671.39	6.71	3.02
Cofcaville	**II**	5	1600	300	123.03	656.18	656.18	6.56	2.95
		6	1250	300	119.57	498.19	498.19	4.98	2.24
		7	900	300	104.50	313.50	313.50	3.14	1.41
		8	2000	300	118.83	792.22	792.22	7.92	3.57
Divisoria Sur	**III**	9	3400	300	68.67	778.22	778.22	7.78	3.50
		10	4250	300	64.10	908.08	908.08	9.08	4.09
		11	4800	300	69.50	1112.00	1112.00	11.12	5.00
		12	3200	300	59.07	630.04	630.04	6.30	2.84
San Pedro	**IV**	13	4750	300	142.23	2252.03	2252.03	22.52	10.13
		14	3600	300	115.87	1390.40	1390.40	13.90	6.26
		15	2000	300	104.80	698.67	698.67	6.99	3.14
		16	2550	300	105.57	897.32	897.32	8.97	4.04
San Salvador	**V**	17	1800	300	86.87	521.20	521.20	5.21	2.35
		18	3900	300	87.37	1135.77	1135.77	11.36	5.11
		19	3100	300	82.37	851.12	851.12	8.51	3.83
		20	3500	300	87.67	1022.78	1022.78	10.23	4.60
Villa Agullana	**VI**	21	3450	300	102.00	1173.00	1173.00	11.73	5.28
		22	2150	300	90.00	645.00	645.00	6.45	2.90
		23	2000	300	93.33	62.22	62.22	0.62	0.28
		24	2000	300	103.67	691.11	691.11	6.91	3.11

Appendix Table 21. Biomass density of corn farms.

Area	Plot	Sample	TFW (g)	SSFW (g)	ODW_{avg} (g)	ODWt (g)	Biomass (g/m^2)	Biomass (ton/ha)	Total Carbon (ton/ha)
San Bernabe	**I**	1	3050.00	300.00	94.97	965.49	965.49	9.65	4.34
		2	2950.00	300.00	85.87	844.36	844.36	8.44	3.80
		3	1750.00	300.00	96.90	565.25	565.25	5.65	2.54
		4	1800.00	300.00	91.07	546.40	546.40	5.46	2.46
Cofcaville	**II**	5	700.00	300.00	80.43	187.68	187.68	1.88	0.84
		6	1500.00	300.00	101.47	507.33	507.33	5.07	2.28
		7	1200.00	300.00	85.77	343.07	343.07	3.43	1.54
		8	2200.00	300.00	118.23	867.04	867.04	8.67	3.90
Divisoria Sur	**III**	9	1650.00	300.00	75.57	415.62	415.62	4.16	1.87
		10	1950.00	300.00	88.27	573.73	573.73	5.74	2.58
		11	1950.00	300.00	89.60	582.40	582.40	5.82	2.62

		12	2050.00	300.00	98.20	671.03	671.03	6.71	3.02
San Pedro	**IV**	13	350.00	350.00	42.10	42.10	42.10	0.42	0.19
		14	850.00	300.00	45.20	128.07	128.07	1.28	0.58
		15	850.00	300.00	44.30	125.52	125.52	1.26	0.56
		16	850.00	300.00	40.90	115.88	115.88	1.16	0.52
San Salvador	**V**	17	2300.00	300.00	74.20	568.87	568.87	5.69	2.56
		18	2150.00	300.00	77.93	558.52	558.52	5.59	2.51
		19	2500.00	300.00	79.40	661.67	661.67	6.62	2.98
		20	2970.00	300.00	78.83	780.45	780.45	7.80	3.51

Table 22. Soil organic carbon (SOC) of various land uses in Quirino.

Area	Plot	Sample	FW (g)	Ht. of the soil (cm)	ODW (g)	Bulk Density (g/cm^3)	Wt. of the Soil (ton/ha)	%OM	% Carbon	Organic Carbon (ton/ha)
San Bernabe Brushland	**I**	1	225.00	7	153.93	1.00	2990.29	4.94	2.87	85.68
		2	150.00	7	141.43	0.92	2747.47	4.94	2.87	78.73
		3	250.00	7	162.23	1.05	3151.52	4.94	2.87	90.30
		4	250.00	9	169.83	0.86	2566.01	4.94	2.87	73.53
	II	5	225.00	10	158.47	0.72	2154.85	4.94	2.87	61.75
		6	150.00	6	114.70	0.87	2599.51	4.94	2.87	74.49
		7	200.00	9	152.23	0.77	2300.10	4.94	2.87	65.91
	III	8	200.00	9	160.13	0.81	2419.46	4.94	2.87	69.33
		9	250.00	9	178.43	0.90	2695.95	4.94	2.87	77.25
		10	200.00	7	139.55	0.90	2710.88	4.94	2.87	77.68
		11	200.00	7	164.27	1.06	3191.02	4.94	2.87	91.44
		12	200.00	7	149.40	0.97	2902.23	4.94	2.87	83.16
San Bernabe Grassland	**I**	1	175.00	6	127.13	0.96	2881.29	3.21	1.86	53.65
		2	200.00	8	140.20	0.79	2383.07	3.21	1.86	44.37
		3	200.00	6	124.10	0.94	2812.54	3.21	1.86	52.37
		4	200.00	8	135.43	0.77	2302.05	3.21	1.86	42.86
	II	5	250.00	9	148.87	0.75	2249.23	5.15	2.99	67.19
		6	200.00	8	134.23	0.76	2281.65	5.15	2.99	68.16
		7	200.00	9	132.73	0.67	2005.47	5.15	2.99	59.91
		8	200.00	8	124.17	0.70	2110.54	5.15	2.99	63.05

Cofcaville Grassland	**III**	1	200.00	6	124.87	0.94	2829.92	4.26	2.47	69.93
		2	150.00	5	108.53	0.98	2951.70	4.26	2.47	72.94
		3	200.00	6	114.15	0.86	2587.04	4.26	2.47	63.93
		4	150.00	5	111.20	1.01	3024.22	4.26	2.47	74.73
	IV	5	200.00	8	113.37	0.64	1926.97	4.02	2.33	44.93
		6	150.00	7	104.73	0.68	2034.54	4.02	2.33	47.44
		7	200.00	6	107.97	0.82	2446.90	4.02	2.33	57.06
		8	150.00	7	108.40	0.70	2105.76	4.02	2.33	49.10
Divisoria Sur Grassland	**V**	1	300.00	8	129.23	0.73	2196.66	2.71	1.57	34.53
		2	250.00	8	164.23	0.93	2791.58	2.71	1.57	43.88
		3	250.00	9	177.43	0.89	2680.84	2.71	1.57	42.14
		4	250.00	10	174.90	0.79	2378.31	2.71	1.57	37.39
	VI	5	250.00	9	129.63	0.65	1958.63	1.48	0.86	16.81
		6	200.00	10	250.95	1.14	3412.45	1.48	0.86	29.29
		7	200.00	7	111.93	0.72	2174.40	1.48	0.86	18.67
		8	250.00	7	136.77	0.89	2656.81	1.48	0.86	22.81
San Pedro Grassland	**VII**	1	300.00	10	242.52	1.10	3297.77	1.22	0.71	23.34
		2	250.00	10	217.83	0.99	2962.12	1.22	0.71	20.96
		3	300.00	10	239.27	1.08	3253.57	1.22	0.71	23.02
		4	250.00	10	206.10	0.93	2802.57	1.22	0.71	19.83
	VIII	5	300.00	10	275.50	1.25	3746.28	0.72	0.42	15.65
		6	350.00	10	283.97	1.29	3861.41	0.72	0.42	16.13

		7	250.00	10	235.23	1.07	3198.73	0.72	0.42	13.36
		8	300.00	10	244.17	1.11	3320.21	0.72	0.42	13.87
San Salvador Grassland	**IX**	1	250.00	7	166.43	1.08	3233.11	3.67	2.13	68.83
		2	200.00	7	145.77	0.94	2831.64	3.67	2.13	60.28
		3	250.00	7	134.87	0.87	2619.90	3.67	2.13	55.77
		4	150.00	6	129.23	0.98	2928.88	3.67	2.13	62.35
	X	5	250.00	9	196.77	0.99	2972.95	3.19	1.85	55.01
		6	260.00	8	250.95	1.42	4265.56	3.19	1.85	78.93
		7	250.00	9	206.45	1.04	3119.26	3.19	1.85	57.72
		8	250.00	9	191.73	0.97	2896.90	3.19	1.85	53.60
Villa Agullana Grassland	**XI**	1	200.00	9	133.97	0.67	2024.10	2.68	1.55	31.47
		2	150.00	6	82.73	0.63	1875.03	2.68	1.55	29.15
		3	250.00	7	132.43	0.86	2572.63	2.68	1.55	39.99
		4	150.00	7	103.57	0.67	2011.87	2.68	1.55	31.28
	XII	5	200.00	8.5	138.47	0.74	2215.16	3.17	1.84	40.73
		6	200.00	7	132.13	0.86	2566.81	3.17	1.84	47.20
		7	250.00	9	174.20	0.88	2631.99	3.17	1.84	48.40
		8	250.00	8	163.73	0.93	2783.08	3.17	1.84	51.17
San Bernabe Cornfield	**I**	1	200.00	7	124.83	0.81	2425.00	4.63	2.69	65.13
		2	250.00	9	141.83	0.71	2142.96	4.63	2.69	57.55
		3	250.00	10	169.30	0.77	2302.16	4.63	2.69	61.83
		4	200.00	9	109.13	0.55	1648.90	4.63	2.69	44.28

Cofcaville Cornfield	**II**	1	200.00	6	131.80	1.00	2987.05	3.68	2.13	63.76
		2	200.00	7	151.30	0.98	2939.13	3.68	2.13	62.74
		3	200.00	8	172.57	0.98	2933.23	3.68	2.13	62.61
		4	200.00	10	156.73	0.71	2131.28	3.68	2.13	45.49
Divisoria Sur Cornfield	**III**	1	250.00	10	149.80	0.68	2037.00	3.26	1.89	38.52
		2	200.00	9	111.70	0.56	1687.68	3.26	1.89	31.91
		3	200.00	9	118.67	0.60	1792.94	3.26	1.89	33.90
		4	200.00	9	109.13	0.55	1648.90	3.26	1.89	31.18
San Pedro Cornfield	**IV**	1	300.00	10	255.17	1.16	3469.78	0.94	0.55	18.92
		2	300.00	10	251.43	1.14	3419.02	0.94	0.55	18.64
		3	300.00	10	244.63	1.11	3326.55	0.94	0.55	18.14
		4	300.00	10	264.97	1.20	3603.05	0.94	0.55	19.65
San Salvador Cornfield	**V**	1	250.00	6	159.10	1.20	3605.77	4.3	2.49	89.94
		2	250.00	9	158.63	0.80	2396.79	4.3	2.49	59.78
		3	200.00	6	116.75	0.88	2645.97	4.3	2.49	66.00
		4	200.00	6	145.13	1.10	3289.23	4.3	2.49	82.04
San Bernabe Ricefield	**I**	1	250.00	8	151.37	0.86	2572.88	2.8	1.62	41.79
		2	325.00	9.5	190.97	0.91	2733.46	2.8	1.62	44.39
		3	300.00	9	291.97	1.47	4411.33	2.8	1.62	71.65
		4	200.00	9	133.60	0.67	2018.56	2.8	1.62	32.78
Cofcaville Ricefield	**II**	1	250.00	9.5	152.70	0.73	2185.72	3.61	2.09	45.77
		2	200.00	9	134.27	0.68	2028.64	3.61	2.09	42.48
		3	200.0	9	162.8	0.82	2460.	3.61	2.09	51.52

			0		5		50			
		4	250.00	9	161.43	0.81	2439.10	3.61	2.09	51.07
Divisoria Sur Ricefield	**III**	1	250.00	7	113.03	0.73	2195.77	3.86	2.24	49.16
		2	250.00	8	138.50	0.78	2354.17	3.86	2.24	52.71
		3	300.00	10	154.23	0.70	2097.28	3.86	2.24	46.96
		4	300.00	10	170.90	0.77	2323.92	3.86	2.24	52.03
San Pedro Ricefield	**IV**	1	250.00	10	226.17	1.03	3075.44	1.26	0.73	22.48
		2	300.00	10	255.50	1.16	3474.32	1.26	0.73	25.39
		3	350.00	10	261.63	1.19	3557.72	1.26	0.73	26.00
		4	300.00	9.5	235.87	1.13	3376.15	1.26	0.73	24.67
San Salvador Ricefield	**V**	1	250.00	8	196.90	1.12	3346.84	2.68	1.55	52.03
		2	300.00	9	205.93	1.04	3111.45	2.68	1.55	48.37
		3	250.00	7	183.07	1.19	3556.23	2.68	1.55	55.28
		4	250.00	8	187.37	1.06	3184.79	2.68	1.55	49.51
Villa Agullana Ricefield	**VI**	1	250.00	9.5	170.73	0.81	2443.84	2.42	1.40	34.30
		2	300.00	10	190.40	0.86	2589.08	2.42	1.40	36.34
		3	200.00	8	141.87	0.80	2411.40	2.42	1.40	33.85
		4	250.00	10	185.73	0.84	2525.62	2.42	1.40	35.45
Malabing, Kasibu, N. Viscaya, Fruit Orchard	**I**	1	200.00	7	144.37	0.93	2804.45	6.74	3.91	109.64
		2	200.00	8	149.23	0.85	2536.61	6.74	3.91	99.17
		3	250.00	8	180.33	1.02	3065.24	6.74	3.91	119.84
		4	150.00	7	115.13	0.75	2236.57	6.74	3.91	87.44
		5	250.00	9	175.23	0.88	2647.60	6.74	3.91	103.51

		6	225.00	8	148.77	0.84	2528.68	6.74	3.91	98.86
		7	175.00	7	121.60	0.79	2362.19	6.74	3.91	92.35
		8	200.00	7	127.20	0.82	2470.97	6.74	3.91	96.60
	II	9	200.00	9	142.43	0.72	2152.03	5.48	3.18	68.41
		10	250.00	9	164.67	0.83	2487.95	5.48	3.18	79.08
		11	250.00	9	160.90	0.81	2431.04	5.48	3.18	77.27
		12	225.00	9	154.17	0.78	2329.31	5.48	3.18	74.04
		13	200.00	9	139.47	0.70	2107.20	5.48	3.18	66.98
		14	250.00	10	181.20	0.82	2463.98	5.48	3.18	78.32
		15	200.00	7	148.77	0.96	2889.92	5.48	3.18	91.86
		16	200.00	9	156.40	0.79	2363.05	5.48	3.18	75.11
	III	17	250.00	9	156.23	0.79	2360.53	5.3	3.07	72.57
		18	200.00	8	141.73	0.80	2409.13	5.3	3.07	74.06
		19	250.00	9	161.93	0.82	2446.65	5.3	3.07	75.22
		20	250.00	9	161.40	0.81	2438.59	5.3	3.07	74.97
		21	250.00	10	163.00	0.74	2216.49	5.3	3.07	68.14
		22	250.00	9	158.90	0.80	2400.82	5.3	3.07	73.81
		23	250.00	9	158.67	0.80	2397.30	5.3	3.07	73.70
		24	250.00	9	136.57	0.69	2063.39	5.3	3.07	63.43
	IV	25	225.00	8	162.47	0.92	2761.55	4.98	2.89	79.77
		26	250.00	9	176.47	0.89	2666.24	4.98	2.89	77.02
		27	200.00	9	151.60	0.76	2290.53	4.98	2.89	66.16
		28	250.00	9	168.33	0.85	2543.35	4.98	2.89	73.47

		29	200.00	7	146.57	0.95	2847.19	4.98	2.89	82.24
		30	175.00	6	125.47	0.95	2843.52	4.98	2.89	82.14
		31	250.00	8	179.20	1.02	3045.98	4.98	2.89	87.99
		32	250.00	8	173.03	0.98	2941.16	4.98	2.89	84.96
	V	33	250.00	9	171.00	0.86	2583.64	5.74	3.33	86.02
		34	250.00	9	173.30	0.87	2618.39	5.74	3.33	87.18
		35	200.00	9	147.27	0.74	2225.05	5.74	3.33	74.08
		36	250.00	9	163.27	0.82	2466.80	5.74	3.33	82.13
		37	250.00	9	171.17	0.86	2586.16	5.74	3.33	86.11
		38	200.00	9	146.40	0.74	2211.96	5.74	3.33	73.65
		39	250.00	9	159.07	0.80	2403.34	5.74	3.33	80.02
		40	250.00	9	164.00	0.83	2477.88	5.74	3.33	82.50
Brgy. Del Pilar, Cabarroguis, Quirino	**I**	1	300.00	9	196.37	0.99	2966.91	4.26	2.47	73.31
		2	260.00	8	161.93	0.92	2752.48	4.26	2.47	68.01
		3	250.00	7	168.73	1.09	3277.79	4.26	2.47	80.99
		4	250.00	10	191.93	0.87	2609.93	4.26	2.47	64.49
		5	250.00	10	163.93	0.74	2229.18	4.26	2.47	55.08
		6	250.00	10	173.73	0.79	2362.45	4.26	2.47	58.38
		7	250.00	8	203.17	1.15	3453.35	4.26	2.47	85.33
		8	250.00	8	195.00	1.10	3314.54	4.26	2.47	81.90
	II	9	300.00	9	215.73	1.09	3259.52	3.68	2.13	69.58
		10	300.00	9	203.97	1.03	3081.74	3.68	2.13	65.78
		11	300.0	10	194.	0.88	2647.	3.68	2.1	56.51

			0		70		55		3	
		12	275.00	10	208.83	0.95	2839.74	3.68	2.13	60.62
		13	300.00	10	215.77	0.98	2934.02	3.68	2.13	62.63
		14	300.00	10	220.90	1.00	3003.82	3.68	2.13	64.12
		15	300.00	10	222.70	1.01	3028.30	3.68	2.13	64.64
		16	300.00	10	198.30	0.90	2696.51	3.68	2.13	57.56
	III	17	300.00	9	190.93	0.96	2884.81	2.38	1.38	39.83
		18	250.00	8	154.37	0.87	2623.87	2.38	1.38	36.22
		19	300.00	10	181.07	0.82	2462.16	2.38	1.38	33.99
		20	250.00	7	154.77	1.00	3006.48	2.38	1.38	41.50
		21	300.00	9	176.53	0.89	2667.24	2.38	1.38	36.82
		22	300.00	9	203.47	1.02	3074.18	2.38	1.38	42.44
		23	300.00	6	170.13	1.29	3855.82	2.38	1.38	53.23
		24	300.00	8	185.80	1.05	3158.16	2.38	1.38	43.60
	IV	25	250.00	9	173.10	0.87	2615.37	3.27	1.90	49.61
		26	250.00	9	146.90	0.74	2219.51	3.27	1.90	42.10
		27	250.00	8	169.17	0.96	2875.43	3.27	1.90	54.54
		28	250.00	6.8	178.27	1.19	3564.84	3.27	1.90	67.62
		29	250.00	9	181.27	0.91	2738.76	3.27	1.90	51.95
		30	300.00	9	170.73	0.86	2579.61	3.27	1.90	48.93
		31	250.00	8	177.17	1.00	3011.42	3.27	1.90	57.12
		32	250.00	8	170.57	0.97	2899.23	3.27	1.90	54.99
	V	33	250.00	9	185.97	0.94	2809.77	4.93	2.86	80.35
		34	250.0	9	181.	0.91	2742.	4.93	2.8	78.43

			0		53		79		6	
		35	250.00	9	192.63	0.97	2910.50	4.93	2.86	83.23
		36	250.00	8	183.17	1.04	3113.40	4.93	2.86	89.03
		37	250.00	9	186.37	0.94	2815.82	4.93	2.86	80.52
		38	250.00	9	172.10	0.87	2600.26	4.93	2.86	74.36
		39	200.00	8	149.53	0.85	2541.71	4.93	2.86	72.68
		40	150.00	6	120.13	0.91	2722.64	4.93	2.86	77.86
	VI	41	250.00	10	198.43	0.90	2698.32	3.05	1.77	47.74
		42	250.00	8	178.97	1.01	3042.01	3.05	1.77	53.82
		43	250.00	7	176.43	1.14	3427.37	3.05	1.77	60.64
		44	200.00	6	164.77	1.24	3734.19	3.05	1.77	66.06
		45	250.00	6.5	181.90	1.27	3805.38	3.05	1.77	67.32
		46	250.00	5	163.67	1.48	4451.12	3.05	1.77	78.75
		47	250.00	10	161.63	0.73	2197.91	3.05	1.77	38.88
		48	250.00	9	155.30	0.78	2346.43	3.05	1.77	41.51
	VII	49	200.00	9	154.53	0.78	2334.85	6.13	3.56	83.02
		50	250.00	9	163.77	0.82	2474.35	6.13	3.56	87.98
		51	250.00	8	176.73	1.00	3004.05	6.13	3.56	106.81
		52	200.00	9	155.97	0.79	2356.50	6.13	3.56	83.79
		53	200.00	8	155.50	0.88	2643.13	6.13	3.56	93.98
		54	250.00	9	173.57	0.87	2622.42	6.13	3.56	93.25
		55	250.00	10	169.53	0.77	2305.33	6.13	3.56	81.97
		56	250.00	9	178.43	0.90	2695.95	6.13	3.56	95.86
	VIII	57	250.0	9	188.	0.95	2841.	3.34	1.9	55.04

			0		03		00		4	
		58	250.00	9	180.90	0.91	2733.22	3.34	1.94	52.95
		59	300.00	10	215.83	0.98	2934.93	3.34	1.94	56.86
		60	250.00	6	161.53	1.22	3660.91	3.34	1.94	70.92
		61	250.00	10	189.07	0.86	2570.95	3.34	1.94	49.81
		62	250.00	10	198.10	0.90	2693.79	3.34	1.94	52.19
		63	300.00	7	248.23	1.61	4822.15	3.34	1.94	93.42
		64	250.00	8	186.30	1.06	3166.66	3.34	1.94	61.35
	IX	65	250.00	10	171.60	0.78	2333.44	3.2	1.86	43.31
		66	300.00	10	199.00	0.90	2706.02	3.2	1.86	50.23
		67	250.00	9	199.73	1.01	3017.77	3.2	1.86	56.01
		68	200.00	6	154.17	1.16	3493.96	3.2	1.86	64.85
		69	250.00	9	180.47	0.91	2726.67	3.2	1.86	50.61
		70	250.00	8	172.83	0.98	2937.76	3.2	1.86	54.53
		71	250.00	8	179.27	1.02	3047.11	3.2	1.86	56.56
		72	200.00	7	149.07	0.97	2895.75	3.2	1.86	53.75
	X	73	250.00	8	172.53	0.98	2932.66	3.26	1.89	55.46
		74	200.00	7	146.53	0.95	2846.54	3.26	1.89	53.83
		75	250.00	9	190.87	0.96	2883.81	3.26	1.89	54.53
		76	250.00	8	189.53	1.07	3221.62	3.26	1.89	60.92
		77	250.00	8	192.00	1.09	3263.55	3.26	1.89	61.71
		78	250.00	8	181.40	1.03	3083.37	3.26	1.89	58.31
		79	250.00	7	169.17	1.10	3286.21	3.26	1.89	62.14
		80	200.0	7	152.	0.99	2965.	3.26	1.8	56.07

			0		63		04		9	
Villa Gracia, Agroforestry	**I**	1	300.00	10	209.03	0.95	2842.46	2.02	1.17	33.30
		2	300.00	10	225.37	1.02	3064.56	2.02	1.17	35.91
		3	300.00	10	202.47	0.92	2753.16	2.02	1.17	32.26
		4	250.00	10	163.43	0.74	2222.38	2.02	1.17	26.04
		5	300.00	10	189.63	0.86	2578.66	2.02	1.17	30.21
		6	300.00	10	194.80	0.88	2648.91	2.02	1.17	31.04
		7	300.00	10	197.40	0.89	2684.27	2.02	1.17	31.45
		8	300.00	10	190.23	0.86	2586.81	2.02	1.17	30.31
	II	9	300.00	10	173.43	0.79	2358.37	2.8	1.62	38.30
		10	300.00	10	190.83	0.86	2594.97	2.8	1.62	42.15
		11	250.00	10	168.37	0.76	2289.47	2.8	1.62	37.18
		12	200.00	10	121.77	0.55	1655.80	2.8	1.62	26.89
		13	300.00	10	192.03	0.87	2611.29	2.8	1.62	42.41
		14	300.00	10	188.20	0.85	2559.16	2.8	1.62	41.56
		15	300.00	10	178.33	0.81	2425.00	2.8	1.62	39.39
		16	300.00	10	180.10	0.82	2449.02	2.8	1.62	39.78
	III	17	300.00	10	221.60	1.00	3013.34	5.3	3.07	92.64
		18	350.00	10	262.80	1.19	3573.58	5.3	3.07	109.86
		19	250.00	9	211.27	1.06	3192.03	5.3	3.07	98.13
		20	300.00	10	253.30	1.15	3444.40	5.3	3.07	105.89
		21	200.00	9	186.47	0.94	2817.33	5.3	3.07	86.61
		22	250.00	9	213.67	1.08	3228.29	5.3	3.07	99.25
		23	275.0	10	216.	0.98	2939.	5.3	3.0	90.38

			0		20		91		7	
		24	250.00	9	199.10	1.00	3008.20	5.3	3.07	92.48
	IV	25	275.00	10	228.20	1.03	3103.09	6.76	3.92	121.68
		26	300.00	10	247.73	1.12	3368.71	6.76	3.92	132.09
		27	300.00	10	232.53	1.05	3162.01	6.76	3.92	123.99
		28	350.00	10	276.87	1.25	3764.86	6.76	3.92	147.62
		29	200.00	10	145.33	0.66	1976.26	6.76	3.92	77.49
		30	250.00	10	195.70	0.89	2661.15	6.76	3.92	104.35
		31	250.00	10	188.63	0.86	2565.06	6.76	3.92	100.58
		32	300.00	10	220.20	1.00	2994.30	6.76	3.92	117.41
	V	33	250.00	10	143.07	0.65	1945.44	6.22	3.61	70.19
		34	250.00	10	189.40	0.86	2575.48	6.22	3.61	92.92
		35	300.00	10	245.03	1.11	3331.99	6.22	3.61	120.21
		36	300.00	10	235.67	1.07	3204.62	6.22	3.61	115.62
		37	250.00	10	195.50	0.89	2658.43	6.22	3.61	95.91
		38	275.00	10	174.30	0.79	2370.15	6.22	3.61	85.51
		39	300.00	10	214.40	0.97	2915.44	6.22	3.61	105.19
		40	300.00	10	228.53	1.04	3107.62	6.22	3.61	112.12

Report on the Socio-Economic Survey
Conducted during the planning phase of the project in 2006

- Survey Instrument
- Survey Results

SOCIO-ECONOMIC REPORT

Total Number of Respondents

There were a total of 498 respondents in the proposed CDM project in Quirino province. This represented 10% of the total number of households in the proposed project covering the municipalities of Aglipay, Maddela and Nagtipunan. In Aglipay, 11 barangays were covered while in Maddela, 13 barangays were included. In Nagtipunan, Barangay Sangbay is the lone barangay that was included in the proposed project. Forty nine percent or 245 respondents came from the town of Aglipay while 42% or 210 respondents came from Maddela. A mere nine percent or 43 respondents came from Nagtipunan.

Table 1. Number of respondents per barangay in the proposed CDM project in Quirino Province, Philippines.

LOCATION	NUMBER OF RESPONDENTS	PERCENT OF TOTAL
AGLIPAY		
Victoria	23	4.62
San Manuel	14	2.81
San Ramon	14	2.81
Ramos	16	3.21
San Antonio	10	2.01
Palacian	39	7.83
Pinaripad Sur	26	5.22
Diodol	16	3.21
Dungo	14	2.81
Villa Santiago	34	6.83
San Francisco	39	7.83
Sub-total	**245**	**49.19**
MADDELA		
Divisoria Sur	20	4.02
Divisoria Norte	13	2.61
Sto. Tomas	13	2.61
San Bernabe	21	4.22

Cofcaville	14	2.81
Villa Ylanan	12	2.41
San Martin	23	4.62
Villa Gracia	19	3.82
Villa Agullana	10	2.01
San Salvador	9	1.81
San Pedro	20	4.02
Manglad	14	2.81
Sto. Nino	22	4.42
Sub-total	**210**	**42.19**
NAGTIPUNAN		
Sangbay	43	8.63
Sub-total	**43**	**8.63**
TOTAL	**498**	**100.00**

Age of Respondents

Almost half of the respondents in the proposed project were in the middle age as around 44% of them have 36-50 years of age (Table 2). Only about 3% or 16 respondents had ages of 20-25 while almost 12% or 59 respondents had ages greater than 60. Almost 10% or 48 respondents were in the age bracket of 31-35 while another 10% of the respondents had ages between 51 - 55. Forty three respondents or nearly 9% of the total respondents belonged to age bracket of 26-30 while the remaining 9% or 45 respondents were in the age bracket of 56 - 60.

Table 2. Age of respondents in the CDM project in Quirino Province.

AGE	FREQUENCY	PERCENT
20-25	16	3.21
26-30	43	8.63
31-35	48	9.64
36-40	81	16.27
41-45	86	17.27
46-50	53	10.64
51-55	52	10.44
56-60	45	9.04
>60	59	11.85
No answer	15	3.01
TOTAL	**498**	**100**

Sex and Civil Status of the Respondents.

Most of the respondents were males numbering to a total of 429 or around 86% of the total. The remaining 69 respondents were females which represented 14% of the total respondents. This was expected because in the Philippines the head of the family or the men were the one who earn a living for the family and work in the farm. The women only helped their husbands in farm work but their main tasks in the family were to do domestic activities and care for the children.

Out of the total 498 respondents, about 467 mentioned that they were married. This represented about 94% of the total respondents. The remaining 6% were either single, widow or separated. About 17 people said that they were single while 13 persons claimed that they were widow/widower. One respondent however, mentioned that he/she was separated from his/her husband/wife. Results showed that in the Philippines, people value marriage too much, thus case of husband being separated from his wife was not very common.

Table 3. Sex of the respondents in the proposed CDM project in Quirino province.

ITEM	**FREQUENCY**	**PERCENT**
Sex		
Male	429	86.14
Female	69	13.86
Total	**498**	**100.00**
Civil Status		
Single	17	3.41
Married	467	93.78
Widow/er	13	2.61
Separated	1	0.20
Total	**498**	**100.00**

Migration Pattern

Most of the respondents was native in the area. This represented 69% of the total respondents numbering to around 346 people. Only 31% of the total respondents however, mentioned that they were migrants to the area (Table 4).

Respondents who answered that they migrated to the area cited a number of places where they originally reside. Out of the 152 respondents who said that they were migrants to the area, 142 respondents or 93% of the total respondents cited that their place of origin were in the nearby provinces where the dialect used by the people was the same dialect used by the people from the proposed CDM project. These provinces included: Abra, Apayao, Benguet, Cagayan Valley, Ifugao, Ilocos Norte, Ilocos Sur, Isabela, Pangasinan, Mt. Province, Nueva Vizcaya, and Tarlac. This result was expected because the migrants and their families prefer to move to another area where they could speak the same dialect and possibly eat almost the same kind of food as the one they had back home so they do not necessarily have to make much adjustments.

Two respondents came from Bicol region while one respondent originated from Capiz, a province in the island of Visayas. One respondent each came from Marinduque and Mindoro provinces. Six respondents said that they came from other municipalities of the Quirino province while four respondents failed to give their places of origin. Surprisingly, one respondent came from Makati City, the business district of Metro Manila. This was very unusual because most people from Manila don't normally transfer to the province because there were very limited livelihood opportunities and leisure activities in the rural areas. The normal trend is that the people living in the provinces transfer to big cities like Makati City.

Table 4 further showed the number of years that the migrants stayed in the proposed CDM project in Quirino province. Most of the migrants lived in the area for quite a long time already. For instance, around 20% lived in the area for 16 – 20 years; 10% for 21 – 25 years; 11% for 26 – 30 years; 9% for 31 – 35 years; 7% for 36 – 40 years; 8% for 41 – 45 years and another 8% for more than 45 years. Eight migrants did not give any answer as regards the number of years they already stayed in the area.

A number of reasons were cited by the respondents why they migrated to the area. These included: (1) an opportunity to earn a living in the area; (2) married a native of the area; (3) bought lots in the area; (4) inherited a lot located in the area; (4) to look for better opportunities; (5) there was available land to till in the area; and (6) employed in an organization located in the area. Of the responses given, almost half of the respondents mentioned that they moved to the area because they wanted to earn income for their families. This reason was understandable because people really look for places where they could earn some money to meet the needs of their families. The second popular reason why they moved to the area was "to search for greener pasture'. This response was cited by a total of 23 respondents representing around 18% of the total responses. Each person wanted to look for a place where his family's socio-economic condition could be improved or be better off. The response 'there was available land to till in the area' gathered the next highest response. Eighteen respondents or around 14% of the total responses mentioned this reason why they migrated in the area. Around 13 respondents or 10% of the total responses however said that they married a native of the area so they decided to settle there. Four persons moved to the area because they had invested some of their money through acquisition of lots since lots in Quirino were fairly cheap. Three respondents mentioned that they were able to land a job in the area so they decided to relocate to lessen transportation costs whenever they report to their respective offices. Only one respondent said that he inherited a lot located in the area from his parents so he and his family decided to transfer to the proposed project site. Eight persons did not give any reason why they moved to the area. Results indicated that people migrate to other areas mainly because of economic reasons.

Table 4. Number of respondents who are native in the area.

PLACE OF ORIGIN	**FREQUENCY**	**PERCENT**
Native	346	69.48
Migrant	152	30.52
Total	498	100.00
Classification		
Inter-provincial	6	3.95
Intra-provincial	142	93.42
No answer	4	2.63
Total	**152**	**100**
NUMBER OF YEARS		
< 15	34	22.37
16-20	31	20.39
21-25	15	9.87
26-30	16	10.53
31-35	13	8.55
36-40	11	7.24
41-45	12	7.89
>45	12	7.89
No answer	8	5.26
Total	**152**	**100.00**

Primary occupation of the respondents.

There were a number of primary occupations that the respondents were engaged in. These included: farming, employment at a concrete product factory, teaching, tailoring, furniture making, being an employee at a government office, owning a store, carpentry and driving. Of the occupations mentioned, farming was the most popular occupation in the area. This occupation was mentioned by a total of 476 persons representing about 96% of the total respondents. This result was typical to any rural area in the Philippines where large tract of lands were available for farming. The remaining 4% of the total responses received was being shared by the rest of the occupations mentioned. It should be noted however, that most of the jobs cited do not require high level of educational attainment. For instance, persons who were involved in tailoring, carpentry, driving and furniture making were required to have skills but do not need to attain a certain level of education. Owning a store also does not require any educational background but required capital to set up one. It should be emphasized however that this type of business was only small scale and does not require huge capital to get a sari-sari store operational. Employment at concrete product factory neither required any educational background nor skill because this only required a good amount of strength to undertake such occupation. Similarly, being a store keeper does not require any good educational background nor skill. Teaching and serving as a public servant were the only two occupations that required good educational background. Any person who wanted to get involved in these types of occupations need a degree of a four year course in college.

Primary occupations of most of the respondents were located within the province of Quirino. For instance, there were a total of 453 respondents who mentioned that their primary occupations were undertaken in any of the municipalities of Maddela, Aglipay, Saguday and Nagtipunan. The 453 respondents were distributed as follows: Maddela (254); Aglipay (198); Nagtipunan (1); and Saguday (43). This was expected because most people prefer to work in areas where they need not incur transportation expenses because this will mean big savings for them. They will be able to utilize their whole earnings from the primary occupations in meeting the expenses of their families. A very small percentage of the total respondents however, mentioned that their primary occupations were undertaken in the nearby provinces. For instance, one respondent said that his primary occupation was located in Aritao, Nueva Vizcaya while another respondent cited that his main job was in Cordon, Isabela.

Most of the respondents were already engaged with their primary occupation for quite a long time already. For instance, more than 70% of the respondents mentioned that they were undertaking their primary occupations for more than 11 or more years already. Some even answered that they were engaged in their primary occupations for more than 40 years already (Table 5).

Results showed that half of the respondents derived very little income from their primary occupation. For instance, about 231 persons representing 46% of the total respondents said that their annual incomes were within the range of less than PhP 20,000 to PhP 70,000. This indicated that many people in the area lived below subsistence level. Assuming that on the average, each family had earnings of PhP 50,000 per year, this would translate to only PhP 4000/month or PhP 133/day of budget for the family. Considering that this amount should cover the expenses of the family for food, education, clothing and utilities, there was no doubt that the income derived from primary occupation of half of the respondents was not at all sufficient. Since the priority was to provide food for the family, most often almost all of the income earned was spent to this item. Oftentimes, expenses related to education were given the last priority. Thus, most young people in the rural areas only reach the high school level as only up to this point where the government offer free education through the operations of public schools. Some 41% of the total respondents however mentioned that their annual incomes were higher as they were within PhP 70,001 to PhP 170,000. Since the standard of living in the provinces like Quirino is quite low, respondents earning within this range can live within the subsistence level. A mere 10% of the total respondents or 46 persons can be considered well off since they had annual incomes that were within the PhP 170,001 to more than PhP 222,000.

Table 5. Primary occupation of the respondents in the CDM project in Quirino Province

ITEM	FREQUENCY	PERCENT
Occupation		
Farming	476	95.58
Carpentry	2	0.40
Store keeping	2	0.40
Furniture making	2	0.40
Concrete production	1	0.20
Teaching	2	0.40
Tailoring	1	0.20
Govt employee	9	1.81
Store owner	2	0.40
Driving	1	0.20
Total	**498**	100.00
Length of time engaged (years)		
0 - 10	135	27.11
11 - 20	163	32.73
21 - 30	109	21.89
31 - 40	61	12.25
Above 40	27	5.42
no answer	3	0.60
Total	**498**	100.00
Income per year (PhP)		
<20,000	12	2.41
20,000-70,000	219	43.98
70,001-120,000	149	29.92
120,001-170,000	56	11.24
170,001-220,000	15	3.01
>220,000	35	7.03
No answer	12	2.41
Total	**498**	100.00

Secondary occupation of the respondents.

To meet the needs of their families, 78 respondents engaged themselves not only to primary sources of income but to secondary occupations as well. There were a total of 15 secondary occupations that were noted by the respondents which they were engaged into (Table 6). Of these occupations mentioned, being a laborer was the most popular as this was mentioned by 24 respondents representing about 5% of the total. ‘Serving as an employee’ of a government office was the next popular secondary occupation receiving

24 responses which represented 4% of the total respondents. Farming was the third most popular with 13 responses or an equivalent of almost 3%. A mere 0.8% of the total respondents or 4 persons said that driving was their secondary occupation while about 0.4% or three respondents claimed store keeping as their next important job. Other occupations such as vending in the market, serving as employee in a private company, owning a piggery, teaching and running a business received two responses each. The remaining 1% of the total respondents cited that they were either engaged in carpentry, buy and sell, platero, dress making and pedicure/manicure as their secondary occupations. Some 420 respondents representing about 32% of the total respondents mentioned that they do not have any secondary occupation.

Similar to the primary occupation, secondary jobs of the respondents were mostly located in Quirino. Concentration was in municipalities of Maddela and Aglipay where 68 persons or 87% of the total respondents carried out their secondary occupations in such towns. Only four people had secondary occupations at Nagtipunan, another municipality of Quirino. As mentioned earlier, most respondents prefer to work in areas near their places of residences to refrain from incurring transportation costs. Surprisingly, there were two respondents who mentioned that their secondary occupations were located in Bulacan province (about eight hours drive from Quirino) and Manila (about 10 hours drive from Quirino). Most likely these respondents were engaged in business in the mentioned areas.

The respondents were relatively new in their engagement with their secondary occupations. More than half of the respondents or 48 persons were undertaking their secondary occupations for 0 to 10 years only. There were even two people who had just engaged with their secondary occupations in less than a year. About 22% or 17 persons were engaged from 11 to 20 years while some 6% or 5 persons were into their secondary occupations from 21 – 30 years. About 9% of the total respondents were engaged in their secondary occupations for a long time already. For instance, almost 4% were doing their second sources of income for 31 – 40 years while almost 3% were engaged in their secondary occupations for 41 – 50 years. Two respondents were even engaged with their secondary occupation for more than 50 years already.

Similar to the annual incomes derived by the respondents from their primary occupations, income per year from the secondary sources were fairly small. For instance, bulk of the respondents mentioned that their incomes from their secondary occupations were less than PhP 70001 per year. About 40% of the total respondents said that they receive less than PhP 20000 per year from their secondary occupation while 56% cited that their incomes were within the range of PhP 20000 – PhP 70000. Two respondents failed to estimate the amount of money they received from their secondary sources of income.

Table 6. Secondary occupation of the respondents.

ITEM	**FREQUENCY**	**PERCENT**
Occupation		
Laborer	24	4.82
Govt employee	20	4.02
Farming	13	2.61
Driving	4	0.80
Store keeping	2	0.40
Market vendor	2	0.40
Private employee	2	0.40
Piggery	2	0.40
Teaching	2	0.40
Businessman	2	0.40
Carpentry	1	0.20
Buy and sell	1	0.20
Platero	1	0.20
Dress making	1	0.20
Pedicure/manicure	1	0.20
None	420	84.34
Total	**498**	**100.00**
Length of time engaged (years)		
0-10	48	61.54
11-20	17	21.79
21-30	5	6.41
31-40	3	3.85
41-50	2	2.56
>50	2	2.56
No answer	1	1.28
Total	**78**	**100.00**
<20000	32	41.03
20000-70000	44	56.41
70001-120000	0	0.00
120001-171000	0	0.00
171001-122000	0	0.00
>122000		0.00
No answer	2	2.56
Total	**78**	**100.00**

Tertiary Occupations of the Respondents

There were seven types of tertiary occupations that were mentioned by the respondents. These tertiary occupations include: serving as barangay official, buying and selling, farming, earnings from lot rental, operating chainsaw, serving as laborer and handicraft making. These occupations were undertaken by only nine persons which indicated that most respondents who already had primary and secondary occupations did not engage anymore in a third occupation. Maybe those people who had tertiary sources of income were those whose nature of work does not demand too much time or that their third occupation does not necessarily demand their presence and time. For instance, one respondent mentioned that his tertiary occupation was to allow people to rent his lot. Through such, he was able to receive money on a monthly basis which served as an additional source of income for his family. Serving as barangay official, farming, operating a chainsaw and handicraft making were claimed by four respondents as their tertiary sources of income. Each of this occupation represented around 0.2% of the total respondents. Buying and selling and serving as laborer received two responses each or about 0.4% of the total respondents.

Similar to the locations of primary and secondary occupations, tertiary occupations of the respondents were mostly located in Maddela and Aglipay, Quirino. Five respondents or 56% undertook their tertiary occupations in Maddela while another three respondents had their tertiary occupations at Aglipay. One person or 11% of the total respondents had tertiary occupation in San Agustin, Isabela. As mentioned in the previous discussions, people preferred to have their jobs near their places of residence so they could save money supposedly spent for transportation expenses. Moreover, people working near their homes could have bigger net income because they could just go home for lunch.

The respondents who mentioned that they have tertiary occupations were surprisingly new to their jobs. As indicated in Table 7, eight respondents or 89% were doing their third occupations from less than one year to 10 years. However, it was worthy to note that one respondent had been engaged in his tertiary occupation for more than 20 years already.

Annual income derived from tertiary occupations were quite small as respondents engaged in such jobs received income per year of less than PhP 20000 to PhP 70000. Six of them or roughly 67% of the total respondents said that they had annual income of less than PhP 20000 per year while three respondents or about 33% had annual incomes between PhP 20000 - PhP70000. This was understandable since this source of income was only supplementary to the main and secondary sources of income of the respondents.

Table 7. Tertiary occupations of the respondents.

ITEM	FREQUENCY	PERCENT
Tertiary occupation		
Bgy. official	1	0.20
Buy and sell	2	0.40
Farming	1	0.20
Lot rental	1	0.20
Chainsaw operator	1	0.20
Laborer	2	0.40
Handicraft making	1	0.20
No tertiary occupation	489	98.19
Total	**498**	100.00
Length of time engaged (years)		
0-10	8	88.89
11-20	0	0.00
21-30	1	11.11
31-40	0	0.00
41-50	0	0.00
>50	0	0.00
Total	**9**	**100.00**
Income		
<20000	6	66.67
20000-70000	3	33.33
70001-120000	0	0
Total	**9**	**100**

Lots Used by the Family

Table 8 showed the number of lots used by the respondents and their families. About 23% of the total respondents or 114 persons said that they used one lot only. Since this group had one lot only, they allocated a portion of their lots to build their houses and utilized the rest of the area for their crops. Nearly 62% of the total respondents or 307 persons however mentioned that they used two lots while around 12% or 59 persons utilized three lots. About 1% of the total respondents or seven persons used four lots while two respondents used more than five lots. Results indicated that there were some members of the villages covered by the proposed project site that were better off than others because they had more lots to utilize. Hence, this group had larger areas to grow crops and earn higher income compared with other farmers who only had one or two lots.

Table 8. Number of lots that the family use.

NUMBER OF LOTS	FREQUENCY	PERCENT
1	114	22.89
2	307	61.65
3	59	11.85
4	7	1.41
5	0	0.00
6	1	0.20
7	1	0.20
No answer	9	1.81
Total	**498**	**100.00**

Lots Inside the Project Boundary

Considerable number of lots used by the respondents were located inside the project boundary. According to 432 persons or about 87% of the total respondents, their lots were within the proposed project site. Only three respondents or less than 1% mentioned that the lots they were using were outside the project boundary. Some 63 respondents however, failed to indicate whether their lots were inside or outside the proposed project.

Landuses of the lots inside the project boundary include: natural forest, tree plantation, agroforestry, cornland, riceland, banana plantation, grassland and vegetable garden including root crops. Of these landuses, corn was the most popular crop in the proposed project site. For instance, according to 417 farmers representing 56% of the total respondents, their areas were planted with corn. The next most popular crop was banana as about 17% of the total respondents mentioned that their lots were planted with such crop. Rice, the third most popular crop, was planted by 123 farmers or nearly 17% of the total respondents. The remaining 10% of the respondents mentioned that their lots were covered with grasses (8%); vegetable garden (0.95%), natural forest (0.54%), tree plantation (0.68%), and agroforestry crops (0.14%). Based on the results obtained, it can be deduced that the area was predominantly planted with corn since most respondents cited such landuse. This analysis was consistent with the results of the reconnaissance survey undertaken by the team members from Conservation International, World Agroforestry Centre, and Mitsubishi Research Institute at the start of the project sometime in September 2006.

As regards, tenurial instrument, more than half of the lots inside the project boundary according to the farmers were alienable and disposable lands and had titles. About 32% of the respondents or 158 farmers however claimed that they had Certificates of Stewardship Contract (CSCs) or CBFM certificates only as proofs of their rights over the lands they were tilling. These certificates of ownership were awarded to the farmers during the launching of the Integrated Social Forestry (ISF) and Community Based Forest Management (CBFM) programs, two of the country's community forestry programs. Moreover, four respondents said that they do not possess any tenurial instrument for their lots while 14 respondents were not aware of what tenurial instruments that they had as regards to their lots. This situation happens either because some farmers are just tenants of the farms they are cultivating or they are just leasing the areas they are working at. Four farmers representing 0.80% mentioned that they do not have any tenurial instrument at present as regards their lots.

Table 9. Landuses and tenurial instruments of lots inside the project boundary

ITEM	FREQUENCY	PERCENT
Landuse		
Cornland	417	56.35
Banana Plantation	127	17.16
Riceland	123	16.62
Grassland	56	7.57
Vegetable garden	7	0.95
Natural forest	4	0.54
Plantation	5	0.68
Agroforestry	1	0.14
Total	**740**	100.00
Tenurial instrument		
Titled	322	64.66
CSC/CBFM	158	31.73
None	4	0.80
Don’t know	14	2.81
Total	498	100.00

Area of each landuse

Most of the respondents mentioned that the area they devoted to corn is ≤ 1 ha. This accounted for 254respondents or an equivalent of about 61% of the total respondents (Table 10). Thus, assuming that each respondent had a hectare of corn, it can be assumed that there will be a total of 254 ha planted to corn by the mentioned number of farmers alone.

Table 10 further showed that around 103 persons or 25% of the total respondents had cornfields of about 1.1 ha to 2 ha while some 26 respondents or 6% had 2.1 – 3 ha of areas planted to corn. Some 20 persons or roughly 5% cited that about 3.1 – 4.0 ha of their areas were covered with corn while 11 respondents claimed that their cornfields covered about 4.1 – 5 ha. Some respondents devoted even larger portion of their lots to corn. For instance, around three respondents allotted more than 5 ha to grow corn.

Similar to the trend observed in areas devoted to corn, most of the farmers planted rice to small portion only of their lots. Out of the total 123 respondents who said that they planted rice to their lots, 104 of them or 85% planted the mentioned crop in ≤ 1 ha. Eight persons or mere 7% of the total respondents cited that their rice fields were around 1.1 – 2 ha while only two respondents mentioned that his rice field measures about 2.1 – 3 ha. However, nine farmers failed to give an estimate of the area they devoted to rice.

Banana, another popular crop in the province of Quirino was planted to ≤ 1 ha by each of the 71 farmers representing 56% of the total respondents who mentioned banana as one of their crops. Thirty one respondents had banana plantation which covered around 1.1 – 2 ha while 15 respondents planted banana in areas that were somewhere between 2.1 – 3 ha. Two respondents planted banana to 3.1 – 4 ha while another two respondents said that they had banana plantation which was spread out in about 4.1 – 5 ha.

Only two respondents claimed that their areas contained secondary forest. One of them said that around 2.1 – 3 ha of his lot was occupied by the secondary forest while the other person mentioned that his area contained more than 5 ha.

Similar to secondary forests, very few respondents claimed that they had tree plantations inside their lots. As shown in Table 10, there were only three farmers who said that they had such land use. One of these farmers had tree plantation in ≤ 1 ha of his lot while the remaining two farmers representing 67% of the total respondents claimed that their tree plantations cover around 2.1 – 3 ha.

Six farmers of around 86% of the total respondents claimed that each of them devoted ≤ 1 ha of their lots to grow vegetables while one respondent did not reveal as to how much of his lot was dedicated to vegetables. Results showed that in the area, farmers were not very keen on growing vegetables. Farmers who were engaged into growing vegetables usually planted such crops mainly for the consumption of the family.

There were quite a number who claimed that their lots had portions that were covered with grasses. However, many of them mentioned that grassland areas comprised only small portion of their lots. For instance around 34% said that grassland areas in their lots were approximately less than or equal to a hectare. Some 25% of the total respondents emphasized that grasses in each of their lots covered 1.1 – 3 ha while around 9% mentioned that grasslands in each of their lots occupied 3.1 – 5 ha. It is worthy to note though that there were two farmers whose large portion of their lots were with grasses as grasslands covered more than 5 ha each.

The lone respondent who mentioned that he was using agroforestry as a strategy in developing his area said that he allocated about 2.1 – 3 ha of his lot to plant fruit bearing trees and other crops.

Table 10. Area of each land use

AREA (ha)	CORN		RICE		BANANA		NATURAL FOREST		PLANTATION		VEGETABLE GARDEN		GRASS LAND		AGRO FORESTRY	
	FREQ	**%**	**FREQ**	**%**	**FREQ**	**%**	**FREQ**	**%**	**FREQ**	**%**	**FREQ**	**%**	**FREQ**	**%**	**FREQ**	**%**
≤ 1 ha	254	60.91	104	84.55	71	55.91	0	0.00	1	33.33	6	85.71	19	33.93	0	0.00
1.1-2.0	103	24.70	8	6.50	31	24.41	0	0.00	0	0.00	0	0.00	9	16.07	0	0.00
2.1-3.0	26	6.24	2	1.63	15	11.81	1	50.00	2	66.66	0	0.00	5	8.93	1	100
3.1-4.0	20	4.80	0	0.00	2	1.57	0	0.00	0	0.00	0	0.00	1	1.79	0	0.00
4.1-5.0	11	2.64	0	0.00	2	1.57	0	0.00	0	0.00	0	0.00	4	7.14	0	0.00
>5.0	3	0.72	0	0.00	0	0.00	1	50.00	0	0.00	0	0.00	2	3.57	0	0.00
No answer	0	0.00	9	7.32	6	4.72	0	0.00	0	0.00	1	14.29	16	28.57	0	0.00
Total	**417**	**100**	**123**	**100**	**127**	**100**	**2**	**100**	**3**	**100**	**7**	**100**	**56**	**100**	**1**	**100**

Distance of the Lots Inside the Project Boundary from House, Market and Road

As shown in Table 11, lots of the farmers were not far from their houses. Around 205 farmers representing 41% of the total respondents mentioned that their lots were less than a kilometer away from their houses. These respondents could be those farmers whose houses were located inside their farm lots because they utilized one lot only. Moreover, a little more than half of the respondents said that their lots were only around 1 to 5 km away from their houses. This was cited by 273 farmers representing 55% of the total respondents. A mere 1% of the total respondents mentioned that their farms were located around 6 to 10 km away from their places of residences.

Distance of the lots inside the project boundary from the market were farther compared to the distance of the former from the houses. Distance of the lots inside the project from the market ranged from 1 to 20 kilometers. This result was expected because markets were usually located in the centre of every municipality. Out of the total 498 respondents, 193 farmers representing 39% of the total respondents mentioned that their farms were ≤ 5 kilometers away from the market. Another 39% said that their farms were about 6 to 10 kilometers away from the market. This implied that most farmers sold their farm products in markets that were within the municipalities of Maddela, Aglipay and Nagtipunan to reduce the costs of transporting their products.

From the road, lots inside the project boundary were found to be generally near. There were around 60% of the total respondents who mentioned that their lots were just less than a kilometer away from the nearest road while around 35% said that their lots were only 1 to 5 kilometers away from the road. Very small percentage of the total respondents claimed that their lots were more than 5 kilometers away from the road. Results showed that most farmers did not find difficulty in bringing their products as their farms were relatively near the road.

Table 11. Distance of lots inside the project boundary from house, market and road

DISTANCE (KM)	**FROM HOUSE**		**FROM MARKET**		**FROM ROAD**	
	FREQUENCY	**PERCENT**	**FREQUENCY**	**PERCENT**	**FREQUENCY**	**PERCENT**
< 1	205	41.16	0	0	301	60.44
1 - 5	273	54.82	193	38.76	173	34.74
6 - 10	7	1.41	194	38.96	6	1.20
11 - 15			60	12.05		
16 - 20			21	4.22		
No answer	13	2.61	30	6.02	18	3.61
Total	**498**	**100.00**	**498**	**100.00**	**498**	**100.000**

Benefits Derived from Lots Inside the Project Boundary

A number of benefits derived from the lots inside the project boundary were cited by the farmers. These include: fuelwood, food, source of income, source of water, lumber, and fodder. For 175 farmers or 35 % of the total respondents, their lots inside the project boundary were their source of fuelwood. About 98 people or nearly 20% of the total respondents however emphasized that their lots were their source of food of their families. Some 65 respondents or about 13% said that their lots were their source of income while for 47 respondents, their lots were their source of water. About 44 respondents mentioned that their lumber needs were met by the trees planted in the lots inside the project boundary while 20 respondents depended on their lots inside the boundary for fodder of their animals. It should be noted that about 6% of the total respondents were not aware of the benefits that they derive from their lots while mere 3% did not give any answer.

Table 12. Benefits derived from lots inside the project boundary

BENEFITS	**FREQUENCY**	**PERCENT**
Fuelwood	175	35.14
Food	98	19.68
Source of income	65	13.05
Water source	47	9.44
Lumber	44	8.84
Fodder	20	4.02
Don't know	32	6.43
No answer	17	3.41
Total	**498**	**100.00**

Labor Costs Incurred in Lots Inside the Project Boundary

Corn

Cost of labor for corn during land preparation ranged from as low as ≤ PhP 3000 to as high as > PhP 15000. While these wide range of values exist, more than half of the respondents mentioned that they spend ≤ PhP 3000 for the mentioned activity. Thus, in the absence of an average value, it can be deduced that in general, labor cost for land preparation for corn is quite low. For some 29% of the total respondents, they cited that they spend around PhP 3001 to PhP 9000 while according to a mere 6% of the total respondents, they spend >PhP 9000 for labor cost during land preparation.

Similar to the cost of labor during land preparation, cost incurred for planting corn ranged from PhP 3000 to > PhP 15000. Most of the respondents mentioned that they incur ≤ PhP 3000 as labor cost during planting. This was cited by 305 farmers representing 74% of the total respondents. Some 22% said that the labor cost they incurred during planting fall within the range of PhP 3000 to PhP 9000 while the remaining 4% mentioned that their labor cost for planting corn was >PhP 9000.

As regards cost of labor spent for weeding their corn fields, 67% of the total respondents claimed that they spent ≤ PhP 3000. Sixteen percent of the total respondents however mentioned that they incurred PhP 3001 – P 9000 while 3% of the total respondents spent PhP 9001 to P15000. About 5% of the total respondents cited a labor cost for weeding of >PhP 15000.

More than half of the respondents indicated that they spent ≤ PhP 3000 to pay for the laborers during fertilization of their corn fields. Twenty three percent mentioned that for the same activity, labor cost they incurred was within the range of PhP 3000 – PhP 15000. Mere 1% claimed that they spent more than PhP 15000 for fertilization alone.

Labor cost for harvesting corn ranged from ≤ PhP 3000 to > PhP 15000. However, almost all of the respondents (84%) said that the labor cost they incur for harvesting was ≤ PhP 3000 to PhP 6000. Only 1% of the total respondents mentioned that they spent >PhP 15000 for labor cost during harvesting.

As regards labor cost for spraying, respondents mentioned that they incur ≤ PhP 3000 to PhP 6000 only. This was expected because this activity does not consume too much time and spraying can be done by one or two persons only.

Rice

Compared with corn, labor costs in all activities undertaken in growing rice were generally smaller. For instance from land preparation to watering, labor costs range from ≤ PhP 1000 to PhP >PhP 3000 only.

During land preparation, respondents mentioned that labor costs they incurred were somewhere between ≤ PhP 1000 to >PhP 2000. About 36% of the total respondents cited that they incurred ≤ PhP 1000 for the labor costs during land preparation while 38% spent PhP 1001 to PhP 1500 for the same item. The remaining 26% of the total respondents claimed that they pay out PhP 1501 – P2000 to laborers who helped in preparing the land for rice production.

During planting, more than half of the respondents mentioned that the labor cost they incurred was ≤ PhP 1000. Around 39% said that they spent PhP 1001 – PhP 2000 to pay for the laborers who planted in their rice fields. The remaining 8% of the total respondents, incurred > PhP 2000 for the labor costs during planting.

Bulk of the respondents cited that the labor costs they incurred due to weeding was ≤ PhP 1000. Around 19% of the total respondents claimed to have paid laborers an amount which was between PhP 1001 – 2000 while only 1% claimed that he spent > PhP 3000for labor cost due to weeding.

Similar to weeding, most of the respondents spent small amount only for labor costs due to fertilization. As shown in Table 13, around 86% of the total respondents mentioned that labor costs incurred related to fertilization was ≤ PhP1000. The remaining 14% of the total respondents spent PhP 1001 – PhP 2000 for the same item.

During harvesting, labor costs incurred by about half of the respondents were ≤ PhP 1000. Around 40% of the total respondents however mentioned that they spent a little bit more as their labor costs were within PhP 1001 – PhP 2000. The remaining 7% of the total respondents said that their labor costs due to harvesting were more than PhP 2000.

Labor costs incurred by the respondents due to spraying range from ≤ PhP1000 - PhP 1500 only. Bulk of the respondents spent ≤ PhP1000 for labor costs due to spraying.

Banana

Labor costs incurred in growing banana were almost the same as those incurred in growing corn. In all the almost all the activities, labor costs range from PhP ≤ 2500 - > PhP 10000.

During land preparation, more than 50% of the total respondents mentioned that they incurred labor costs that fall within the range of ≤ PhP 2500 to PhP 5000 while around 16% spent about PhP 5001 – PhP 10000 to pay for the laborers helping them in preparing the land for banana plantation. Around 26% of the total respondents however mentioned that they incurred more than PhP 10000 for the same activity.

For planting activity, 29% of the total respondents mentioned that they spent ≤ PhP 2500. Almost half of the respondents however mentioned that they incurred labor cost of PhP 2500 – PhP 5000 while around 16% said that they spent about PhP 5001 – PhP 10000. A mere 9% of the total respondents cited that they spent > PhP 10000 for the labor cost during planting activity.

Labor costs due to weeding activity according to most of the respondents were ≤ PhP 2500. This was cited by around 72% of the total respondents or 55 farmers. About 25% of the total respondents mentioned that they spent PhP 2500 – PhP 7500.

For fertilization, only one respondent claimed that he hired a laborer to apply fertilizer in his banana plantation. For this activity, he spent around PhP 2500.

During harvesting, around 35% of the total respondents mentioned that they spent ≤ PhP 2500 for labor while 19% spent PhP 2500 – PhP 5000 for the same activity. Some 27% of the total respondents said that the labor costs incurred during harvesting were within PhP 5001 – PhP 10000 while nearly 20% of the total respondents said that they incurred labor cost of more than PhP 10000.

Vegetable Garden

Labor costs incurred by the respondents in raising vegetables were minimal. In all the activities that were undertaken, labor costs were less than PhP 500. For instance, during land preparation, planting, weeding, fertilization, spraying and watering, the respondents mentioned that the labor costs they incurred in all these activities were < PhP 500. This could be attributed to the size of the area that was allocated to vegetables. Since most of the farms were devoted to either rice or corn, very small portion of the land was allocated to raise vegetables. These vegetables were raised by farmers mainly for the consumption of their families.

Costs of Farm Inputs in Lots Inside the Project Boundary

Aside from labor costs, the farmers also incurred costs of inputs in cultivating their lots. These include the costs of fertilizer, seeds/seedlings, pesticide, insecticide, and herbicide. For seeds/seedlings, a little more than 50% of the total respondents mentioned that they spent around < PhP 5000 to PhP 10000 while around 30% spent PhP 10001 – PhP 30000. A small percentage of the respondents however said that they spent more than PhP 30000 for seeds/seedlings.

As regards the cost of fertilizers that the respondents were spending in cultivating their farms, around 57% of the total respondents mentioned that they spent < PhP 10000 to PhP 20000. Some 24% however cited that they spent PhP 20001 – PhP 50000 while about 4% bought fertilizers amounting to > PhP 50000.

As shown in Table 14, most of the respondents did not spend too much in buying pesticide. For instance, 50% of the total respondents mentioned that they spent < PhP 2500 while around 33% bought pesticide amounting to PhP 2501 – PhP 10000. Around 7% of the total respondents however cited that they spent more than P10000 for pesticides.

Not many farmers mentioned that they use insecticide. As shown in Table 14, two respondents spent < PhP 2500 for insecticide while another two respondents said that the insecticides they bought amount to PhP 2501 – PhP 5000.

Bulk of the respondents mentioned that they spent < PhP 2500 for herbicide while nearly 10% of the total respondents spent PhP 2501 – PhP 5000 for the same farm input.

Table 13. Labor costs incurred in lots inside project boundary

CROP	COST/LABOR													
	LAND PREPARATION		PLANTING		WEEDING		FERTILIZATIO N		HARVESTIN G		SPRAYING		WATERING	
CORN	**FREQ**	%	**FREQ**	%	**FREQ**	%	**FREQ**	%	**FREQ**	%	**FREQ**	%	**FREQ**	%
≤ 3000	266	64.25	305	73.67	279	67.39	259	62.56	215	51.93	18	4.35	-	
3001- 6000	98	23.67	72	17.39	59	14.25	68	16.43	135	32.61	3	0.72	-	
6001-9000	22	5.31	21	5.07	8	1.93	21	5.07	28	6.76	0	0.00	-	
9001-12000	13	3.14	6	1.45	7	1.69	4	0.97	14	3.38	0	0.00	-	
12001-15000	7	1.69	5	1.21	6	1.45	4	0.97	14	3.38	0	0.00	-	
> 15000	6	1.45	5	1.21	19	4.59	6	1.45	6	1.45	0	0.00	-	
None	2	0.48			36	8.70	52	12.56	2	0.48	393	94.93	-	
TOTAL	**414**	**100**	**414**	**100**	**414**	**100**	**414**	**100**	**414**	**100**	**414**	**100**	-	
RICE														
≤ 1000	44	36.36	65	53.28	62	79.49	72	85.71	58	52.73	28	84.85	-	
1001-1500	46	38.02	35	28.69	10	12.82	8	9.52	32	29.09	5	15.15	-	
1501-2000	31	25.62	12	9.84	5	6.41	4	4.76	12	10.91			-	
2001-2500			3	2.46	0	0.00			6	5.45			-	
2501-3000			5	4.10	0	0.00			1	0.91			-	
>3000			2	1.64	1	1.28			1	0.91			-	
None									0	0.00			-	
TOTAL	**121**	**100**	**122**	**100**	**78**	**100**	**84**	**100**	**110**	**100**	**33**	**100**	-	
BANANA														
≤ 2500	22	27.5	28	28.57	55	72.37	1	25.00	30	34.88	**-**		**-**	
2500 -5000	22	27.5	45	45.92	18	23.68			16	18.60	**-**		**-**	
5001 -7500	12	15	7	7.14	1	1.32			19	22.09	**-**		**-**	
7500 - 10000	1	1.25	9	9.18	0	0.00			4	4.65	**-**		**-**	

> 10000	21	26.25	9	9.18					17	19.77	**-**		**-**	
None	2	2.5			2	2.63	3	75.00			**-**		**-**	
TOTAL	**80**	**100**	**98**	**100**	**76**	**100**	**4**	**100**	**86**	**100**	**-**		**-**	
VEGE-TABLE CROPS														
< 500	3	100	2	100	2	100	1	100	1	100	1	100	1	100
TOTAL	**3**	**100**	**2**	**100**	**2**	**100**	**1**	**100**	**1**	**100**	**1**	**100**	**1**	**100**

Table 14. Farm inputs costs incurred in lots inside project boundary

COST OF FARM INPUTS (PhP)	FREQUENCY	PERCENT
Seeds/seedling		
< 5000	96	20.17
5000 - 10000	178	37.39
10001 - 15000	75	15.76
15001 - 20000	37	7.77
20001 - 2500	17	3.57
25001 - 30000	11	2.31
> 30000	11	2.31
No answer	51	10.71
Total	**476**	**100**
FERTILIZER		
< 10000	118	24.79
10001 - 20000	153	32.14
20001 - 30000	62	13.03
30001 - 40000	28	5.88
40001 - 50000	25	5.25
> 50000	20	4.20
No answer	70	14.71
Total	**476**	**100**
PESTICIDE		
< 2500	54	50.47
2,501 - 5,000	15	14.02
5,001 - 7,500	11	10.28
7,501 - 10,000	9	8.41
> 10,000	7	6.54
No answer	11	10.28
Total	**107**	**100**
INSECTICIDE		
< 2500	2	14.29
2,501 - 5,000	2	14.29
No answer	10	71.43
Total	**14**	**100**
HERBICIDE		
< 2500	31	73.81
2,501 - 5,000	4	9.52
No answer	**7**	**16.67**
Total	**42**	**100**

Sources of Inputs

Inputs used by farmers in their lots inside the project boundary came from a number of sources: dealer/buyer, farm supply store, cooperative, Department of Agriculture and own farm. Half of the respondents obtained their farm inputs from the buyers/dealers of their farm produce. This source was mentioned by around 251 farmers or 50% of the total respondents. Results indicated that half of the farmers in the proposed project site do not have enough capital to buy inputs for their farms thus they resort to borrowing some money from buyers/dealers. These farmers entered into an agreement with the buyers/dealers where the buyers lent farm inputs to the farmers and such loan were paid by the farmers once the crops were harvested. This scheme was found by farmers as quite unfair because the prices of the farm produce were dictated by the buyers/dealers. Most often the amount paid for the farm produce to the farmers by these dealers/buyers were far below compared to the actual amount that the farmers should receive if they sold their products to the market or other dealers whom they were not indebted to. .

Around 27% of the total respondents obtained their inputs from the farm supply store in their respective municipalities while a mere 6% said that their source of farm inputs was the local cooperative where they were members. Four respondents mentioned that their source of inputs such as seeds was the Department of Agriculture while two farmers mentioned that their source was their own farm lots. Considerable number of farmers did not give any source for their inputs.

Table 15. Sources of inputs used in the lots inside the project boundary

SOURCE	**FREQUENCY**	**PERCENT**
Dealer/Buyer	251	50.40
Farm supply store	135	27.11
Cooperative	32	6.43
Department of Agriculture	4	0.80
Own farm	2	0.40
No answer	74	14.86
Total	**498**	**100.00**

Place Products are Sold

About 83% of the total respondents mentioned that they sold their products in Maddela and Aglipay markets. This group of farmers preferred to sell their products to the nearby markets so that cost of transporting their farm produce from the farms to the market would only be minimal. Other farmers sold their products either in markets in the nearby provinces (0.6%), dealers (9%), and cooperative (1%).

Table 16. Place products are sold

PLACE PRODUCTS SOLD	**FREQUENCY**	**PERCENT**
Local market (within Quirino)	413	82.93
Markets in other provinces	3	0.60
Dealers/Buyers	46	9.24
Cooperative	7	1.41
No answer	29	5.82
Total	**498**	**100**

Income Derived from Lots Inside the Project Boundary and Percent Contribution to Total Income

Annual income derived from lots inside the project boundary ranged from less than PhP 50000 to PhP 400000 (Table 17). Around 29% of the total respondents mentioned that income they derived was less than PhP 50000 while almost half of the total respondents said that their income from the lots ranged from PhP 50001 to PhP 100000. About 16% of the total respondents said that their income ranged from PhP 100001 to Php 150000 while a mere 12% cited that their incomes ranged from PhP 150001 to PhP 400000. Results showed that most of the farmers derive not a very significant amount from their lots inside the project boundary.

In terms of percent contribution, almost half of the respondents mentioned that the incomes they derived from their lots inside the project boundary represented around 76% to 100% of the total income of the family. Results indicated that the incomes the respondents derived from their lots inside the project boundary constituted a very large percentage of their families' total income. Thus, if these areas will be given up for the project, alternative sources of income must be provided to replace whatever income they derive from such areas.

Table 17. Income derived from lots inside the project boundary and percent contribution to total family income

ITEM	FREQUENCY	PERCENT
Income		
< 50000	189	28.59
50001-100000	287	43.42
100001-150000	106	16.04
150001-200000	35	5.30
200001-250000	22	3.33
250001-300000	9	1.36
300001-350000	6	0.91
350001-400000	7	1.06
Total	**661**	**100**
Percent contribution		
1 - 25	73	11.04
26 - 50	138	20.88
51 - 75	123	18.61
76 - 100	309	46.75
No answer	18	2.72
Total	**661**	**100**

Number of Months Crops Are Grown

According to the respondents, corn is grown from three to six months. Around 68% of the total respondents cited that corn is grown for five months while some 16% claimed that it is grown for four months only. Mere 5% of the total respondents said that corn is grown for three months while almost 10% mentioned that it needs six months to raise the crop.

Similar to corn, more than half of the respondents claimed that rice is grown for five months. However for around 23% of the total respondents, rice can be grown from three to four months while about 14% claimed that rice can be raised from six to seven months.

For banana, around 30 respondents mentioned that it can be grown anytime of the year and once they are planted, they reproduce by themselves hence replanting need not be undertaken. One respondent however cited that it takes five months before banana can be grown.

For vegetables like eggplant, one respondent said that it can be grown all throughout the year. As regards cassava, one respondent mentioned that it requires eight months for the crop to be raised.

Table 18. Number of months that the crops are grown

NUMBER OF MONTHS	FREQUENCY	PERCENT
Corn		
3	30	5.06
4	93	15.68
5	406	68.47
6	57	9.61
No answer	7	1.18
Total	**593**	**100.00**
Rice		
3	5	3.73
4	26	19.40
5	79	58.96
6	17	12.69
7	2	1.49
No answer	5	3.73
Total	**134**	**100.00**
Banana		
All year round	33	27.97
May-Sept	1	0.85
No answer	84	71.19
Total	**118**	100.00
Eggplant:		
through out the year	**1**	**100**
Cassava		
8	**1**	**100**

Awareness About the Agroforestry System and its Benefits

Table 19 shows that most of the respondents were already aware of the agroforestry system. This response was cited by 380 farmers representing 76% of the total respondents. This was expected because agroforestry system had long been introduced in many parts of the country many years back. Many seminars and trainings related to agroforestry system were conducted in most parts of the country. Also, this strategy was one of the components of any social forestry program launched by the government such as the Community Based Forest Management.

As regards the benefits that can be derived from the agroforestry system, the respondents mentioned the following: (1) additional/source of income; (2) source of food; (3) prevent soil erosion; (4) protect the environment; (5) improve soil fertility; (6) multiple benefits; (7) ensured income; (8) source of fuelwood and (9) preserve water. Of the benefits mentioned, agroforestry system as additional or main source of income garnered the highest response. This was cited by 355 farmers representing around 70% of the total respondents. Moreover, two respondents believed that in agroforestry system, income is ensured. Aside from the income that the farmers could derive from the agroforestry system, around 8% claimed that such system could be a source of food while a mere 0.20% said that it could be a source of fuelwood. Results indicated that most of the farmers in the area believed that they would mainly get economic benefit from the agroforestry system. Aside from goods, the respondents were also able to identify that agroforestry system could provide environmental services. For instance, about 20% of the total respondents mentioned that agroforestry system help prevent occurrence of excessive soil erosion because trees or woody component of the system reduce the impact of raindrops to the soil. Likewise, about 1% of the total respondents said that forest or fruit trees improve fertility of the soil while mere 0.20% cited that it could preserve water or make water supply more stable. About 11 respondents mentioned that in general, forest or fruit trees protect the environment while three farmers said that agroforestry system provide multiple benefits.

Table 19. Awareness about the agroforestry system and its benefits

ITEM	**FREQUENCY**	**PERCENT**
Awareness		
Aware	380	76.31
Not aware	114	22.89
Don't know	4	0.80
TOTAL	**498**	**100.00**
Benefits		
Additional/Source of income	355	71.29
Source of food	38	7.63
Prevent soil erosion	17	3.41
Protect the environment	11	2.21
Improve soil fertility	5	1.00
Multiple benefits	3	0.60
Ensured income	2	0.40
Source of fuelwood	1	0.20
Preserve water	1	0.20
No answer	65	13.05
TOTAL	**498**	**100.00**

Constraints to Non-adoption of Agroforestry in the Area

Agroforestry system was not well adopted in the area because of many reasons: (1) lack of capital; (2) lack of technical know how; (3) decreased area for agricultural crops; (4) longer period of harvesting; (5) difficult to market the products; (6) people are lazy; (7) farmers are used to cash crop farming; (8) people not interested; (9) hard to implement; and (10) no demonstration of agroforestry farm. Of these reasons, 'lack of technical know how' was the most popular as it was cited by 215 farmers or 43% of the total respondents. This was quite surprising considering that agroforestry system had been in the Philippines for quite a long time already.

Cited by about 199 farmers representing 40% of the total respondents, the reason 'lack of capital' received the second highest response. This was understandable since developing an area into agroforestry farm is quite costly and small time farmers do not have much capital to buy inputs for their farms. Most often, farmers borrow money from buyers/dealers to address such need and pay them back when harvest season comes.

For about 2% of the total respondents, the long period of waiting before something can be harvested from agroforestry system shunned them from planting fruit trees in their farms. This reason also drove them to plant primary or cash crops instead as these types of crops can give them quick money to meet the needs of their families. Also, cash crops were more preferred than agroforestry crops because according to about 1% of the total respondents, they were more comfortable planting cash crops since they had been doing such for many years already. Another 2% of the total respondents said that agroforestry products were difficult to market so they do not want to embark on such system while less than 1% were afraid to venture on agroforestry system because they don't want to reduce the area they devote for agricultural crops. About three farmers noted that people were just lazy to do agroforestry while two farmers said that farmers were not at all interested with adopting agroforestry as a means to develop their areas. One respondent mentioned that the reason why agroforestry was not well adopted in the area was that the system was hard to implement while another respondent said that the absence of an agroforestry demonstration farm in the area prevented the adoption of many farmers of the system. This was expected because farmers wanted to be assured that when they invest on agroforestry they would make money. Thus, in the absence of a demonstration farm that could show success in venturing to agroforestry, there would be limited number of adopters of the system.

Table 20. Constraints why agroforestry system is not well adopted in the area

REASON	FREQUENCY	PERCENT
Lack of technical know how	215	43.17
Lack of capital	199	39.96
Longer period of harvesting	11	2.21
Difficult to market the products	9	1.81
Farmers are used to cash crop farming	6	1.2
Decreased area for agricultural crops	3	0.60
People are lazy	3	0.60
Not interested	2	0.40
Hard to implement	1	0.20
No demonstration of agroforestry farm	1	0.20
No answer	48	9.64
TOTAL	**498**	**100.00**

Type of Livestock

In the Philippines, farmers usually own either a cow or a carabao since these types of animals were the ones they were using in their farms. This same trend was also observed in areas covered by the project site since many farmers in the area either owned a carabao (51%) or a cow (12%). Aside from carabao and cow, some respondents also owned horses. Such type of animal was usually used to transport farm products from the farm to the house. Since horses are quite expensive, not many farmers could afford to own one thus, of the total respondents sampled, only two mentioned that they owned horses. Aside from carabao, cow and horse, farmers also owned pig (16%), chicken (11%), duck (3%), goat (2%), turkey (0.44%), and goose (0.15%). These types of animals were usually raised by the farmers to augment the incomes they derive from their farms by selling some of them to other people in the community. Also, certain percent of these animals were set aside by the farmers for the consumption of their families.

Table 21. Type of livestock owned by the farmers inside the project boundary

LIVESTOCK	FREQUENCY	PERCENT
Carabao	350	51.40
Pig	112	16.45
Cow	80	11.75
Chicken	76	11.16
Duck	23	3.38
Goat	15	2.20
Turkey	3	0.44
Horse	2	0.29
Goose	1	0.15
None	19	2.79
TOTAL	**681**	**100.00**

Quantity of Livestock

Of the animals owned by the farmers, chicken and ducks had the largest number. For instance, 17 respondents or 22% mentioned that they own more than 21 heads of chicken while three respondents or 13% cited that they raise ducks numbering to more than 21 heads. This was expected because most families in the area raise chicken and ducks mainly for their consumption and sold certain portion only to increase the income of the family. Also, hens and ducks normally lay many eggs and of these eggs considerable number became chicks and ducklings. Thus, it would be fairly easy to raise many chicken and ducks.

As regards carabao, more than half of the respondents mentioned that they possess at one of this type of animal. About 35% of the total respondents cited that they own 2 – 3 carabaos while 3% had four carabaos. A mere 1% of the total respondents claimed that they own five carabaos.

Out of the total 80 respondents who mentioned that they own cows, around 40% mentioned that they have one cow. About 31% of the total respondents said that they have 2 - 3 cows while 9% said that they own four cows. Some well off farmers comprising of nearly 20% of the total respondents cited that they own more than five cows.

For pigs, around 74% of the total respondents said that they own less than five heads while nearly 3% mentioned that they have more than 16 heads. About 13% of the total respondents claimed that they have 6 – 10 pigs while almost 5% said that they have 11 – 15 pigs. Similar to chicken and ducks, this type of animal is not too difficult to raise since when pig gives birth, piglets number to as much as 10. However, owners of pigs sometimes encounter difficulty in early stage of the lives of the piglets as they sometimes become sensitive to disease that causes death.

Goats were owned by about 15 farmers in the area. Of these goat raisers, about 12 of them or 80% of the total number of respondents indicated that they had less than five goats while about 13% own 6 – 10 goats.

Since horse is quite expensive, only one respondent said that he owned a horse. Similar to horse, geese were also owned by one respondent only. According to this respondent, he had less than five geese.

As regards turkey, around 33% of the total respondents mentioned that they own less than five turkeys while 67% had 6 – 10 heads of turkey.

Table 22. Quantity of livestock owned by the farmers inside the project boundary

LIVESTOCK	FREQUENCY	PERCENT
CARABAO		
1	206	58.86
2	86	24.57
3	37	10.57
4	12	3.43
> 5	4	1.14
No answer	5	1.43
Total	**350**	**100**
COW		
1	32	40.00
2	17	21.25
3	8	10.00
4	7	8.75
> 5	14	17.50
No answer	2	2.50
Total	**80**	**100**
CHICKEN		
< 5	18	23.68
6 -10.	21	27.63
15 - 20	15	19.74
> 21	17	22.37
No answer	5	6.58
Total	**76**	**100**
PIG		
< 5	83	74.11
6.-10	14	12.50
11.-15	5	4.46
> 16	3	2.68
No answer	7	6.25
Total	**112**	**100**
GOAT		
< 5	12	80.00
6.-10	2	13.33
No answer	1	6.67
Total	**15**	**100**
Duck		
< 5	8	34.78

6 -10.	7	30.43
15 - 20	5	21.74
> 21	3	13.04
Total	**23**	**100**
HORSE		
1	2	100
Total	**2**	**100**
TURKEY		
< 5	1	33.33
6 -10.	2	66.67
Total	**3**	**100**
Goose		
< 5	1	100
Total	**1**	**100**

Further Clarification About the CDM Proposed Project?

Despite the orientation meetings conducted by the Conservation International – Philippines (CIP) with the local communities in the different barangays covered by the proposed CDM project, there were about 73% of the total respondents who mentioned that they need more explanations about the CDM proposed project. Around 18% however, cited that they no longer need further clarifications about the project because the details laid down by the CIP staff were enough for them to understand the background, objectives and components of the proposed CDM project. Some 8% of the total respondents said that they were not sure whether they still need more explanation about the project.

Table 23. Respondents who need further clarification about the CDM proposed project

RESPONSE	**FREQUENCY**	**PERCENT**
Yes	365	73.29
No	92	18.47
Don't know	41	8.24
TOTAL	**498**	**100.00**

Willingness to Include Farm in the CDM project

Out of the total 498 respondents, 444 persons or 89% mentioned that they were willing to include their farms in the CDM project. Twenty two respondents or mere 4% however deliberately said that they were not willing to include their farms in the project while 32 persons were still undecided whether they would include their farms or not.

There were various reasons cited by the respondents who were undecided to join the project (Table 24). About 18% or six respondents mentioned that they wanted to observe more because they had to study first the advantages and disadvantages of joining the project. Around 16% of the total respondents said that they lack information regarding the project while some 9% mentioned that the long period of agreement or long duration of the project drive them away from joining the project. Two respondents said that the non assurance of income that will be derived was the reason why they were hesitant to include their farms in the project. Two more respondents mentioned that they do not have any tenurial instrument so they could not commit to the project. Two respondents wanted to see first a demonstration farm before they decide to join the project or not. One respondent said that if he see somebody who joined the project succeed he would join as well. Another respondent was not willing to include his farm because he wanted his lot to be devoted to its current land uses *i. e.* corn, forest and fruit trees while another respondent reasoned that he lack financial resources. One respondent said he lacked time to join the project while eight respondents gave no reason at all.

Table 24. Willingness to include farm in the CDM project

ITEM	**FREQUENCY**	**PERCENT**
Willingness to include farm		
Yes	444	89.16
No	22	4.42
Don't know	32	6.43
TOTAL	**498**	**100**
Reason why undecided		
Need to observe more	6	18.75
Lack of information regarding the project	5	15.63
Long project duration	3	9.38
No assurance of income	2	6.25
No tenurial instrument	2	6.25
Need demonstration farm	2	6.25
If somebody tried and result is good, we will join also	1	3.13
Land is intended for corn/established forest trees and fruit bearing tree	1	3.13
Financial	1	3.13
Lack of time to join	1	3.13
No reason	8	25.00
Total	**32**	**100.00**

Expectations and Conditions in Joining the Proposed Project

Respondents who were willing to join the project had a long list of expectations from the project. For 311 respondents representing 60%, they see the project as their source of income. About 76 persons expect to receive free seedlings while 40 persons said that they think their economic situations will improve with the project. The 26 respondents who were interested with Jatropha said that support in terms of marketing Jatropha was what they expect to receive once they join the project. Ten persons however expect to receive technical know how from the concerned agencies once they get involved with the project. Some six respondents said that the project will result to a healthy environment while four farmers expect to gain multiple benefits from the project. Three farmers expect that the project will provide establishment and maintenance cost while another three farmers anticipate the project as the source of food. Two respondents each assume that the agroforestry/Jatropha will be easier to maintain and will become more productive compared with the cash crops while another two persons want their farms to be developed as demonstration farms. One respondent said that there will be proper maintenance of the land once he joined the project. Nine respondents did not give any answer to the question while five respondents said they do not know the benefits that they can derive.

Table 25 shows the conditions that the respondents would like to demand once their lots were included in the project boundary. The most cited condition was 'provision of financial assistance' as this was mentioned by 385 farmers representing around 73% of the total respondents. The financial assistance will be mainly used to support the development and maintenance costs of their lots. Aside from financial assistance, some respondents said that they will join the project if they can receive assistance in marketing their products. Cited by 41 farmers or around 8% of the total respondents, this condition was deemed important by the farmers. Other conditions cited by the farmers include 'provision of technical assistance' (27 respondents or 5%), 'conduct of seminar/provision of training' (13 respondents or 2%), 'provision of free seedlings' (23 respondents or 4%), 'provision of labor assistance' (5 respondents or 0.95%), 'further clarification' (2 respondents or 0.38%) and 'remain as owner of the land' (1 respondent or 0.19%). Twenty seven farmers or 5% of the total respondents did not indicate any condition as regards their joining of the project.

Table 25. Expectations and conditions in joining the project

ITEM	FREQUENCY	PERCENT
Expectations		
Source of income	311	60.38
Free seedlings	76	14.76
Improve economic situation	40	7.77
Support the marketing of jatropha	26	5.05
Provide technical know how	28	5.44
Healthy environment	6	1.17
Multiple benefit	4	0.78
Provide establishment and maintenance cost	3	0.58
Source of food	3	0.58
Easy to maintain	2	0.39
Farm developed into a demonstration farm	2	0.39
Farm become more productive	2	0.38
Proper maintenance of the land	1	0.19
No answer	6	1.17
Don't know	5	0.97
TOTAL	**439**	**100.00**
Conditions		
Provide establishment/maintenance cost	385	73.47
Assist in marketing of the products	41	7.82
Provide technical assistance	27	5.15
Conduct seminar/provide training	13	2.48
Free seedlings	23	4.39
Provide labor assistance	5	0.95
Further clarification	2	0.38
Remain as owner of the land	1	0.19
No answer	27	5.15
Total	**524**	**100.00**

Percent of Land Devoted to Trees, Fruit Trees, and Jatropha

More than half of the respondents said that they were willing to allocate around 41 – 50% of their lots for trees. Around 28% of the total respondents however would like to devote ≤ 40% of their area to grow trees while 20% of the total respondents would like to allocate > 50% of their areas for the same crop. Results showed that trees were highly acceptable to be integrated to current crops used by the farmers. Moreover, it could be assumed that respondents who were willing to dedicate more than 50% of their areas to forest trees were those farmers who own or cultivate more than one lot. Most often, farmers with limited area would opt to grow cash crops in larger area of their farms since forest trees cannot provide ready cash for the family.

As regards percent of the land that the farmers were willing to devote to fruit trees, results showed that around 55% of the total respondents would like to allocate 41 – 50% of their lots to the mentioned crops. For about 29% of the total respondents, portion of their lots they would like to set aside for fruit trees was less than 41% while for 16% of the total respondents, portion of their lots they were willing to allocate for the same crop was more than 50% of their lots. This was unexpected since farmers would normally opt to devote small portion of their lots only to woody perennials and oftentimes they would plant trees along the boundaries of their lots only. Similar to the reason why farmers were willing to devote large percent of their areas to trees, farmers who indicated that they could also allocate large portion of their lots to fruit trees were those who owned two or more lots.

For Jatropha, only one respondent mentioned that he was willing to allocate about 41 - 50% of his area to the mentioned crop. However, five respondents said that they would like to devote less than 41% of their lots to the same crop while only one respondent cited that he is willing to set aside 91 – 100% of his lot to grow Jatropha.

Table 26. Percent of land to be devoted to trees, fruit trees and jatropha.

PERCENT OF LAND	**TREES**		**FRUIT TREES**		**JATROPHA**	
1%-10%	8	1.85	10	2.57	0	0.00
11%-20%	27	6.24	19	4.88	1	14.29
21%-30%	84	19.40	73	18.77	4	57.14
31%-40%	2	0.46	12	3.08	0	0.00
41%-50%	225	51.96	214	55.01	1	14.29
51%-60%	13	3.00	1	0.26	0	0.00
61%-70%	5	1.15	4	1.03	0	0.00
71%-80%	47	10.85	15	3.86	0	0.00
81%-90%	1	0.23	1	0.26	0	0.00
91%-100%	21	4.85	40	10.28	1	14.29
TOTAL	**433**	**100**	**389**	**100**	**7**	**100**

Preferred Species for Reforestation and Agroforestry

There were six species that the respondents prefer for their reforestation component. Among the species mentioned, Jatropha was the most preferred. This was cited by 260 farmers or 39% of the total respondents. Results show that among the crops that the farmers would like to plant in the lots inside the project boundary, Jatropha was the most popular although this species was not at all a reforestation species. Gmelina and Mahogany ranked second and third, respectively in terms of preferred species of the farmers. Around 28% of the total respondents mentioned that they prefer Gmelina while 24% said that their choice was Mahogany. A mere 7% cited Narra as preferred reforestation species while Ipil and Eucalpytus were mentioned by 0.3% of the total respondents. Results showed that the popular reforestation species among the farmers in the area were exotic maybe because they were fast growing and could easily thrive in an area.

In the proposed agroforestry area, there were over 10 species that the respondents would like to plant (Table 27). Order of preference of the fruit tree species by the respondents is as follows: citrus > rambutan > kalamansi > mango > pomelo > mandarin >lanzones > ponkan > perante > coconut, red chander > chico > satsuma, guyabano, dayap, pili nut. Citrus was the most popular among the fruit tree species because this fruit command a high price. Moreover, the farmers believe that they could grow such crop in the area because there were many orchards in Nueva Vizcaya, adjacent province of Quirino that grow citrus. Aside from citrus, orchards in Nueva Vizcaya also grow ponkan, perante, pomelo and satsuma. Thus, these species were also mentioned by the respondents as their preferred species in their agroforestry areas. For instance, around 100 respondents preferred pomelo while 33 farmers said they wanted to plant ponkan. Six farmers however, said they wanted to plant perante while one person mentioned he preferred satsuma instead.

The second popular fruit tree species mentioned was rambutan, a fruit commonly found in southern Luzon. This fruit could also command high price because it is not grown in the provinces of northern Luzon where Quirino belong. Rambutan fruits sold in these areas usually come from Laguna province thus its price is quite high. Thus, the farmers believe that growing rambutan in the area would not only mean higher income for them but it would also result to availability of the fruit to the people from their province and nearby areas at a lower price. Likewise, the farmers were confident that they would be successful in growing rambutan despite the hot weather in the province because there is one resident in the area who succeeded in growing the crop.

Table 27. Preferred reforestation species

REFORESTATION			AGROFORESTRY		
SPECIES	**FREQUENCY**	**PERCENT**	**SPECIES**	**FREQUENCY**	**PERCENT**
Jatropha	260	39.04	Citrus	302	27.89
Gmelina	192	28.83	Rambutan	239	22.07
Mahogany	162	24.32	Kalamansi	133	12.28
Narra	50	7.51	Mango	108	9.97
Ipil	1	0.15	Pomelo	100	9.23
Eucalyptus tree	1	0.15	Mandarin	81	7.48
			Lanzones	59	5.45
			Ponkan	33	3.05
			Perante	6	0.55
			Coconut	3	0.28
			Red chander	3	0.28
			Chico	2	0.18
			Satsuma	1	0.09
			Guyabano	1	0.09
			Dayap	1	0.09
			Pili nut	1	0.09
			Any species	9	0.83
			Can't decide	1	0.09
TOTAL	**666**	**100.00**	**TOTAL**	**1083**	**100**

Thinning

Out of the total 433 respondents who wanted to get involved in the reforestation component of the project, 184 respondents or about 37% would like to do thinning in their areas. Around 49% on the other hand or 246 respondents mentioned they will not do any thinning at all while three respondents 'don't know' if they would conduct thinning or not in the future. Results indicated that the respondents were keen to take away in the future some of the trees that they intend to plant. Considering that the proposed project is a forestry carbon project where thinning would affect the estimated amount of carbon that the project could sequester, this intention of the respondents should be taken into consideration.

When asked about the percent thinning that would be undertaken in the reforestation area, over 60% of the respondents said that they will remove 5 - 10% of the trees to provide more space to the remaining stand. The remaining 31% of the total respondents however mentioned that they would like to remove more than 10% of the trees. For instance, 22 respondents cited that they wanted to take out 15% of the trees while 18 respondents would like to thin 20% of the stand. Seven respondents mentioned they intend to conduct 25% thinning while two respondents plan to remove 30% of the trees in their respective reforestation areas. Finally, eight respondents would like to take away 35% of their stand.

Table 28. Thinning to be undertaken by the farmers inside the proposed project

ITEM	FREQUENCY	PERCENT
Thinning		
With thinning	184	36.95
Without thinning	246	49.40
Don't know	68	13.65
TOTAL	**498**	**100**
Percent thinning		
5%	13	7.07
10%	114	61.96
15%	22	11.96
20%	18	9.78
25%	7	3.80
30%	2	1.09
35%	8	4.35
TOTAL	**184**	**100**

Alternative Livelihood

A number of alternative livelihoods were identified by the respondents in case their current lots are given up for the project. The most cited alternative source of livelihood was farming as this was mentioned by 184 respondents representing 37% of the total. This group of people will either engage themselves into growing corn or rice. Following farming, the occupation 'serving as laborer' was the next popular occupation since it was mentioned by 144 respondents. Almost all (98%) of these respondents forsee themselves to serve as laborers in the farm while two respondents (2%) would like to become laborers in the reforestation project.

Livestock or raising pigs, cattle and poultry was also seen as potential source of livelihood for would be displaced farmers once project is implemented. This alternative livelihood was cited by 34 persons or an equivalent of 7% of the total respondents. Other alternative sources of livelihood that were mentioned and the corresponding number of times mentioned were as follows: agroforestry (10 or 2%); employee (10 or 2%); banana production (6 or 1%); storekeeping (6 or 1%); driving (5 or 1%); buy and sell (4 or 0.8%); business (2 or 0.4%); carpentry (2 or 0.40%); vegetable gardening (2 or 0.40%); manicure/pedicure (2 or 0.40%); furniture making (2 or 0.40%); and handicraft (1 or 0.2%). Eleven persons or 2% were not able to identify any alternative source of livelihood while 73 persons or 15% don't have any idea what sort of job they could engaged with once they are displaced because of the implementation of the project.

Results indicated that farming particularly growing rice and corn was still the occupation that is close to the hearts of the respondents. Considering that they had been in this type of work for many years already, this could be the only occupation which they think they could do well. This may mean that the respondents will only be shifting to another place doing the same type of economic activity that they were doing before the project implementation. This should be noted or monitored as there maybe new areas that will be opened/utilized to give way to growing rice and corn once the lots they were currently tilling will be used for the CDM project.

Table 29. Alternative livelihood.

LIVELIHOOD	**FREQUENCY**	**PERCENT**
Farming	184	36.95
Laborer	144	28.92
Livestock	34	6.83
Agroforestry farming	10	2.01
Employee	10	2.01
Banana production	6	1.20
Storekeeping	6	1.20
Driving	5	1.00
Buy and sell	4	0.80
Business	2	0.40
Carpentry	2	0.40
Vegetable gardening	2	0.40
Manicure/pedicure	2	0.40
Furniture making	2	0.40
Handicraft	1	0.20
None	73	14.66
Don't know	11	2.21
TOTAL	**498**	**100**

Current and New Sources of Fuelwood

Almost 50% of the total respondents mentioned that they currently get their fuelwood from their own farmlots. This group of farmers planted fast growing trees such as *Gmelina arborea* in their respective areas some years back. In most cases, farmers only get the dead branches to meet their fuelwood needs. About 16% of the total respondents however cited that their current source of fuelwood are their backyards. Some respondents confided that they got fuelwood from the public lands. For instance about 27% said that they gather fuelwood from the reforestation areas of the DENR while 5% got them from the forestlands classified as secondary forest. Mere 1% of the total respondents mentioned that they gather fuelwood from the riverbanks while 0.6% said they just buy their fuelwood from the market. Some four respondents don’t know the source of the fuelwood their families were using while another four respondents did not disclose the source of their fuelwood.

Once the project is implemented, the respondents whose source of fuelwood was their farmlots inside the project boundary said that their new sources of fuelwood were as follows: backyard (64%), reforestation areas of the DENR (21%), secondary forest (7%), and market (7%).

Table 30. Current and new sources of fuelwood

SOURCE	**FREQUENCY**	**PERCENT**
Current		
Farmlot	257	48.67
Backyard	84	15.91
Reforestation	144	27.27
Forestland	25	4.73
Riverbanks	7	1.33
Market	3	0.57
Don't know	4	0.76
No answer	4	0.76
TOTAL	**528**	**100**
Future		
Backyard	9	64.29
Reforestation	3	21.43
Secondary forest	1	7.14
Market	1	7.14
TOTAL	**14**	**100**

Current and New Sources of Timber

As regards the need for timber, the respondents mentioned that they meet such need by getting their timber from various sources. About 52 respondents or 58% mentioned that they got their timber from the secondary forest. For those respondents who had tree farms, they said that they meet their need for timber by cutting their trees from their farms. This group of farmers numbered to about 13 representing 15% of the total respondents. Around 20% emphasized that they just bought lumber from the hardware while 6% said they got lumber from their own farmlots. A mere 1% cut the trees that are planted in his backyard whenever he needs timber.

Once the project is implemented, respondents whose source of timber was their farmlots did not mention any alternative source for their timber.

Table 31. Current and new sources of timber

SOURCE	FREQUENCY	PERCENT
Current		
Secondary forest	52	58.43
Lumber/hardware	18	20.22
Tree farm	13	14.61
Farmlot	5	5.62
Backyard	1	1.12
Total	**89**	100.00

Energy Related Items Needed

When asked what sort of energy related items were needed, the respondents mentioned the following: electricity, gasoline, fuelwood, diesel, charcoal, liquified petroleum gas (LPG), and kerosene. Of these energy items, fuelwood was the most popular as it was cited by 448 farmers representing 48% of the total respondents. This result was expected since LPG is quite expensive. Normally, a tank of LPG would cost around P500 but this would cost more if this will be brought to the villages because of the transportation cost that will be added to the price of an LPG tank. Thus, only 1% of the total respondents said that they need LPG. In addition, the farmers knew that there were available fuelwood around their areas thus they prefer to use fuelwood to cook the food of their families which they could get for free or at a minimal cost.

Aside from fuelwood, electricity was also mentioned by many respondents. A total of 373 farmers representing 40% of the total respondents said that they need electricity in their homes. Currently, most of the villages covered by the proposed CDM project used generators to meet their electricity needs. Those families who could not afford to pay for the use of the generator in the barangay utilize candles or kerosene – fueled lamps. About 5% however, mentioned that they need gasoline while 1% require diesel. These energy products were normally used by the farmers for their threshers and “kuliglig”. A mere 2% of the total respondents cited that they need charcoal to cook their food while another 2% said that his family need kerosene for their lamps and stoves.

Table 32. Energy related items needed by the respondents

ENERGY RELATED ITEM	FREQUENCY	PERCENT
Fuelwood	448	48.07
Electricity	373	40.02
Gasoline	43	4.61
Kerosene	20	2.15
Charcoal	19	2.04
LPG	14	1.50
Diesel	13	1.39
No answer	2	0.21
Total	**932**	**100**

Quantity of Energy-Related Items Needed

The quantity needed for electricity ranged from < 15 to > 40 kwh per month. Results showed that the electricity requirements of the families in the covered barangays of the proposed CDM project were not that huge. For instance, around 28% of the total respondents mentioned that they need less than 15 kwh per month while about 53% said that they require 15 - 40 kwh per month. Only 19% cited that they require more than 40 kwh per month for their electricity needs.

Similar to electricity, the need for gasoline by the respondents was not very large. For instance, a little less than 50% of the total respondents mentioned that they need diesel below 10 li/mo while around 36% said that they need 11 – 50 li/mo.

Diesel requirement of the respondents ranged from < 10 to > 50 liters per month. Around 19% of the total respondents mentioned that they require < 10 liters per month of diesel while 31% said that they need more than 50 liters of the same commodity per month. About 25% of the total respondents however cited that they require 11 – 30 liters of diesel per month while another 25% of the total respondents claimed that they want to have 31 – 50 liters of diesel for the same period of time.

For fuelwood requirement, about 17% of the total respondents mentioned that their families need ≤ 20 bundles of fuelwood per month. A little over 50% said that they need 21-60 bundles while about 27% need 61 – 100 bundles. Around 2% however mentioned that they need more than 100 bundles of fuelwood. Less than 1% of the total respondents failed to estimated the fuelwood requirement of their families.

Quantity of charcoal needed by the families inside the project boundary ranged from 1 to > 6 sacks per month. About 35% of the total respondents mentioned that they need only one sack of charcoal per month while about 4% require more than six sacks. Families that need small quantity of charcoal could be those whose household sizes are small. Around 25% of the total households require 2 – 3 sacks of charcoal per month while about 35% need 4 – 5 sacks per month.

As regards the LPG, all the 18 respondents who mentioned that they need such commodity cited that their families require one tank per month. For kerosene, almost half of the respondents mentioned that they need more than 5 bottles of kerosene per month. Around 10% of the total respondents however said that they need 2 bottles of kerosene while another 10% mentioned that they require 3 bottles of the same good.

Table 33. Quantity of energy related items needed by the respondents

QUANTITY NEEDED PER MONTH	FREQUENCY	PERCENT
Electricity (kwh)		
Below 15	109	27.59
15 - 20	102	25.82
21 - 25	37	9.37
26 -30	35	8.86
31-35	9	2.28
35 -40	27	6.84
above 40	76	19.24
Total	**395**	**100.00**
Gasoline (li)		
Below 10	27	48.21
11 - 20	4	7.14
21 - 30	4	7.14
31 - 40	8	14.29
41 - 50	4	7.14
Above 50	9	16.07
Total	**56**	**100.00**
Diesel (li)		
Below 10	3	18.75
11 - 20	3	18.75
21 - 30	1	6.25
31 - 40	2	12.50
41 - 50	2	12.50
Above 50	5	31.25
Total	**16**	**100**
Fuelwood (bundle)		
0-20	62	13.51
21-40	148	32.24
41-60	113	24.62
61-80	39	8.50
81-100	85	18.52
> 100	8	1.74

No answer	4	0.87
Total	**459**	**100**
Charcoal (sack)		
1	10	35.71
2	4	14.29
3	3	10.71
4	9	32.14
5	1	3.57
> 6	1	3.57
Total	**28**	**100.00**
LPG (tank)		
1	18	100
Total	**18**	**100**
Kerosene (bottle)		
1		
2	2	9.52
3	2	9.52
4	8	38.10
> 5	9	42.86
Total	**21**	**100.00**

Sources of Energy Related Items

As regards the sources of the energy related items, all of the respondents mentioned that their electricity was provided by the local electric company called Quirino Electric Cooperative (QUIRELCO). This result was expected because only electric cooperatives like QUIRELCO operate in rural areas in the Philippines.

For gasoline and diesel, the only source mentioned by the respondents was the gasoline station present in Quirino. About 62 farmers mentioned that they buy gasoline from the mentioned source while 12 respondents cited such source for their diesel requirement.

For fuelwood, a lot of sources were mentioned by the respondents. For almost half of the respondents, fuelwood was derived from their own farmlots. About 146 respondents however mentioned that they collect fuelwood from the tree farms while another 84 respondents said that their fuelwood were collected from their backyards. It should be noted however that there were some respondents who depend on the reforestation areas of the DENR and the secondary forests to meet their fuelwood needs. Each of these sources was cited by 49 farmers representing 9% of the total respondents. Mere eight farmers got their fuelwood from riverbanks while 16 respondents just bought fuelwood from the market.

Respondents who were in need of kerosene cited they derive such from a store while for those who need LPG bought it from the public market.

Table 34. Sources of energy related items needed by the respondents

SOURCES	**FREQUENCY**	**PERCENT**
Electricity		
QUIRELCO	384	97.22
No answer	11	2.78
Total	**395**	**100**
Gasoline		
Gasoline station	62	100
Total	**62**	**100**
Diesel		
Gasoline station	12	75
No answer	4	25
Total	**16**	**100**
Fuelwood		
Farmlot	231	43.02
Backyard	84	15.64
Tree farm	146	27.19
Reforestation	49	9.12
Secondary forest	49	
Riverbanks	8	1.49
Public market	16	2.98
Don’t know	3	0.56
Total	**537**	**100**
Kerosene		
Store	3	100
Total	**3**	**100**
LPG		
Public market	23	95.83
No answer	1	4.17
Total	**24**	**100**

Current and Future Electric Goods

There were a number of electric goods that were currently owned by the respondents. Since media were very important to keep updated with what is happening around, most of the respondents mentioned that they have television sets and radios. Around 30% of the total respondents said that they have televisions while another 27% mentioned that they own radios. This was expected because in the Philippines, the most common media used were television sets and radios. Thus, in almost every household, radios can be found. However, if budget of the family permits, television sets were also bought. Other electric goods currently owned by the respondents include: VCD player (14%), electric fan (10%), refrigerator (8%), washing machine (5%), flat iron (3%), cellphone (2%), computer (0.56%), rice cooker (1%), electric pump (0.67%), component (0.22%) and pressurized pump (0.11%).

If given the chance, the respondents mentioned that they would like to have a number of electric goods in the future. These electric goods include: refrigerator (36%), television (19%), washing machine (19%), computer (7%), DVD/VCD/CD player (9%), radio (6%), electric fan (2%), rice cooker (0.89%), airconditioner (0.45%) and oven (0.45%). Results indicated that in the future there will be more demand for electricity in the area since many of the members of the local community were planning to purchase electric goods.

Table 35. Current and future electric goods of the respondents

ELECTRIC GOODS	FREQUENCY	PERCENT
Current		
Television	271	30.38
Radio	237	26.57
VCD player	123	13.79
Electric fan	91	10.20
Refrigerator	61	6.84
Washing machine	43	4.82
Flat iron	30	3.36
Cellphone	13	1.46
Computer	5	0.56
Rice cooker	9	1.01
Electric pump	6	0.67
Pressurized pump	1	0.11
Component	2	0.22
Total	**892**	**100.00**
Future		
Refrigerator	81	36.16
Television	43	19.20
Washing machine	42	18.75
Computer	16	7.14
DVD/VCD/CD player	21	9.38
Radio	13	5.80
Electric fan	4	1.79
Rice cooker	2	0.89
Aircon	1	0.45
Oven	1	0.45
Total	**224**	**100.00**

Current and Future Gasoline and Diesel Powered Products

Of the total 498 respondents, only 32 mentioned that they currently own gasoline powered products. This was expected because not many of the farmers could afford to buy such products as most of them only live either within or below subsistence level. Gasoline powered products currently owned by the 32 respondents were either used to run their business or earn income or for personal purposes only. Around 28% of the total respondents who own gasoline powered products said that they have hand tractors at present while some 25% mentioned that they have motorcycles. Twelve percent of the total respondents however mentioned that they own tricycles while another 12% said that they own jeepneys. Around 9% of the total respondents said that they have cars while a mere 6% cited that they have treshers. One respondent each said that they either have chainsaw or truck.

In the future, around 31 respondents mentioned that they plan to have motorcycles, car, tractor, tricycle, and tractor. More than half of these respondents mentioned that they plan to buy motorcycles. This product was cited by 18 farmers representing 58% of the total 31 respondents. Around 19% of the total respondents however mentioned that they plan to buy tractors while another 13% wanted to have cars. About 6% said that they plan to buy jeepneys while about 3% wanted to purchase tricycle.

As regards diesel powered products, only five farmers out of the total 498 respondents claimed that they own such products. Of these five farmers, three of them have hand tractors representing 60% of the total responses received. One person or 20% owns a jeepney while another person or 20% has a truck. In the future, only one respondent plans to buy a truck.

Results show that in the area, demand for gasoline will be greater than the demand for diesel. This is mainly due to greater number of gasoline powered products that the respondents currently and in the future would like to own. Overall however, demand for gasoline and diesel will not be that much because only 7% of the total 498 respondents currently use gasoline and diesel powered products. In the future, the same trend is expected to be observed as only 14% of the total respondents have equipments or products that utilize gasoline and diesel.

Table 36. Current and future gasoline powered products of the respondents

PRODUCTS	FREQUENCY	PERCENT
Gasoline		
Current		
Motorcycle	8	25.00
Hand tractor	9	28.13
Tricycle	4	12.50
Jeepney	4	12.50
Car	3	9.38
Tresher	2	6.25
Chainsaw	1	3.13
Truck	1	3.13
Total	**32**	**100**
Future		
Motorcycle	18	58.06
Tractor	6	19.35
Car	4	12.90
Jeepney	2	6.45
Tricycle	1	3.23
Total	**31**	**100**
Diesel		
Current		
Hand tractor	3	60.00
Jeepney	1	20.00
Truck	1	20.00
Total	**5**	**100.00**
Future		
Truck	1	100
Total	**1**	**100**

Current Use of the Land Inside the Project Boundary

According to the respondents, the land inside the project boundary has the following land uses: cornland, banana plantation, riceland, grassland, agroforestry, vegetable garden, plantation, coffee plantation and secondary. A little more than half of the respondents mentioned that the land inside the project boundary is planted with corn while 16% of them said that there are banana plantations in the area. Some 14% of the total respondents cited riceland while 12% mentioned grassland as the land uses inside the project boundary. Four percent of the total respondents noted that agroforestry is present inside the project boundary while less than one percent said that tree plantation is present in the area. Less than 1% mentioned 'coffee plantation', and 'secondary forest' as the land uses inside the project boundary. Results show that the land inside the project boundary is dominantly planted with corn.

Table 37. Current land use in the project boundary.

CURRENT LAND USE	FREQUENCY	PERCENT
Corn plantation	411	52.69
Banana plantation	122	15.64
Rice land	113	14.49
Grassland	92	11.79
Agroforestry	29	3.72
Vegetable garden	5	0.64
Tree plantation	3	0.38
Coffee plantation	3	0.38
Secondary forest	2	0.26
Total	**780**	**100**

Alternative Landuse as Perceived by the Local Community

There were three alternative land uses identified by the respondents. Among the identified alternative landuses inside the project boundary, forest was cited by most respondents. This land use was mentioned by 398 farmers or 57% of the total respondents. About 31% or 215 respondents mentioned agriculture as an alternative land use while only 13% or 91 respondents said that the project boundary could be an agroforestry area. Considering that there are communities present inside or near the project boundary, it is surprising that a little more than half of the respondents perceived that the alternative land use of the area is a forest.

Table 38. Alternative land uses of the project boundary

ALTERNATIVE LANDUSE	FREQUENCY	PERCENT
Forest	398	56.53
Agriculture	215	30.54
Agroforestry	91	12.93
TOTAL	**704**	**100**

Barriers Why the Area Cannot be Developed into a Forest

When the respondents were asked about the possibility of the proposed project area to be reforested, around 67% of the respondents said that it is not at all possible. Around 29% of the total respondents however said otherwise while 6% do not have any idea whether it will turn into a forest or not.

Respondents who mentioned that the area cannot be reforested cited a number of barriers. For about 61% of the respondents, the main reason why the area could not be reforested was the lack of financial resources to revegetate the mentioned area. Based on the DENR estimate, about PhP 50,000 is needed to plant a hectare of land. Thus, if the area contains around 5000 ha of denuded land, around PhP 250,000,000 is needed to put forest cover in the area. The sad thing is that currently, the government has no funds to reforest barren areas in the Philippines.

Aside from the lack of financial resources, the respondents also mentioned a number of barriers to conversion of the proposed CDM site into a forest. These include: lack of technical expertise, lack of experience, lack of technology, rampant illegal logging, poor enforcement of forest laws, demographic pressure or increasing population and the absence of nearby forest that can be a source of regenerants. Some 21% of the total respondents mentioned that the area could not be converted into a forest because there is no sufficient technical expertise available. About 10% of the total respondents however said that the people looking after the lots inside the project boundary lack experience in reverting the area back to forest. Also, the lack of technology available in reforesting the area is viewed by about 5% of the total respondents as a barrier to its conversion into a forest. The remaining 2% of the total respondents however identified the presence of illegal logging activities, poor enforcement of laws, increasing population in the area and absence of nearby forest which can be a source of regenerants as other barriers to its conversion into a forest.

Table 39. Barriers to conversion of the proposed CDM site into a forest

BARRIERS	**FREQUENCY**	**PERCENT**
Lack of financial resources	406	61.14
Lack of technical expertise	139	20.93
Lack of experience	69	10.39
Lack of technology	35	5.27
Rampant illegal logging	7	1.05
Poor enforcement of forest laws	6	0.90
Demographic pressure	1	0.15
No nearby forest	1	0.15
TOTAL	**664**	**100**

Effects of the CDM Proposed Project

About 91% of the respondents believed that the CDM project would affect them while about 2% argued otherwise. Around 7% said that they do not know whether the CDM project would affect them or not. Results implied that in general, the affected barangays were very much aware that the CDM project once implemented in their areas would influence their surroundings and their manner of living.

Reforestation

In terms of effects, the respondents viewed that reforestation has a number of positive and negative consequences. However, it should be noted that the respondents cited more positive effects than negative impacts. One of the positive impacts of reforestation that was noted by around 175 respondents was that reforestation is a source of income. This perception of the farmers was based on their past experiences with the forestry projects of the government through the DENR where the local communities were hired as laborers during planting and maintenance activities of the project. During such time local communities earn some income although such is only for a short period of time. Aside from being a source of income, respondents also mentioned that reforestation area is a source of wood products such as fuelwood (91 respondents) and lumber (83 respondents). In addition, the respondents also noted the role that reforestation areas play in the provision of environmental services. According to 14 respondents, reforestation projects promote healthy environment. For 55 respondents, trees help in the conservation of soil and water while 20 farmers said that trees protect the environment. Six respondents emphasized that trees improve soil fertility while five respondents said that trees absorb carbon from the atmosphere and improve water supply. The numerous positive impacts of reforestation projects cited by the respondents prove that they are very much aware of the importance of trees.

As regards the negative effects of reforestation, the respondents mentioned only two impacts: long period of waiting before harvesting could be undertaken and the reduction of the area for agricultural production. The first impact was cited by six farmers representing about 1% of the total respondents. When a farmer plants trees, it takes a while before he can harvest timber because he has to wait for at least 8 years before he can cut such trees. For farmers who mainly depend on the income from crops, such long period of waiting attached to tree farming makes the activity unattractive to venture on.

For 18 farmers representing about 4% of the total respondents, reforestation reduces the area allotted for agricultural production. When trees are planted in a farm, considerable portion of the area are shaded because trees grow. Since most farmers grow cash crops, this scenario is not very favorable because cash crops require enough sunlight to attain good growth resulting to bountiful harvest.

Agroforestry

In the agroforestry system, the respondents perceived more positive than negative impacts. The respondents overwhelmingly mentioned agroforestry farms as source of income for their families. A total of 421 persons or 72% of the total respondents mentioned such effect. About 24% of the total respondents or around 143 persons mentioned that the agroforestry project is also the source of fruits for the family’s consumption. Aside from these economic benefits, the respondents also noted environmental benefits associated with agroforestry. For instance, seven persons or mere 1% said that agroforestry systems control soil erosion because of its tree component. Four respondents cited that multiple benefits can be reaped from agroforestry farms while two respondents said that the agroforestry system ameliorates the soil. Three respondents believe that agroforestry system reduces the impact of natural phenomenon because trees serve as shelter breaks while one respondent said that the mentioned system helps protect the environment.

When compared with agricultural crops, two respondents mentioned that agroforestry is easier to establish and manage while one respondent said that the system requires lesser maintenance cost.

As regards negative effects, respondents noted the following impacts of agroforestry system: long period of waiting before harvesting the products, difficult to market the products and difficult to manage. Among these negative effects, 'long period of waiting before harvesting the products' is the most popular. This was cited by 39 farmers representing about 8% of the total respondents. The second most popular negative effect noted by the respondents is 'difficult to manage'. According to the two respondents who mentioned such negative effect, agroforestry systems are quite difficult to manage. This is surprising because agroforestry farms usually require lesser maintenance compared with agricultural crops. Another negative effect mentioned by one respondent was the difficulty in marketing agroforestry products. According to the respondent, cash crops are easier to market compared with fruit trees.

Jathropa

Similar to reforestation and agroforestry projects, a number of both positive and negative effects of jatropha were noted by the respondents. The positive effects noted include: source of income, medicine, reduce carbon, source of biodiesel, help protect the environment, prevents soil erosion, easy to maintain and establish, and can be used in washing the dishes. Of these effects, Jatropha as a source of income is the most popular. This effect was cited by 352 persons or 71% of the total respondents. Forty persons representing 8% noted that Jatropha can heal some illnesses and has been tested by the local community to be very effective. Some 17 respondents who seem to be very much aware of the role of Jatropha to climate change said that it helps in reducing carbon. Ten respondents noted that Jatropha is a source of biodiesel while five respondents mentioned that it helps prevent soil erosion. Three respondents emphasized that establishing and maintaining a Jatropha plantation is fairly easy. One respondent mentioned that it can be used in washing the dishes while another respondent said that it helps protect the environment.

While there were good effects that were noted by the respondents as regards Jatropha, there were also bad effects that were cited. Foremost among these effects is the difficulty in marketing the product. Cited by 51 respondents, this negative effect according to them would lead to the absence of source of livelihood for their families. Since the farmers and their families solely depend on the incomes that they derive from their farms, absence of market for Jatropha would mean starvation of the farmers and their families. Other negative impacts of Jatropha noted by the respondents were as follows: lack of technical expertise (0.8%); possible rat infestation (0.2%); long period of harvest (0.2%); and lack of information (0.2%).

Table 40. Effects of reforestation

EFFECTS	FREQUENCY	PERCENT
Reforestation		
Positive		
Source of income	175	35.14
Source of fuelwood	91	18.27
Source of lumber	83	16.67
Healthy environment	14	2.81
Soil and water conservation	55	11.04
Protect the environment	20	4.02
Improve soil fertility	6	1.20
Absorb carbon	4	0.80
Improve water supply	1	0.20
No idea	49	9.84
Total	**498**	**100**
Negative		
Long period of waiting before harvesting	6	1.20
Area for agricultural crops reduced	18	3.61
No idea	474	95.18
Total	**498**	**100**
Agroforestry		
Positive		
Source of income	421	71.72
Source of fruits for family's consumption	143	24.36
Control soil erosion	7	1.19
Multiple benefits	4	0.68
Soil amelioration	2	0.34
Easier to establish and manage	2	0.34
Helps protect the environment	6	1.02
Shelter belt	1	0.17
Lesser maintenance cost	1	0.17
Total	**587**	**100**
Negative		
Long period of waiting before harvesting products	39	7.83
Difficult to market the products	1	0.20
Difficult to manage	2	0.40
No idea	456	81.33
Total	**498**	**100**
Jatropha		

Positive		
Source of income	352	70.68
Medicine	40	8.03
Help in reducing carbon from atmosphere	17	3.41
Source of biodiesel	10	2.01
Prevents soil erosion	5	1.00
Easy to maintain and establish	3	0.60
Help protect the environment	1	0.20
Can be use in washing dishes	1	0.20
No idea	69	13.86
Total	**498**	**100**
Negative		
Difficult to market	51	10.24
Lack of technical expertise	4	0.80
Possible rat infestation	1	0.20
Long period before harvest	1	0.20
Lack of information	1	0.20
No idea	440	88.35
Total	**498**	**100**

Comparing overall positive and negative effects, do you perceive to be better off with the project?

Many of the respondents believe that overall, they will be better off if they join the project. There were 451 persons or 90% of the total respondents who said that they think their situation will improve once they join the project because of the economic and environmental benefits that the project will be bringing. Two persons answered otherwise while 45 persons or mere 9% do not know if they will be better off or not once they join the project. Result of the survey shows that there is high acceptability of the project among the local community or the potential project participants because they believe that their current situation will improve with the implementation of the project in their area.

Appendix 3. Copy of Certificate of Stewardship Contract (CSC)

CERTIFICATE OF STEWARDSHIP AGREEMENT

This Agreement made and entered into this _________ day of __________ , 20___ between the Republic of the Philippines represented by the Secretary of Natural Resources, hereinafter referred to as the GRANTOR and __________________, of legal age, Filipino, with postal address at _____________________hereinafter referred to as the GRANTEE.

WITNESSETH

WHEREAS, the GRANTEE, is qualified to lease public forest lands under the laws of the Republic of the Philippines and has filed with the Secretary of the Environment and Natural Resources for permission to act as steward and commits himself to stewardship responsibilities for a parcel of land described in the attached map to be hereinafter referred to as "the land";

WHEREAS, the GRANTOR, after having determined that the GRANTEE is the actual tiller of the land and a resident of the barangay or adjacent barangay of the land, hereby recognizes and considers said GRANTEE as qualified participant in the rehabilitation of denuded forest lands and in the expansion of national productivity. In the case of a married couple, both the husband and wife shall be considered the GRANTEE duly named on the Certificate of Stewardship;

WHEREAS, according to official records on file with the GRANTOR, no adverse claim has been presented nor any objection or opposition has been filed against the application of the GRANTEE;

NOW, THEREFORE, for and in consideration of the foregoing promises, the GRANTOR authorizes the GRANTEE, under this STEWARDSHIP AGREEMENT to develop, manage and administer the land subject to existing forest laws, policies, rules and regulations and the following terms and conditions:

A. EFFECTIVITY AND TENURE

The Agreement shall become effective upon the execution thereof by the parties and shall continue for a period of TWENTY-FIVE (25) YEARS to expire on _____________, renewable for another period of TWENTY-FIVE (25) years.

B. RIGHT OF THE GRANTEE

1. The GRANTEE shall have the right to peacefully possess and cultivate the land and enjoy the fruits thereof; to manage and live on the land in accordance with appropriate forest and farm methods and practices; and such other rights as may be granted by law.
2. All income/proceeds derived from the land shall accrue to the GRANTEE.
3. The GRANTEE has the right to nominate their heir to the Stewardship Agreement, subject to the approval of the Secretary or his authorized representative, to facilitate orderly transfer upon the death or incapacity of the original stewards, movement outside of the area by the stewards, and change of vocation of the Certificate of Stewardship holders.
4. Upon expiration of the Stewardship Agreement, the GRANTEE or direct next-of-kin shall have the right of pre-emption to any subsequent Stewardship Agreement covering their allocated land, and when for some reasons the GRANTOR opts to allocate the land for Stewardship, the GRANTEE shall be entitled to just compensation for permanent improvement introduced therein, including trees that will not be removed.

5. The GRANTEE may avail of assistance provided by other government and non-government organizations.
6. The GRANTEE shall develop their allocated land into productive farm consistent with sound ecological practices.
7. The GRANTEE shall devote at least twenty percent (20%) of the land within the project area to tree farming of suitable species to contribute to ecological stability of the community and country.
8. The GRANTEE is expected to join other stewards of the area in doing the following:
8.1 Delineate project area and conduct parcellary survey as a means to resolve boundary conflict;
8.2 Participate in the preparation of the Project Stewardship Plan and in the establishment of the agroforestry nursery for the land;
8.3 Protect and conserve the forest growth within the project areas and cooperate with the DENR in the protection of forest areas adjacent thereto;
8.4 Preserve monuments and other landmarks indicating corners and outline of boundaries within the project area in the course of implementing the project stewardship plan;
8.5 Prevent and suppress unauthorized fires within the project areas and other areas immediately adjacent thereto;
8.6 Protect and preserve trees or other vegetation within a twenty-meter strip of land along the edge of the normal high waterline, rivers and streams with channel of at least five meters wide bordering or passing through the project area. In case of rivers less than five meters in width, the strip shall be ten meters on each side of the river or creeks;
9. The GRANTEE shall abstain from cutting or harvesting naturally growing trees within and adjacent social forestry areas except when authorized by the DENR in accordance with existing forest regulations and guidelines.

C. RIGHTS AND RESPONSIBILITIES OF THE GRANTOR

1. The GRANTOR reserves the right to regulate the cutting or harvesting of timber crops to ensure proper balance of forest cover on the land.

2. The GRANTOR reserves the right to permit the opening, if public interest requires, of such portions of the land for road right-of-way provided, that the person or entry granted the road rightof-way will pay the GRANTEE just compensation for any damage to permanent improvement and/or growing crops.
3. The GRANTOR or his duly authorized representative shall have free access to that area for purposes of supervision and periodic monitoring and evaluation.
4. The GRANTOR shall extend technical, legal, financial, marketing, credit, extension services and other available support to the GRANTEE.
5. The GRANTOR shall maintain the present legal status of the land and shall not grant to any third parties any privileges or extension thereof to develop, utilize or manage the land during the existence of this Agreement.
6. The GRANTOR shall collect fees for the use of the land under the STEWARDSHIP Agreement.
7. Unless the law provides otherwise, the GRANTOR shall exempt the GRANTEE from payment of forest charges from forest products derived and/or harvested from the project area.

D. GENERAL PROVISIONS

1. The GRANTEE shall not use tenant labor but must till the land himself without prejudice, however, with assistance from his family.
2. The GRANTEE shall not sublease the land or any portion thereof.
3. The GRANTOR and the GRANTEE shall conform with other related laws, rules and regulations that may be promulgated thereafter pursuant to the implementation of the Integrated Social Forestry Program.

E. TERMINATION/CANCELLATION OF STEWARDSHIP AGREEMENT AND COMPENSATION

The GRANTOR shall terminate/cancel the Stewardship Agreement for any of the following causes:
1. When the GRANTEE fails to comply with the terms and conditions of the Agreement one year after being notified of his neglect in writing by the DENR Regional Director;
2. When the GRANTEE willfully used false information to obtain the Agreement;
3. Serious and continued violation of forestry laws, rules and regulations; and
4. When public interest, as determined by the Secretary of Environment and Natural Resources, so demands.

In the event that the Stewardship Agreement is canceled due to conditions (1) to (3), all permanent improvements on the land shall be forfeited in favor of the GRANTOR.

However, in case the cancellation is due to condition (4), the GRANTEE shall be entitled to reimbursement for all permanent improvements introduced on the land, based on the fair market value of such improvement as assessed by the government assessor or disinterested and qualified third party as of the date of cancellation, minus all charges or other obligations accruing to the government, if any. For this purpose, permanent improvements are those which cannot be removed without damages to the land. Temporary improvements, however, shall be removed by the participants within a reasonable period as determined by the DENR in consultation with the participants.

Moreover, when the cancellation is caused by condition (4), the affected program participant, aside from just compensation, shall, whenever practicable, be resettled to other areas, upon the approval of the Secretary or his authorized representative.

The GRANTEE shall participate in the selection of the alternative site.

Upon cancellation of a Certificate of Stewardship, the GRANTEE loses the right to nominate another qualified individual/s or couple to take over his/her stewardship.

This Stewardship Agreement may be pre-terminated by mutual agreement of the contracting parties.

F. RATIFICATION

The GRANTOR shall explain all the provisions of this Agreement to the GRANTEE in the dialect understandable to them prior to signing.

The GRANTOR and the GRANTEE shall sign each page of this Agreement.

This Stewardship Agreement shall form an integral part of the Certificate of Stewardship.

In the case that the Certificate of Stewardship shall be issued to spouses, both husband and wife shall sign this Agreement. In the event the GRANTEE/S does/do not know how to write, he/she/they shall affix his/her/their thumbmarks in the agreement in place of his/her/their signature/s.

IN WITNESS WHEREOF, the said parties have hereunto set their hands this ________ day of ___, 200__, in ______________________________.

By Authority of the Secretary:

____________________________	____________________________
GRANTOR	GRANTEE
	____________________________
	GRANTEE

WITNESSES

____

____

____

____

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DEPARTMENT OF THE INTERIOR AND LOCAL GOVERNMENT

JOINT MEMORANDUM CIRCULAR NO. 98-01

MANUAL OF PROCEDURES FOR DENR-DILG-LGU PARTNERSHIP ON DEVOLVED AND OTHER FOREST MANAGEMENT FUNCTIONS

Pursuant to Republic Act 7160, otherwise known as the Local Government Code of 1991, Presidential Decree 705 s amended, otherwise known as the Forestry Reform Code of the Philippines ; Executive Order No. 192 defining the mandates, organization, and functions of the Department of Environment and Natural Resources (DENR), DENR Administrative Order No. 30, Series of 1992 prescribing the guidelines for the transfer and implementation of DENR functions; the following Manual of Procedures is hereby promulgated to effectively implement devolution of forest management functions and enhance partnership between the LGUs and the DENR.

Section 1. Basic Policies

Subject to the general policies on devolution as contained in RA 7160 and DENR Administrative Order No. 30, Series of 1992, the following basic policies shall govern the implementation of DENR-DILG-LGU partnership on devolved and other forest management functions:

1.1 The Department of Environment and Natural Resources (DENR) shall be the primary government agency responsible for the conservation, management, protection, proper use and sustainable development of the country's environment and natural resources.

1.2 The LGUs shall share with DENR the responsibility in the sustainable management and development of the forest resources within their territorial jurisdiction. Toward this end, the DENR and the LGUs shall endeavor to strengthen their collaboration and partnership in forest management.

1.3 Comprehensive land use and forest land use plans are important tools in the holistic and efficient management of forest resources. Toward this end, the DENR and the LGUs together with other government agencies shall undertake forest land use planning as an integral activity of comprehensive land use planning to determine the optimum and balanced use of natural resources to support local, regional and national growth and development.

1.4 To fully prepare the LGUs to undertake their shared responsibilities in the sustainable management of forest land resources, the DENR, in coordination with DILG, shall enhance the capacities of the LGUs in the various aspects of forest management. Initially, the DENR shall coordinate guide and train the LGUs in the management of the devolved functions. As the LGUs' capacity in forest management is enhanced, the primary tasks in the management of devolved functions shall be performed by the LGUs and the role of the DENR becomes assistive and coordinative.

1.5 To further the ends of local autonomy, the DENR in consultation with the LGUs shall devolved additional functions and responsibilities to the local government units, or enter into agreements with them for enlarged forest management and other ENR-related functions.

1.6 To seek advocacy, popular support and ultimately help achieve community empowerment, DENR and DILG shall forge the partnership and cooperation of the LGUs and other concerned sectors in seeking and strengthening the participation of local communities for forest management including enforcement of forestry laws, rules and regulations.

Section 2. Objectives

This Manual of Procedures has the following objectives:

2.1 Operationalize and make effective the devolution of forest management functions from the DENR to the LGUs as contained in Republic Act 7160 and DENR Administrative Order No. 30, Series of 1992.

2.2 Strengthen and institutionalize DENR-DILG-LGU partnership and cooperation on devolved and other forest management functions.

2.3 Serve as reference for the DENR, DILG and the LGUs in the implementation, monitoring and evaluation of devolved and other forest management functions.

Section 3. Provisions of RA 7160 on Devolved Forest Management Functions from DENR to LGUs

The pertinent provisions of RA 7160 (Local Government Code of 1991) providing for the devolution of forest management functions from the DENR to the LGUs are cited below.

"SECTION 17. Basic Services and Facilities.- (a) Local government units shall endeavor to be self-reliant and shall continue exercising the powers and discharging the duties and functions currently vested upon them. They shall also discharge the functions and responsibilities of national agencies and offices devolved to them pursuant to this Code. Local government units shall likewise exercise such other powers and discharge such other functions and responsibilities as are necessary, appropriate, or incidental to efficient and effective provision of the basic services and facilities enumerated therein."

(b) Such basic services and facilities include, but are not limited to, the following:"

3.1 For a Province

"Pursuant to national policies and subject to supervision, control and review of the DENR, enforcement of forestry laws limited to community-based forestry projects, xxx." Sec. 17, (b) (3) (iii)

3.2 For a Municipality

Extension and on-site research services and facilities related to x x x, and enforcement of fishery laws in municipal waters including the conservation of mangroves." Sec. 17 (b) (2) (i)

"Pursuant to national policies and subject to supervision, control and review of the DENR, implementation of community-based forestry projects, which include integrated social forestry programs and similar projects; management and control of communal forest with an area not exceeding fifty (50) square kilometers, establishment of tree parks, greenbelts, and similar forest development projects." Sec. 17 (b) (2) (ii)

3.3 For a City

All the services and facilities of the municipality and provinces, x x x." Sec.17 (b) (4)

The other provisions Municipal Mayor

"For efficient, effective and economical governance the purpose of which is the general welfare of the municipality government, and in this connection shall: x x x Adopt adequate measures to safeguard and conserve x x x forest, and other resources of the municipality ; x x x Sec. 444 (b) (3) (vii)

3.5 To the Sangguniang Bayan

" Approve ordinances and pass resolutions necessary for an efficient and effective municipal government, and in this connection shall: x x x Protect the environment and impose appropriate penalties for acts which endanger the environment, such as x x x illegal logging and smuggling of logs, smuggling of natural resources products and of endangered species of flora and fauna, slash and burn farming x x x." Sec. 447 (a) (1) (vi)

"Approve ordinances which shall ensure the efficient and effective delivery of the basic services and facilities as provided for under Section 17 of this Code, and in addition to said services and facilities, shall: Provide for the establishment, maintenance, protection, and conservation of communal forests and watersheds, tree parks, greenbelts, mangroves, and other similar forest development projects." Sec.447 (a) (5) (i)

3.6 To the City Mayor

" Ensure the delivery of basic services and the provision of adequate facilities as provided for under Section 17 of this Code x x x. " Sec. 455 (b) (4)

3.7 To the Sangguniang Panglungsod
"Approve ordinances and pass resolutions necessary for an efficient and effective city government, and in this connection, shall: x x x Protect the environment and impose appropriate penalties for acts which endanger the environment, such as x x x illegal logging and smuggling of logs, smuggling of natural resources products and endangered species of flora and fauna, slash and burn farming, x x x." Sec.458 (a) (1) (vi)

"Approve ordinances which shall ensure the efficient and effective delivery of basic services and facilities as provided for under Section 17 of this Code, and in addition to said services and facilities, shall: Provide for the establishment, maintenance, protection and conservation of communal forests and watersheds, tree parks, greenbelts, mangroves, and other similar forest development projects." Sec. 458 (a) (5) (i)

3.8 To the Provincial Governor

" For efficient, effective and economical governance the purpose of which is the general welfare of the province and its inhabitants pursuant to Section 16 of this Code, the provincial governor shall:

"Adopt adequate measures to safeguard and conserve x x x, forest and other resources of the province, in coordination with the mayors of component cities and municipalities :" 465 (b) (3) (v)

"Ensure the delivery of basic services and the provision of adequate facilities as provided for under Section 17 of this Code, x x x. " Sec. 456

3.9 To the Sangguniang Panlalawigan

Approve ordinances and pass resolution necessary for an efficient and effective provincial government and in this connection, shall: Protect the environment and impose appropriate penalties for acts which endanger the environment, such as x x x illegal logging and smuggling of logs, smuggling of natural resources products and of endangered species of flora and fauna, slash and burn farming x x x " Sec 468 (a) (1) (vi)

The Local Government Code did not devolve any specific forest management functions to the barangays.

Section 4. Definitions

4.1 Communal Forest refers to a tract of forest land set aside by the Secretary of the DENR upon the recommendation of the concerned LGU for the use of the residents of a municipality/city. Said residents may cut, collect and remove forest products for their personal use in accordance with existing laws and regulations and subject to the provision that utilization of resources therein shall be in accordance with sustainable development. For this purpose, the concerned LGU with the assistance of the DENR shall prepare sustainable operations plan prior to any utilization.

4.2 Community Environment and Natural resources Office (CENRO) refers to the DENR Office, headed by a Community Environment and Natural Resources Officer Appointed by the Secretary of DENR, which is responsible for the implementation of DENR policies, programs, project and activities and the enforcement of ENR laws and regulations in the community level.

4.3 Community Based Forest Management Program refers to the program involving local communities which integrates and unites the Integrated Social Forestry Program (ISFP), Forestry Sector Program, Forestry Sector Project, Forest Land Management Agreement Program (FLMP), Community Forestry Program (CFP), Ancestral Domains Management Program (ADMP) and other people oriented forestry projects.

4.4 Community Watershed Areas refer to forestlands set aside by the Secretary of the DENR upon the recommendation of the concerned LGU as sources of water supply for specific local communities subject to the provision that the utilization thereof shall be in accordance with sustainable development .

4.5 DENR refers to the Department of Environment and Natural Resources.

4.6 DENRO refers to Deputized Environment and Natural Resources Officer with power and authority as provided for by law and spelled out in the deputation.

4.7 DILG refers to the Department of the Interior and Local Government.

4.8 Devolution refers to the act by which the national government confers power and authority, upon the various LGUs to perform specific functions and responsibilities.

4.9 Environment and Natural Resources Officer (ENRO) refers to the LGU official who may be appointed by the concerned Local Chief Executive and who shall be directly responsible for the Planning and implementation of the devolved DENR functions.

4.10 Foreign Assisted Projects refers to DENR projects that are wholly or partially funded from foreign sources.

4.11 LGU refers to Local Government Unit either at the barangay, municipal, city or provincial level.

4.12 Provincial Environment and Natural Resources Office (PENRO) refers to the DENR office, headed by the Provincial Environment and Natural Resources Officer appointed by the Secretary of the DENR, which is responsible for the implementation of DENR policies, programs and projects in the province.

4.13 Protected Areas refers to identified portions of land and water set aside by reason of their unique physical and biological significance and are managed to enhance biological diversity and protected against destructive human exploitation as provided for in RA 7586, otherwise known as the National Integrated Protected Areas Systems (NIPAS) ACT of 1992.

4.14 Regional Environment and Natural Resources Office (RENRO) refers to the DENR Office headed by a Regional Executive Director (RED) appointed by the President that is responsible for the coordination and implementation of all policies, programs and projects on environmental and natural resources development and conservation of DENR in the region.

4.15 Regular Reforestation Projects refers to reforestation activities funded through regular appropriation and implemented by DENR field offices by administration or by contracts or both s distinguished from foreign sourced funds.

Section 5. Forestry Management Programs, Projects and Function of the DENR which Have Been Devolve to the Local Government Units

5.1 To the Provinces

5.1.1 The enforcement of the laws, rules and regulations in community based forestry project areas, community watersheds and communal forests.

5.2 To the Municipalities

5.2.1 The implementation, management, development of and the responsibility for the sustainability of the community based forestry projects and activities are now devolved to the municipalities here they are located.

5.2.2 The following projects and activities, therefore, are now part of the functions and responsibilities of municipalities to which the have been devolved :

(a) Integrated Social Forestry Projects, except at least one project per province, which has been previously identified as Centers for People Empowerment in the Uplands and/or Community Training Centers. However, notwithstanding such retention by the DENR, the management implementation and monitoring of the same shall be with the participation of the LGUs with the aim of strengthening the capacity of the LGUs to manage the devolved ISF Projects. when the situation so warrants, the DENR Secretary may finally devolve all ISF Projects to the municipalities through MOAs with the LGUs ;

(b) Establishment of new regular reforestation projects, except in areas located in protected areas and critical watersheds;

(c) Completed family and community based contract reforestation projects whether regularly funded or foreign funded or foreign fund subject to the policies and procedures of the DENR , except in areas located in protected areas and critical watersheds;

(d) Management and supervision of areas for forest lands covered by FLMAs;

(e) Community Forestry Projects; and

(f) The management, protection rehabilitation and maintenance of communal forests and community watershed areas that are sources of local water supply.

5.2.3 The conservation of mangroves has been devolved to the municipalities. Pursuant to RA 7161 however the cutting of mangrove species is not allowed. The municipalities therefore should conserve the mangrove areas under the category of protected areas status.

5.3 To the Cities

5.3.1 The functions and responsibility of implementing the forestry projects within the territorial jurisdiction of cities are now devolved to the respective cities. These projects are those listed above as having been devolved to the municipalities.

5.3.2 The functions and responsibility of enforcing forestry laws, rules and regulations within community based project areas, community watershed areas and communal forest that are located within the territorial jurisdiction of the cities are now devolved to the respective cities.

5.4 To the Barangays

5.4.1 There are no forest management functions and responsibilities that have been devolved to the barangays.

5.4.2 In spite of the absence of devolved forest management functions to the barangays, barangays play important roles in protecting the forests as well as in rehabilitating degraded forestlands within or near their territorial coverage.

5.4.3 Barangay officials may be designated or deputized by the DENR as DENROs subject to specific rules and regulations to perform environmental functions, including forest protection upon prior consultation with the local Chief Executives.

Section 6. Institutional Mechanisms for the Supervision and Monitoring of the DENR-DILG-LGU Partnership on Devolved and other Forest Management Functions

6.1 National Steering Committee

There is hereby created a National Steering Committee that shall formulate policies and programs toward strengthening and institutionalizing the DENR-DILG-LGU partnership on devolved and other forest management functions. The National Steering Committee shall be composed of the Secretaries and Assistant Secretaries for Planning of the DENR and DILG, the respective Presidents of the Leagues of Provinces, Cities and Municipalities. The Chair and the Co-Chair of the National Steering Committee shall be the Secretaries of the DENR and DILG, respectively.

The National Steering Committee, which shall meet at least once a year shall be supported by a National Technical Working Group to be composed of the Directors of Forest Management Bureau and Planning and Policy Service Office of the DENR, and the Bureau of Local

Government, Development and Supervision of the DILG and Representatives of the Leagues of Provinces Provinces, Cities and Municipalities.

The Forest Management Bureau shall act as the Secretariat of the National Technical Working Group. The FMB Director shall chair the NTWG.

The Secretary of DENR shall initiate the first meeting of the National Steering Committee together with the National Technical Working Group within thirty (30) days from the approval of this Manual.

6.2 Regional are likewise created in the regional level Regional Steering Committees to oversee and monitor the DENR-DILG-LGU partnership on devolved and other forest management functions. The Regional Steering Committee shall be composed of the Regional Executive Director of the DENR, the Regional Director of the DILG, the RTD for Forestry of the DENR and representatives from the Regional Leagues of Provinces, Cities and Municipalities.

The Regional Executive Director of the DENR shall initiate the first meeting of said Regional Steering Committee. The Chair and Co-Chair of the committee shall be the Regional Executive Director of DENR and the Regional Director of DILG, respectively.

The office of the RTD for Forestry shall serve as the Secretariat of the Regional Steering committee.

6.3 Provincial, City and Municipal Working Groups

Provincial, City and Municipal Working Groups may also be created to monitor the implementation of the DENR-DILG-LGU Partnership on devolved and other forest management functions in accordance with Section 7 of this Manual .

Where there are already committees in the provincial, city and municipal levels where the DENR and the LGUs are also members such as the Multisectoral Forest Protection Committees (MFPCs), ENR Councils, Provincial Development Councils, Municipal Development Councils or other similar committees, the functions of the Steering Communities and Working Groups provided above may be lodged in said committees; Provided : a) said committees are fully apprised on this Manual and their responsibilities in carrying out their mandates; b) said committees pass a written resolution resolving to carry out the mandates of this Manual; c) the monitoring of the devolved and partnership functions of the DENR and LGU is forest management be a regular item in every meeting of the committees; and d) said committees come up with a strategy on how to carry out the objectives of this Manual.

The REDs of the DENR shall report to the National Steering Committee progress along this line and recommend such other measures to effectively monitor and evaluate the devolved forest management functions and other devolved functions.

Section 7. General Procedures In the DENR-DILG-LGU Partnership on Devolved and Other Forest Management Activities

7.1 Strategic Planning

Within sixty (60) days from the effectivity of this Manual, the Regional Steering Committee shall convene provincial workshops among Governors, Mayors and their technical assistants, PENROs and CENROs, to, among others :

a) Develop a program for information, education and communication campaigns on this Manual.

b) Prepare a strategic plan on how to strengthen and institutionalize the DENR-DILG-LGU partnership on devolved and other forest management functions.

The strategic plan shall include , among others, joint land use planing, resources sharing, and training for LGU capacitation on forest management.

c) Creation of Working Groups composed of representatives from DENR, DILG and LGU in the provincial, city and municipal levels to oversee the implementation of devolved and forest management functions and the strengthening and institutionalizing DENR- DILG- LGU partnership

At the end of the workshops, the participants shall pass a resolution embodying the various agreements arrived at . Said resolution, strategic plan and the National Steering Committee through the National Technical Working Group for consideration.

7.2 Appointment or Designation of ENRO Officers

To effectively implement the devolved and partnership activities, and to fully capacitate the LGUs in forest management activities, the concerned LGU my appoint or designate an Environment and Natural Resources Officer. The creation of an ENR Office in the LGUs shall also be encouraged.

In areas where the LGUs cannot yet afford to hire an ENR Officer, or is not yet ready to appoint or designate an ENR Officer, the LGU concerned may enter into administrative arrangement with the local DENR Office such that the latter may second to the LGU either on a full time or part time basis one of its environmental officers who shall act as ENRO for the LGU.

Said seconded DENR Officer shall be the acting ENRO for the LGU. The LGU shall designate and understudy of said seconded DENR Officer

7.3 Provision of Technical Assistance

To ensure LGU capacitation in forest management and other ENR activities, the DENR shall conduct continuous training activities for LGU officials and their respective technical staff.

The Regional Steering Committees and the Provincial, City and Municipal Working Groups shall prepare the necessary training designs and sources of funds for the conduct of training. Upon request of the concerned.

7.4 Documentation of Forest Management Projects and Functions Devolved to the LGUs

Forest management projects and functions devolved from the DENR to the LGUs shall be fully documented. Documentation shall include among others a Memorandum of Agreement on projects and functions devolved, personnel, equipment and other resources so transferred from the DENR to the LGU and acceptance of the same by the LGU

The DENR Officer authorized to enter into MOA with the LGU on devolved forest management functions and projects shall be as follows:

for forest areas up to 1,000 has CENRO

more than 1,000 has up to 5,000 has PENRO

more than 5,000 has up to 15,000 has RED

more than 15,000 has up to 30,000 has Undersecretary for Field Operation Operations

more than 30,000 has

7.5 Monitoring and Evaluation

The DENR and the concerned DILG office and / or LGU shall conduct periodic monitoring of activities for the DENR-DILG-LGU partnership in devolved and other forest management functions.

Section 8. Specific Guidelines and Procedures for the effective Implementation of Devolved Forest Management Projects and Functions

8.1 Community Based Forest Management

The Community Based Forest Management Program (CBFMP) integrates all people-oriented forestry programs including the Integrated Social Forestry Program (ISFP), which have been devolved to the LGUs, Community Forestry Program (CFP), Forest Land Management Program (FLMP), Regional Resource Management Program (RRMP), Low Income Upland Community Program (LIUCP), Coastal Environment Program (CEP) and Ancestral Domains/Lands Claims Management Program (ADMP). The CBFM Program shall be strengthened through the partnership of the DENR and the LGU.

8.1.1 Existing CBFM Projects

Existing CBFM Projects shall be reviewed and assessed jointly by the PENRO, Provincial ENRO, representatives of the concerned municipal government, and CENRO having jurisdiction of the said CBFM Projects. The assessment / review shall include, but not limited to the following ;

a) Inventory of all CBFM projects within the province, city or municipality ;

b) Provision by DENR to concerned LGUs of copies of pertinent records, documents, maps and other information of all CBFM projects within the LGUs jurisdiction. In like manner, the concerned LGUs shall update DENR on status of projects already devolved to them;

c) Field assessment, of each project to determine present status, major and resources sharing in the management of the same;

f) Definition of specific roles and responsibilities of DENR, LGU (provincial, municipal/cities, barangay), Communities (or beneficiaries), and other sectors in plan implementation ;

g) Design and implementation of joint monitoring and evaluation system for each CBFM project.

8.1.2 New CBFM Projects

Implementation of new CBFM projects shall be undertaken jointly by DENR and concerned communities/beneficiaries as provided for under DENR DAO 96-29.

a) DENR through its regional, provincial and community field offices shall consult and coordinate with concerned provincial, municipal or city governments for their participation in the implementation of CBFM projects in their respective territorial jurisdiction.

b) Formulation of action plans for CBFM that will include among others :

1. Definition of specific roles/responsibilities of DENR and concerned LGUs consistent with DENR DAO 96-29 and other pertinent rules and regulations;

2. Creation of teams composed of representatives from both offices to undertake the various phases of CBFM;

3. Commitments of financial and other resources needed in CBFM implementation ;

4. Monitoring and evaluation system ;

5. Schedule of activities.

c.) DENR-LGUs Phase-out plan for project management.

8.2 Forest Protection

8.2.1 Forest Protection and Forest Law Enforcement

The DENR and the LGUs shall coordinate closely in forest protection and enforcement of forest laws and regulations.

There shall be created joint DENR-LGU forest protection teams in the regional, provincial, municipal and barangay levels, DENR shall train and deputize LGU officers as DENR officers

The DENR shall not release any forest product, tool, equipment and other conveyance seized during forest law enforcement operations without the recommendation of the concerned LGU. The disposition of forest products shall likewise jointly done by the DENR and the LGU.

8.2.2 Strengthening of the Multisectoral Forest Protection Committees

The various Multisectoral Forest Protection Committees (MFPCs) duly organized shall be strengthened. their participation in the enforcement of forest laws shall be enjoined.

The DENR shall continuously train the members of the forest protection teams and MFPCs on the various aspects of forest law enforcement to maximize and make effective their participation in forest protection and law enforcement .

8.3 Reforestation

Reforestation projects such as new reforestation projects and completed family and community-based contract reforestation project and regular reforestation projects may be devolved to the LGUs. Such devolution shall be effected by a MOA between the DENR and the concerned LGU.

8.4 Communal Forest

8.4.1 Existing Communal Forest

The devolution to and management of the communal forest by the city and municipal governments shall be governed by the following general procedures:

a) DENR , through its CENRO, and the concerned LGU shall undertake the actual identification and assessment of existing communal forests. The assessment shall determine the suitability of the existing communal forests. If these are no longer suitable, then these communal forests may be disestablished. The Approval for disestablishment shall be by the RED upon recommendation of the DENR-LGU assessment Team through the PENRO and the RTD for Forestry;

b) Existing communal forest which are found and recommended by the DENR-LGU Assessment Team as still suitable to achieve their purpose shall be maintained as such. Thereafter, the Sangguniang Panglungsod or Sangguniang Bayan where the communal forest is located shall pass resolution requesting the DENR Secretary for the turnover of said communal forest to the city or municipality. Upon receipt of said resolution, the DENR Secretary shall issue an Administrative Order officially transferring said communal forest to the concerned LGU. The DENR RED shall effect the official transfer to the concerned LGU within fifteen (15) days from the issuance of the administrative order;

c) Within twelve months form the issuance of the Administrative Order and turnover of said communal forest to the city or municipality, the LGU to which the communal forest was transferred shall formulate and submit to the Provincial ENR Council for approval a management plan governing the sustainable development of the communal forest.

For the purpose of formulating the communal forest management plan, DENR shall, in coordination with the concerned LGU, undertake a forest resource inventory and determine the sustainable level of forest resource utilization and provide the LGU technical assistance in all facets of forest management planning to ensure sustainable development . The management plan should include provision for replanting by the communities and the LGUs of the communal forests to ensure sustainability.

8.4.2 Establishment of New Communal Forest

The establishment of new communal forests shall be governed by the following guidelines :

a) DENR, through its CENRO, together with the concerned city/municipal LGU shall jointly identify potential communal forest areas within the geographic jurisdiction of the concerned city/ municipality.

b) Communal forests to be established shall be identified through a forestland use planning to be undertaken jointly between the DENR and the concerned LGU. The ensuing forestland use plan shall indicate, among others, the site and location of the communal forests within the production forest categorized as such in the forestland use plan;

c) Once the forestland use plan has been affirmed, the the local chief executive shall initiate the passage by the LGU's sanggunian of a resolution requesting the DENR Secretary to issue an Administrative Order declaring the identified area as a communal forest. The required administrative order shall be issued within sixty (60) days after receipt of the resolution ;

d) Upon acceptance of the responsibility for the communal forest, the city/municipal LGU shall formulate the management plan and submit the same to its ENR Council. The management plan shall include provision for replanting by the communities and the LGUs of the communal forests to ensure sustainability.

The communal forests of each municipality shall in no case exceed a total of 5,000 hectares.

8.5 Establishment and Management of Community Watershed Areas

8.5.1 Identification and Establishment of Community Watersheds

Pursuant to Sec. 447 (a) (5) (i) of RA 7160 mandating the Sangguniang Bayan to provide for the establishment, maintenance, protection an conservation of watersheds in their respective areas as sources of water supply for specific communities, the following guidelines shall be followed:

a) DENR, through its CENRO, together with the city/municipal LGU shall identify potential watershed areas in the city or municipal territorial jurisdiction that can be sources of water supply for specific communities :

b) Community Watershed Areas to be established shall be identified through a forestland use planning to be undertaken jointly by the DENR and the concerned LGU. The Forestland use plan shall indicate, among others, the site and location of the Community watershed;

c) Once the forestland use plan has been completed, the local chief executive shall initiate the passage by the LGU's sanggunian of a resolution requesting the DENR Secretary to issue an Administrative Order declaring the identified area as Community Watershed as sources of water supply for specific communities. The required administrative order shall be issued within sixty (60) days after receipt of the resolution;

Where there are already existing springs in forests areas in the municipalities being used as water sources by the communities, the community and the LGU shall initiate the passage of the Sangguniang Bayan resolution requesting the DENR Secretary to issue the necessary administrative order;

d) Upon acceptance of the responsibility for the community watershed the local chief executive, in consultation with the ENR Council will prepare the Management Plan. Such plan shall be submitted to the Sangguniang Bayan for approval;

For purpose of formulating the community watershed management plan, the DENR shall, in coordination with the concerned LGU, undertake a forest resource inventory and determine the sustainable level of forest and water utilization and provide the LGU technical and other assistance in all aspects of forest management planning to ensure sustainable development

8.6 Establishment and Management of Forest or Tree parks, Greenbelts and other Tourist Attractions

Pursuant to the mandate of RA 7160 requiring cities and municipalities to provide for the establishment, maintenance, protection, and conservation of tree parks, greenbelts, mangroves and similar forest development projects, the procedures laid down under Sections 8.4 and 8.5 shall be followed where the forest park, tree park, greenbelt and other tourist attraction fall within forestlands.

Section 9. Expanded DENR-LGU Partnership on Forest Management Activities

9.1 Forestland Use Planning

DENR and the concerned LGU shall jointly undertake forestland use planning, the output of which shall become an integral part of the concerned LGUs comprehensive land use plan.

For purpose of this Manual, the following general procedures shall be followed:

a) DENR Central Office shall issue an order directing the REDs to organize within sixty (60) days from issuance thereof, Forest Land Use Planning (FLUP) teams at the provincial, city and municipal levels in coordination with the concerned local chief executives. Corollarily, the concerned local chief executives shall issue the appropriate orders for their LGUs participation in the FLUP;

b) The FLUP Teams shall organize their work and undertake FLUP within twelve (12) months from their organization;

c) The FLUPs thus formulated shall be submitted to the LGU's Sanggunian for endorsement/approval and incorporation of the same to the LGU's comprehensive land use plan;

The Land Evaluation Parties of the DENR Regional Offices shall provide technical assistance to the FLUP teams.

9.2 Joint DENR-LGU Annual Planning and Budgeting for Forest Management

The DENR shall involve the participation of the LGUs in the formulation of annual plans and budgets pertaining to forest management. The LGU shall likewise involve the participation of the DENR in the preparation of its annual plan particularly in the area of forest management.

9.3 Issuance of Licenses and Permits

To Further Strengthen DENR-LGU partnership pursuant to the pertinent provisions of RA 7160, henceforth the issuance by the DENR of tenurial instruments in forestlands and for forest products utilization shall be in coordination with the LGUs as follows :

9.3.1 Approval of Operations Plan of Timber License Agreements

The concerned LGU (province, city or municipality) shall sit in the committee created by DENR to deliberate said operations plan. The comments of the LGU in the committee's deliberations shall be recommmedatory to the DENR.

9.3.2 Other Tenurial Instruments

After the applicant has submitted his application papers to the DENR, the DENR shall notify the LGU (province, city or municipality) of said pending application to solicit the comments of said LGU. The comments made by the LGU shall be advisory to the DENR for the latter's final action on the application.

Section 10. Funding

10.1 Inclusion in DENR Annual Budget and Work Plan

The DENR shall incorporate in its annual appropriations the budgetary requirements for the undertaking the tasks under this circular.

10.2 Inclusion In LGUs ‘ Budget

The LGUs' shall endeavor to provide resources to effectively carry out the mandates of this circular.

10.3 Other Assistance to the LGUs

DENR and DILG, in coordination with other concerned government agencies, shall provide assistance to the local government units in seeking technical and financial assistance from other sources in implementing the tasks under this Circular whenever such assistance is sought by the local government units.

Section 11. Repealing Clause

Any provision of DENR and DILG Administrative Orders, Memorandum Circulars or other issuances not consistent herewith are hereby repealed or modified accordingly.

Section 12. Effectivity

This joint Memorandum Circular shall take effect immediately.

(signed)

VICTOR O. RAMOS

Secretary, DENR

(signed)

EPIMACO A. VELASCO

Secretary, DILG

Appendix 5. Quirino Field Survey Report

RAPID BIODIVERSITY SURVEY OF FLORA AND FAUNA (BIRDS AND BATS) IN THE FOREST CARBON PROJECT SITE, QUIRINO PROVINCE

FIELD REPORT

Milagros Sucaldito, Nestor Bartolome, Glen Lovell Bueser, Ricardo Buenviaje, Estrella Pasion and Mariano Roy Duya

CONSERVATION INTERNATIONAL

PHILIPPINES

Background

The biodiversity monitoring team of Conservation International – Philippines together with the DENR representative and MENR Officer and staffs and local community conducted a rapid baseline survey last July 9 – 18, 2009 to monitor the species composition, diversity and distribution of the flora and fauna (birds and bats) in the four selected sites of the Forest Carbon Project in Quirino Province. Results of the research survey will provide information and will serve as baseline data for the biodiversity within the project sites and will be used for future reference to assess the effects and impacts of the reforestation and agro forestry project activities.

Study Area

There were three sites established in monitoring the flora and fauna (avifauna and bats) within the project area namely: Agroforestry/grassland (Site 1, Barangay Divisoria Sur, Maddela) wherein reforestation and agroforestry activities will be done in the area, Grass/brushland area (Site 2, Barangay San Salvador, Maddela) wherein reforestation and agroforestry will be conducted and Grass/brushland (Site 3, Barangay Sto. Nino, Maddela) where reforestation will be done. Survey was conducted from July 9 - 12, 2009 in mixed vegetation with banana, and crop plantation in Divisoria Sur, July 13 – 15, 2009 in the grassland/brushland area with patches of Gemelina and banana plantation in San Salvador, and in the area on Sto. Nino last July 15 – 18, 2009. Site visit and listing of birds and transect for flora were also conducted in Barangay Sangbay, Nagtipunan, Quirino last July 18, 2009 wherein the area can be considered as cropland/grassland area.

Methodology

Flora

For plants, the Braun-Blanquet Relevè Method was used in sampling all the areas. This method is best suited for sampling the kind of vegetation, like the project sites and areas, as it relies on a ranking scale based on percentage cover. Survey of flora had already been conducted in Divisoria Sur, Maddela. A 100 - meter long strip with a 10-meter width was laid randomly to represent each site. There were five transects established in three sites. Two transects were laid out in Site 1 (San Salvador, Maddela, Quirino), two transects were established in Site 2 (Sto. Nino, Maddela, Quirino) and one transect in Site 3 (Sangbay, Nagtipunan, Quirino). All vascular plants (trees, shrubs, photo-terrestrial herbs, grasses, sedges, lianas, epiphytes, ferns and hemi-parasites) were enumerated as they were encountered in the 100 x 10 meter transect. A score based on the "Braun-Blanquet Rating Scale" was assigned for each plant taxa to account for the percentage cover as they were encountered in the field (Table 1). Plants were photographed as an aid for the identification of plants thru comparison with the pictures available since the team was not allowed to collect specimen.

Table 1. Rating Scale

5 : Aerial shoot cover occupying 75-100% of the area sampled. 4 : Aerial shoot cover occupying 50-75% of the area sampled. 3 : Aerial shoot cover occupying 25-50% of the area sampled. 2 : Aerial shoot cover occupying 5-25% of the area sampled. 1 :Aerial shoot cover occupying less than 5% of the area; represented by numerous individuals + : Represented by few individuals; small cover. R : Rare or single encounter.

Fauna (Birds and Bats)

Survey methods involved the use of mist nets to capture both birds and bats. A one-kilometer transect line for birds observation was established for each three sites. Body weight and morphometrics were taken for each bird captured which include: wing length, tail length, tarsus length, tarsus diameter and bill length. Additional bird sightings in the sites especially those not seen during the transect survey nor caught in the nets were noted. Nomenclature, classification and distribution of birds were based on Kennedy *et al.* (2000) "A Guide to the Birds of the Philippines". The conservation status of birds was based on 2008 IUCN Red List of Threatened Species. For bats, body weight and morphometrics were taken in all captured bats which include total length (TL), tail to vent length (TV), hindfoot length (HF), external ear length (EAR), and forearm length (FA). Taxonomic key of Ingle and Heaney (1992) was used in the identification.

Results

FLORA

Based on the results of the floristic survey and assessment, the three sites differ in species composition and diversity and this is mainly due to site location and activities done in the area. Site 1 (San Salvador) consists of 53 species, is open grassland with only a few patches of trees in the surroundings. Site 3 (Sangbay) has 36 species of plants, is also grassland that was heavily grazed by animals as characterized by the small stature of grasses like the *Chrysopogon aciculatus*. Whereas, Site 2 (Sto. Nino) is a corn land that is cultivated and planted annually consists of 77 species of plants of different habit. The main reason for this is the presence of remnants of tree species which accounts to about 20% in the transect line (Table 2).

Table 2: Summary of plants recorded in the forest carbon project area.

FLORAL HABITS	**SITE 1** (San Salvador)		**SITE 2** (Santo Nino)		**SITE 3** (Sangbay)	
	Ind.	%	Ind.	%	Ind.	%

NUMBER OF HERB	53	80.5	45	58.5	25	69.5
NUMBER OF TREE	3	4.5	15	19.5	4	11.0
NUMBER OF SHRUB	5	7.5	7	10.0	2	5.5
NUMBER OF LIANE/VINE	4	6.0	8	10.5	4	11.0
NUMBER OF PALM	1	1.5	1	1	0	0
NUMBER OF BAMBOO	0	0	1	1	1	3.0
TOTAL NO. OF SPECIES	**66**	**100**	**77**	**100**	**36**	**100**

FAUNA

A total of 74 species of birds and bats were recorded in the project site (Table 3). About 22% or 16 species were Philippine endemic and only 3% or two species were Luzon endemic.

Table 3. Species richness of bats and birds recorded in the project site.

FAUNAL GROUP	**SITE 1 Divisoria Sur** Cropland/Grassland	**SITE 2 San Salvador** Grass/Brushland	**SITE 3 Sto. Nino** Crop/Brushland	**SITE 4 Sangbay** Grassland	**TOTAL**
BIRDS	**35**	**43**	**52**	**24**	**67**
BATS	**4**	**3**	**5**	**-**	**7**
TOTAL NO. OF SPECIES	**39**	**46**	**57**	**24**	**74**
NUMBER OF ENDEMIC SPECIES	**13**	**5**	**14**	**5**	**18**
NUMBER OF NET DAYS/NIGHTS	**30**	**30**	**30**	**-**	**90**
TRANSECT HOURS	**10**	**10**	*general obs.*	**-**	**30**

A total of 67 bird species were recorded in the project site comprising of 30 families (Table 4). Sixteen species of birds were endemic to the Philippines or about 24% of which two are Luzon endemic. On the other hand, about 67% or 45 species were resident; four species were resident/migrant population and one resident/introduced species.

Table 4. Species of birds listed in the three sampling sites of the forest carbon project site, Maddela Quirino Province

Scientific Name		**Common Name**	**Distribution Status**
Family Accipitridae			
1	*Pernis ptilorhynchus*	Oriental Honeybuzzard	Resident/Migrant population
2	*Haliastur indus*	Brahminy Kite	Resident
3	*Circus melanoleucos*	Pied Harrier	Resident/Migrant population

Family Rallidae			
4	*Gallirallus philippensis*	Buff-banded Rail	Resident
5	*Gallirallus striatus*	Slaty-breasted Rail	Resident
6	*Gallirallus torquatus*	Barred Rail	Resident
7	*Amaurornis phoenicurus*	White-Breasted Bush-Hen	Resident
Scientific Name		**Common Name**	**Distribution Status**
Family Turnicidae			
8	*Turnix suscitator*	Barred Buttonquail	Resident
Family Columbidae			
9	*Phapitreron leucotis*	White-eared Brown-Dove	Philippine Endemic
10	*Macropygia phasianella*	Reddish Cuckoo-Dove	Resident
11	*Streptopelia chinensis*	Spotted Dove	Resident
12	*Streptopelia bitorquata*	Island Collared-Dove	Resident
13	*Streptopelia tranquebarica*	Red Turtle-Dove	Resident
14	*Geopelia striata*	Zebra Dove	Resident
15	*Chalcophaps indica*	Common Emerald-Dove	Resident
Family Psittacidae			
16	*Loriculus philippensis*	Colasisi	Philippine Endemic
Family Cuculidae			
17	*Centropus bengalensis*	Lesser Coucal	Resident
18	*Centropus viridis*	Philippine Coucal	Philippine Endemic
Family Tytonidae			
19	*Tyto capensis*	Grass Owl	Resident
Family Apodidae			
20	*Collocalia vanikorensis*	Island Swiftlet	Resident
21	*Collacalia esculenta*	Glossy Swiflet	Resident
22	*Collacalia troglodytes*	Pygmy Swiflet	Philippine Endemic
23	*Apus pacificus*	Fork-tailed Swift	Resident/migrant populations
24	*Cypsiurus balasiensis*	Asian Palm-Swift	Resident
Family Alcedinidae			
25	*Halcyon chloris*	White -collared Kingfisher	Resident
26	*Halcyon smyrnensis*	White-throated Kingfisher	Resident
27	*Actenoides lindsayi*	Spotted Wood-Kingfisher	Philippine Endemic
Family Meropidae			
28	*Merops viridis*	Blue-throated Bee-eater	Resident
29	*Merops philippinus*	Blue-tailed Bee-eater	Resident
Family Capitonidae			
30	*Magalaima haemacephala*	Coppersmith Barbet	Resident
Family Hirundinidae			
31	*Hirundo tahitica*	Pacific Swallow	Resident
32	*Hirundo rustica*	Barn Swallow	Migrant
33	*Hirundo daurica*	Red-rumped Swallow	Resident/migrant
Family Campephagidae			

34	*Lalage nigra*	Pied Triller	Resident
Family Pycnonotidae			
35	*Hypsipetes philippinus*	Philippine Bulbul	Philippine Endemic
36	*Pycnonotus goiavier*	Yellow-vented Bulbul	Resident
Family Dicruridae			
37	*Dicrurus balicassius*	Balicassiao	Luzon Endemic
Family Oriolidae			
38	*Oriolus chinensis*	Black-naped Oriole	Resident
39	*Corvus macrorhynchos*	Large-billed Crow	Resident
Family Paridae			
40	*Parus elegans*	Elegant Tit	Philippine Endemic
Family Rhabdornithidae			
41	*Rhabdornis mystacalis*	Stripe-Headed Rhabdornis	Philippine Endemic
Scientific Name		**Common Name**	**Distribution Status**
Family Turdidae			
42	*Copsychus saularis*	Oriental Magpie-Robin	Resident
43	*Saxicola caprata*	Pied Chat	Resident
Family Sylviidae			
44	*Megalurus timoeriensis*	Tawny Grassbird	Resident
45	*Megalurus palustris*	Striated Grassbird	Resident
46	*Orthotomus castanieceps*	Philippine Tailorbird	Philippine Endemic
47	*Cisticola exilis*	Bright-Capped Cisticola	Resident
Family Muscicapidae			
48	*Rhipidura javanica*	Pied Fantail	Resident
49	*Rhipidura cyaniceps*	Blue-headed Fantail	Luzon Endemic
50	*Hypothymis azurea*	Black-naped Monarch	Resident
Family Motacillidae			
51	*Anthus novaeseelandiae*	Richard's Pipit	Resident
Family Artamidae			
52	*Artamus leucorynchus*	White-Breasted Wood-Swallow	Resident
Family Laniidae			
53	*Lanius schach*	Long-Tailed Shrike	Resident
Family Sturnidae			
54	*Aplonis panayensis*	Asian Glossy Starling	Resident
55	*Acridotheres cristatellus*	Crested Myna	Resident/ Introduced
Family Nectariniidae			
56	*Nectarinia jugularis*	Olive-backed Sunbird	Resident
Family Dicaeidae			
57	*Dicaeum bicolor*	Bicolored Flowerpecker	Philippine Endemic
58	*Dicaeum australe*	Red-keeled Flowerpecker	Philippine Endemic
59	*Dicaeum pygmaeum*	Pygmy Flowerpecker	Philippine Endemic
60	*Dicaeum hypoleucum*	Buzzing Flowerpecker	Philippine Endemic
61	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	Resident

Family Zosteropidae			
62	*Zosterops nigrorum*	Yellowish White-eye	Philippine Endemic
Family Ploceidae			
63	*Passer montanus*	Eurasian Tree Sparrow	Resident
Family Estrilidae			
64	*Padda oryzivora*	Java Sparrow	Resident
65	*Lonchura leucogastra*	White-breasted Munia	Resident
66	*Lonchura punctulata*	Scaly-breasted Munia	Resident
67	*Lonchura malacca*	Chestnut Munia	Resident

For bats, seven species were captured in the project site (Table 5). Only two species were endemic to the Philippines which include *Ptenochirus jagori* and *Rhinolophus cf. rufus*. Four species were categorized as fruit bats while three were insectivorous bats. *Cynopterus brachyotis* had the highest number of captured individuals observed within the project site. Only one individual of *Rhionolophus cf. rufus*, *Rousettus amplexicaudatus* and *Macroglossus minimus* was captured for the whole duration of the field survey.

Table 5. List of bats recorded within the project site.

	Scientific Name	**Common Name**	**Distribution and Conservation Status**
Family Pteropodidae			
1	*Cynopterus brachyotis*	Common Short-nosed fruit bat	Widespread-Abundant
2	*Macroglossus minimus*	Dagger toothed fruit bat	Widespread-Abundant
3	***Ptenochirus jagori***	Musky Fruit Bat	**Endemic-Common**
4	*Rousettus amplexicaudatus*	Common Rousette	Widespread-Abundant
Family Rhinolopidae			
5	*Rhinolophus cf. arcuatus*	Arcuate Horseshoe Bat	Widespread-Common
6	***Rhinolophus cf rufus***	Large Rufous Horseshoe Bat	**Endemic - Uncommon**
Family Vespertilionidae			
7	*Myotis cf. macrotarsus*	Philippine Large-footed Myotis	Uncommon

APPENDICES

Appendix 1. List of plant species encountered at San Salvador, Maddela, Quirino

ITEM	FAMILY NAME	GENUS	SPECIES	% COVER	HABIT	NOTES
1	ANACARDIACEAE	Semecarpus	cuneiformis	R	S	
2	ARACEAE	Amorphophalus	campanalatus	+	H	
3	COMPOSITAE	Blumea	balsamifera	+	H	
4	COMPOSITAE	Blumea	heiracifolia	1	H	
5	COMPOSITAE	Blumea	laciniata	+	H	
6	COMPOSITAE	Blumea	sp.	+	H	
7	COMPOSITAE	Chromolaena	odorata	1	H	
8	COMPOSITAE	Coryza	sumatrensis	+	H	
9	COMPOSITAE	Cyantillium	cinirea	+	H	
10	COMPOSITAE	Cyantillium	sp.1	1	H	
11	COMPOSITAE	Cyantillium	sp.2	+	H	
12	COMPOSITAE	Emilia	sonchifolia	+	H	
13	COMPOSITAE	Indet.		1	H	
14	COMPOSITAE	Mikania	cordata	1	L	
15	COMPOSITAE	Tridax	procumbens	+	H	
16	CONVULVULACEAE	Ipomoea	sp.	+	L	
17	CYPERACEAE	Cyperus	javanicus	+	H	
18	CYPERACEAE	Fimbristylis	sp.1	1	H	
19	CYPERACEAE	Fimbristylis	sp.2	1	H	
20	EUPHORBIACEAE	Chamaecyce	Hirta	+	H	
21	EUPHORBIACEAE	Chamaecyce	vachelli	+	H	
22	EUPHORBIACEAE	Macaranga	tanarius	1	T	
23	EUPHORBIACEAE	Melanolepis	multiglandulosa	+	T	
24	GRAMINAE	Digitaria	sp.1	1	H	
25	GRAMINAE	Digitaria	sp.2	1	H	
26	GRAMINAE	Digitaria	sp.3	1	H	
27	GRAMINAE	Digitaria	sp.4	+	H	
28	GRAMINAE	Imperata	cylindrical	2	H	
29	GRAMINAE	Indet.	C	+	H	
30	GRAMINAE	Maramais		+	H	
31	GRAMINAE	Mnesithea	rottboelliode	+	H	

			s			
32	GRAMINAE	Paspalum	scrobiculatum	2	H	
33	GRAMINAE	Runo		+	H	
34	GRAMINAE	Saccharum	spontaneum	2	H	
35	GRAMINAE	Urochloa	sp.1	+	H	
36	LABIATAE	Hyptis	cf. capitata	2	H	
37	LABIATAE	Hyptis	sp.1	+	H	
38	LABIATAE	Indet.		+	H	
39	LEGUMINOSAE	Indet.		1	H	
40	LEGUMINOSAE	Tephrosia	sp.1	+	H	
41	LEGUMINOSAE	Tephrosia	sp.2	R	H	
42	LEGUMINOSAE	Cf. Mimosa		+	H	
43	LEGUMINOSAE	Leucaena	leucocephala	+	S	
44	LEGUMINOSAE	Mimosa	diplitricha	1	H	
45	LEGUMINOSAE	Mimosa	pudica	1	H	
46	LEGUMINOSAE	Archidendron	sp1.	R	S	
47	LEGUMINOSAE	Crotolaria	mucronata.	R	H	
ITEM	FAMILY NAME	GENUS	SPECIES	% COVER	HABIT	NOTES
48	LEGUMINOSAE	Desmodium	sp.1	+	H	
49	LEGUMINOSAE	Gliricidia	sepium	+	S	Planted
50	LEGUMINOSAE	Uraria	sp.	+	H	
51	LYTHRACEAE	Ammania	baccifera	+	H	
52	MORACEAE	Ficus	septica	+	T	
53	MUSACEAE	Musa	sapientum	1	H	Planted
54	MYRTACEAE	Psidium	guajava	+	S	
55	PALMAE	Cocos	nucifera	+	P	Planted
56	PASSIFLORACEAE	Passiflora	sp.	R	L	
57	RUBIACEAE	Spermacoce	ocymoides	+	H	
58	RUBIACEAE	Spermacoce	sp.1	+	H	
59	RUBIACEAE	Spermacoce	sp.2	+	H	
60	SCHIZACEAE	Lygodium	japonicum	R	L	
61	SOLANACEAE	Solanum	sp.	+	H	
62	STERCULIACEAE	Waltheria	americana	1	H	
63	TILIACEAE	Triumffeta	rhomboidea	+	H	
64	VERBENACEAE	Lantana	camara	1	H	
65	VERBENACEAE	Stachytarphe	jamaicensis	1	H	

		ta				
66	INDET.	Fern	A	+	H	

Appendix 2. List of plant species encountered at Sto. Nino, Maddela, Quirino.

ITEM	FAMILY NAME	GENUS	SPECIES	% COVER	HABIT	NOTES
1	ANACARDIACEAE	Semecarpus	cuneiformis	+	T	
2	ANNONACEAE	Mithrephora	sp.	R	T	
3	APOCYNACEAE	Alstonia	scholaris	+	T	
4	MORACEAE	Alaeanthus	luzonicus	R	T	
5	APOCYNACEAE	Tabernaemontana	pandacaqui	+	S	
6	ARACEAE	Amorphophalus	campanalatus	+	H	
7	ARACEAE	Colocasia	sp.	+	H	Planted
8	CARICACEAE	Carica	papaya	R	H	Planted
9	COMPOSITAE	Blumea	heiracifolia	+	H	
10	COMPOSITAE	Chromolaena	odorata	+	H	
11	COMPOSITAE	Cyantillium	sp.1	1	H	
12	COMPOSITAE	Mikania	cordata	1	L	
13	CONVULVULACEAE	Ipomoea	sp.	2	L	
14	CYPERACEAE	Cyperus	javanicus	+	H	
15	CYPERACEAE	Scleria	scrobiculata	+	H	
16	EBENACEAE	Diospyros	sp.	R	T	
17	EUPHORBIACEAE	Mallotus	philippensis	+	T	
18	EUPHORBIACEAE	Chamaecyce	hirta	1	H	
19	EUPHORBIACEAE	Chamaecyce	vachelli	+	H	
20	EUPHORBIACEAE	Glochidion	urophylloides	R	S	
21	EUPHORBIACEAE	Macaranga	tanarius	+	T	
22	EUPHORBIACEAE	Manihot	esculenta	3	H	
23	EUPHORBIACE	Melanolepis	multiglandul	+	T	

	AE		osa			
24	GRAMINAE	Bambusa		R	B	
25	GRAMINAE	Digitaria	sp.1	2	H	
26	GRAMINAE	Digitaria	sp.4	2	H	
27	GRAMINAE	Imperata	cylindrical	1	H	
ITEM	FAMILY NAME	GENUS	SPECIES	% COVER	HABIT	NOTES
28	GRAMINAE	Indet.	A	2	H	
29	GRAMINAE	Indet.	B	+	H	
30	GRAMINAE	Mnesithea	rottboelliodes	2	H	
31	GRAMINAE	Paspalum	scrobiculatum	2	H	
32	GRAMINAE	Saccharum	spontaneum	+	H	
33	GRAMINAE	Urochloa	sp.1	+	H	
34	LABIATAE	Hyptis	cf. capitata	+	H	
35	LABIATAE	Hyptis	sp.1	1	H	
36	LABIATAE	Spermacoce	ocymoides	1	H	
37	LAURACEAE	Litsea	glutinosa	+	S	
38	LEGUMINOSAE	Indet.		3	L	
39	LEGUMINOSAE	Leucaena	leucocephala	+	T	
40	LEGUMINOSAE	Mimosa	Pudica	1	H	
41	LEGUMINOSAE	Albizia	procera	R	L	
42	LEGUMINOSAE	Archidendron	sp1.	R	T	
43	LEGUMINOSAE	Gliricidia	sepium	+	S	
44	LEGUMINOSAE	Pterocarpus	indicus	+	T	
45	MARANTACEAE	Donax	cannaeformis	+	H	
46	MORACEAE	Ficus	botryocarpa	+	T	
47	MORACEAE	Ficus	Nota	R	S	
48	MORACEAE	Ficus	septica	+	T	
49	MORACEAE	Ficus	variegata	R	T	
50	MUSACEAE	Musa	sapientum	1	H	Planted
51	MYRTACEAE	Psidium	guajava	1	S	
52	PALMAE	Levistonia	cf. merillii	R	P	
53	PASSIFLORACEAE	Passiflora	cf. philippinensis	+	L	
54	POACEAE	Zea	Mays	1	H	Planted
55	RHAMNACEAE	Gouania	sp.	+	L	
56	RUBIACEAE	Spermacoce	hispida	+	H	

57	RUBIACEAE	Spermacoce	ocymoides	+	H	
58	RUBIACEAE	Spermacoce	sp.1	2	H	
59	SCHIZACEAE	Lygodium	japonicum	+	L	
60	SOLANACEAE	Capsicum	sp.	R	H	
61	SOLANACEAE	Solanum	sp.	R	H	
62	STERCULIACEAE	Waltheria	americana	+	H	
63	TILIACEAE	Triumffeta	rhomboidea	+	H	
64	VERBENACEAE	Gmelina	arborea	+	T	Planted
65	VERBENACEAE	Stachytarpheta	jamaicensis	1	H	
66	VITACEAE	Tetrastigma	sp.	+	L	
67	ZINGIBERACEAE	Indet.		+	H	
68	INDET.	Herb	A	+	H	
69	INDET.	Parukpok		+	H	
70	INDET.	Violet flower		+	H	
71	INDET.	Edible		+	H	
72	INDET.	Barsanga		2	H	
73	INDET.	Purikit		2	H	
74	INDET.	Shrub		+	S	
75	INDET.	Sili-sili		2	H	
76	INDET.	Fern	B	1	H	

Appendix 3. List of plant species encountered at Sangbay, Nagtipunan, Quirino.

ITEM	FAMILY NAME	GENUS	SPECIES	% COVER	HABIT	NOTES
1	COMPOSITAE	Chromolaena	odorata	1	H	
2	COMPOSITAE	Cyantillium	cinireum	1	H	
3	COMPOSITAE	Cyantillium	sp.1	1	H	
4	COMPOSITAE	Emilia	senchifolia	1	H	
5	COMPOSITAE	Mikania	cordata	1	L	
6	CYPERACEAE	Fimbristylis	sp.1	1	H	
7	EUPHORBIACEAE	Mallotus	philippensis	R	T	
8	EUPHORBIACEAE	Macaranga	tanarius	R	T	
9	GRAMINAE	Bambusa		R	B	
10	GRAMINAE	Chrysopogon	aciculatus	5	H	
11	GRAMINAE	Imperata	cylindrical	1	H	

12	GRAMINAE	Indet.	D	1	H	
13	GRAMINAE	Paspalum	scrobiculatum	1	H	
14	GRAMINAE	Saccharum	spontaneum	1	H	
15	LABIATAE	Hyptis	suaveolens	+	H	
16	LEGUMINOSAE	Indet.		+	L	
17	LEGUMINOSAE	Mimosa	pudica	1	H	
18	LYTHRACEAE	Ammania	baccifera	1	H	
19	MELASTOMATACEAE	Melastoma	malabathricum	R	S	
20	MORACEAE	Ficus	variegata	+	T	
21	MYRSINACEAE	Embelia	sp.	R	L	
22	MYRTACEAE	Psidium	guajava	+	S	
23	LABIATAE	Indet.		1	H	
24	RUBIACEAE	Spermacoce	ocymoides	1	H	
25	RUBIACEAE	Spermacoce	sp.1	1	H	
26	SCHIZACEAE	Lygodium	japonicum	+	L	
27	SOLANACEAE	Solanum	sp.	+	H	
28	STERCULIACEAE	Waltheria	americana	R	H	
29	TILIACEAE	Triumffeta	rhomboidea	+	H	
30	VERBENACEAE	Gmelina	arborea	+	T	Planted
31	VERBENACEAE	Lantana	camara	+	H	
32	VERBENACEAE	Stachytarpheta	jamaicensis	+	H	
33	VERBENACEAE	Stachytarpheta	sp.2	+	H	
34	INDET.	Herb	B	1	H	
35	INDET.	Purikit		1	H	
36	INDET.	Barsanga		1	H	

Appendix 4. List of plant species encountered within the project site.

ITEM	FAMILY NAME	GENUS	SPECIES	SITE 1	SITE 2	SITE 3
1	ANACARDIACEAE	Semecarpus	cuneiformis	x	x	
2	ANNONACEAE	Mithrephora	sp.		x	
3	APOCYNACEAE	Alstonia	scholaris		x	
4	APOCYNACEAE	Tabernaemontana	pandacaqui		x	
5	ARACEAE	Amorphophalus	campanalatus	x	x	
6	ARACEAE	Colocasia	sp.		x	
7	CARICACEAE	Carica	papaya		x	
8	COMPOSITAE	Blumea	balsamifera	x		
9	COMPOSITAE	Blumea	heiracifolia	x	x	
10	COMPOSITAE	Blumea	laciniata	x		
11	COMPOSITAE	Blumea	sp.	x		
12	COMPOSITAE	Chromolaena	odorata	x	x	x
13	COMPOSITAE	Coryza	sumatrensis	x		
14	COMPOSITAE	Cyantillium	cinireum	x		x
15	COMPOSITAE	Cyantillium	sp.1	x	x	x
16	COMPOSITAE	Cyantillium	sp.2	x		
17	COMPOSITAE	Emilia	senchifolia			x
18	COMPOSITAE	Emilia	sonchifolia	x		
19	COMPOSITAE	Indet.		x		
20	COMPOSITAE	Mikania	cordata	x	x	x
21	COMPOSITAE	Tridax	procumbens	x		
22	CONVULVULACEAE	Ipomoea	sp.	x	x	
23	CYPERACEAE	Cyperus	javanicus	x	x	
24	CYPERACEAE	Fimbristylis	sp.1	x		x
25	CYPERACEAE	Fimbristylis	sp.2	x		
26	CYPERACEAE	Scleria	scrobiculata		x	
27	EBENACEAE	Diospyros	sp.		x	
28	EUPHORBIACEAE	Chamaecyce	hirta	x	x	
29	EUPHORBIACEAE	Chamaecyce	vachelli	x	x	
30	EUPHORBIACEAE	Glochidion	urophylloides		x	
31	EUPHORBIACEAE	Macaranga	tanarius	x	x	x
32	EUPHORBIACEAE	Mallotus	philippensis		x	x
33	EUPHORBIACEAE	Manihot	esculenta		x	
34	EUPHORBIACEAE	Melanolepis	multiglandulosa	x	x	
35	GRAMINAE	Bambusa			x	x
36	GRAMINAE	Chrysopogon	aciculatus			x
37	GRAMINAE	Digitaria	sp.1	x	x	
38	GRAMINAE	Digitaria	sp.2	x		
39	GRAMINAE	Digitaria	sp.3	x		
40	GRAMINAE	Digitaria	sp.4	x	x	
41	GRAMINAE	Imperata	cylindrical	x	x	x

42	GRAMINAE	Indet.	A		x	
43	GRAMINAE	Indet.	B		x	
44	GRAMINAE	Indet.	C	x		
45	GRAMINAE	Indet.	D			x
ITEM	FAMILY NAME	GENUS	SPECIES	SITE 1	SITE 2	SITE 3
46	GRAMINAE	Maramais		x		
47	GRAMINAE	Mnesithea	rottboelliodes	x	x	
48	GRAMINAE	Paspalum	scrobiculatum	x	x	x
49	GRAMINAE	Runo		x		
50	GRAMINAE	Saccharum	spontaneum	x	x	x
51	GRAMINAE	Urochloa	sp.1	x	x	
52	LABIATAE	Hyptis	cf. capitata	x	x	
53	LABIATAE	Hyptis	sp.1	x	x	
54	LABIATAE	Hyptis	suaveolens			x
55	LABIATAE	Indet.		x		
56	LABIATAE	Indetermined				x
57	LABIATAE	Spermacoce	ocymoides		x	
58	LAURACEAE	Litsea	glutinosa		x	
59	LEGUMINOSAE	Albizia	procera		x	
60	LEGUMINOSAE	Archidendron	sp1.	x	x	
61	LEGUMINOSAE	Cf. Mimosa		x		
62	LEGUMINOSAE	Crotolaria	mucronata.	x		
63	LEGUMINOSAE	Desmodium	sp.1	x		
64	LEGUMINOSAE	Gliricidia	sepium	x	x	
65	LEGUMINOSAE	Indet.			x	
66	LEGUMINOSAE	Indet.		x		
67	LEGUMINOSAE	Indet.				x
68	LEGUMINOSAE	Leucaena	leucocephala	x	x	
69	LEGUMINOSAE	Mimosa	diplitricha	x		
70	LEGUMINOSAE	Mimosa	Pudica	x	x	x
71	LEGUMINOSAE	Pterocarpus	indicus		x	
72	LEGUMINOSAE	Tephrosia	sp.1	x		
73	LEGUMINOSAE	Tephrosia	sp.2	x		
74	LEGUMINOSAE	Uraria	sp.	x		
75	LYTHRACEAE	Ammania	baccifera	x		x
76	MARANTACEAE	Donax	cannaeformis		x	
77	MELASTOMATACEAE	Melastoma	malabathricum			x
78	MORACEAE	Alaeanthus	luzonicus		x	
79	MORACEAE	Ficus	botryocarpa		x	
80	MORACEAE	Ficus	Nota		x	
81	MORACEAE	Ficus	septica	x	x	
82	MORACEAE	Ficus	variegata		x	x
83	MUSACEAE	Musa	sapientum	x	x	

84	MYRSINACEAE	Embelia	sp.			x
85	MYRTACEAE	Psidium	guajava	x	x	x
86	PALMAE	Cocos	nucifera	x		
87	PALMAE	Levistonia	cf. merillii		x	
88	PASSIFLORACEAE	Passiflora	cf. philippinensis		x	
89	PASSIFLORACEAE	Passiflora	sp.	x		
90	POACEAE	Zea	Mays		x	
91	RHAMNACEAE	Gouania	sp.		x	
ITEM	FAMILY NAME	GENUS	SPECIES	SITE 1	SITE 2	SITE 3
92	RUBIACEAE	Spermacoce	hispida		x	
93	RUBIACEAE	Spermacoce	ocymoides	x	x	x
94	RUBIACEAE	Spermacoce	sp.1	x	x	x
95	RUBIACEAE	Spermacoce	sp.2	x		
96	SCHIZACEAE	Lygodium	japonicum	x	x	x
97	SOLANACEAE	Capsicum	sp.		x	
98	SOLANACEAE	Solanum	sp.	x	x	x
99	STERCULIACEAE	Waltheria	americana	x	x	x
100	TILIACEAE	Triumffeta	rhomboidea	x	x	x
101	VERBENACEAE	Gmelina	arborea		x	x
102	VERBENACEAE	Lantana	camara	x		x
103	VERBENACEAE	Stachytarpheta	jamaicensis	x	x	x
104	VERBENACEAE	Stachytarpheta	sp.2			x
105	VITACEAE	Tetrastigma	sp.		x	
106	ZINGIBERACEAE	Indet.			x	
107	INDET.	Barsanga			x	x
108	INDET.	Edible			x	
109	INDET.	Fern	A	x		
110	INDET.	Fern	B		x	
111	INDET.	Herb	A		x	
112	INDET.	Herb	B		x	x
113	INDET.	Parukpok			x	
114	INDET.	Purikit			x	x
115	INDET.	Shrub			x	
116	INDET.	Sili-sili			x	
117	INDET.	Violet flower			x	

Appendix 5. List of bird species captured within the project site.

Scientific Name		**Common Name**	**Distribution Status**	**Site 1**	**Site 2**	**Site 3**
Family Apodidae						
1	*Collocalia*	Island Swiftlet	Resident			3

	vanikorensis					
2	*Collacalia troglodytes*	Pygmy Swiftlet	Philippine Endemic	1		1
Family Alcedinidae						
3	*Halcyon smyrnensis*	White-throated Kingfisher	Resident			4
4	*Actenoides lindsayi*	Spotted Wood-Kingfisher	Philippine Endemic	1		
Family Meropidae						
5	*Merops viridis*	Blue-throated Bee-eater	Resident	3		
6	*Merops philippinus*	Blue-tailed Bee-eater	Resident		1	
Family Capitonidae						
7	*Magalaima haemacephala*	Coppersmith Barbet	Resident	3		1
Family Hirundinidae						
8	*Hirundo daurica*	Red-rumped Swallow	Resident/migrant		1	
Family Campephagidae						
9	*Lalage nigra*	Pied Triller	Resident			1
Family Pycnonotidae						
10	*Hypsipetes philippinus*	Philippine Bulbul	Philippine Endemic	6		1
11	*Pycnonotus goiavier*	Yellow-vented Bulbul	Resident	11	2	11
Scientific Name		**Common Name**	**Distribution Status**	**Site 1**	**Site 2**	**Site 3**
Family Dicruridae						
12	*Dicrurus balicassius*	Balicassiao	Luzon Endemic			1
Family Paridae						
13	*Parus elegans*	Elegant Tit	Philippine Endemic			3
Family Rhabdornithidae						
14	*Rhabdornis mystacalis*	Stripe-Headed Rhabdornis	Philippine Endemic			2
Family Turdidae						
15	*Saxicola caprata*	Pied Bushchat	Resident			2
Family Sylviidae						
16	*Megalurus palustris*	Striated Grassbird	Resident		8	
Family Muscicapidae						

17	*Rhipidura javanica*	Pied Fantail	Resident		2	
Family Laniidae						
18	*Lanius schach*	Long-Tailed Shrike	Resident		4	
Family Dicaeidae						
19	*Dicaeum pygmaeum*	Pygmy Flowerpecker	Philippine Endemic	1		
20	*Dicaeum hypoleucum*	Buzzing Flowerpecker	Philippine Endemic	1		
21	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	Resident			1
Family Zosteropidae						
22	*Zosterops nigrorum*	Yellowish White-eye	Philippine Endemic	1		
Family Ploceidae						
23	*Passer montanus*	Eurasian Tree Sparrow	Resident		1	
Family Estrilidae						
24	*Lonchura leucogastra*	White-breasted Munia	Resident			4
25	*Lonchura punctulata*	Scaly-breasted Munia	Resident	1		2
26	*Lonchura malacca*	Chestnut Munia	Resident	1	1	
			TOTAL	30	20	37

Appendix 6. List of bird species recorded within the project site, Quirino Province

Scientific Name		**Common Name**	**Distribution Status**	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Family Accipitridae							
1	*Pernis ptilorhynchus*	Oriental Honeybuzzard	Resident/Migrant population	x			
2	*Haliastur indus*	Brahminy Kite	Resident	x		x	x
3	*Circus melanoleucos*	Pied Harrier	Resident/Migrant population		x		
Family Rallidae							
4	*Gallirallus philippensis*	Buff-banded Rail	Resident		x		
5	*Gallirallus striatus*	Slaty-breasted Rail	Resident		x		
6	*Gallirallus torquatus*	Barred Rail	Resident	x	x		x
7	*Amaurornis phoenicurus*	White-Breasted Bush-Hen	Resident	x	x		x
Family Turnicidae							
8	*Turnix suscitator*	Barred Buttonquail	Resident		x	x	
Family Columbidae							
9	*Phapitreron leucotis*	White-eared Brown-Dove	Philippine Endemic	x	x	x	x

10	*Macropygia phasianella*	Reddish Cuckoo-Dove	Resident	x			
11	*Streptopelia chinensis*	Spotted Dove	Resident		x	x	x
12	*Streptopelia bitorquata*	Island Collared-Dove	Resident		x		
13	*Streptopelia tranquebarica*	Red Turtle-Dove	Resident		x		
14	*Geopelia striata*	Zebra Dove	Resident		x	x	
15	*Chalcophaps indica*	Common Emerald-Dove	Resident	x		x	
Scientific Name		**Common Name**	**Distribution Status**	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Family Psittacidae							
16	*Loriculus philippensis*	Colasisi	Philippine Endemic			x	
Family Cuculidae							
17	*Centropus bengalensis*	Lesser Coucal	Resident	x	x	x	
18	*Centropus viridis*	Philippine Coucal	Philippine Endemic	x	x	x	x
Family Tytonidae							
19	*Tyto capensis*	Grass Owl	Resident		x		
Family Apodidae							
20	*Collocalia vanikorensis*	Island Swiftlet	Resident			x	x
21	*Collacalia esculenta*	Glossy Swiflet	Resident	x	x	x	x
22	*Collacalia troglodytes*	Pygmy Swiflet	Philippine Endemic	x	x	x	x
23	*Apus pacificus*	Fork-tailed Swift	Resident/migrant populations	x	x	x	
24	*Cypsiurus balasiensis*	Asian Palm-Swift	Resident	x	x	x	
Family Alcedinidae							
25	*Halcyon chloris*	White -collared Kingfisher	Resident			x	
26	*Halcyon smyrnensis*	White-throated Kingfisher	Resident	x	x	x	
27	*Actenoides lindsayi*	Spotted Wood-Kingfisher	Philippine Endemic	x			
Family Meropidae							
28	*Merops viridis*	Blue-throated Bee-eater	Resident	x	x	x	x
29	*Merops philippinus*	Blue-tailed Bee-eater	Resident			x	
Family Capitonidae							

30	*Magalaima haemacephala*	Coppersmith Barbet	Resident	x	x	x	x
Family Hirundinidae							
31	*Hirundo tahitica*	Pacific Swallow	Resident	x	x	x	x
32	*Hirundo rustica*	Barn Swallow	Migrant		x	x	
33	*Hirundo daurica*	Red-rumped Swallow	Resident/migrant		x		
Family Campephagidae							
34	*Lalage nigra*	Pied Triller	Resident		x	x	
Family Pycnonotidae							
35	*Hypsipetes philippinus*	Philippine Bulbul	Philippine Endemic	x		x	x
36	*Pycnonotus goiavier*	Yellow-vented Bulbul	Resident	x	x	x	x
Family Dicruridae							
37	*Dicrurus balicassius*	Balicassiao	Luzon Endemic			x	
Family Oriolidae							
38	*Oriolus chinensis*	Black-naped Oriole	Resident	x	x	x	
39	*Corvus macrorhynchos*	Large-billed Crow	Resident		x	x	
Family Paridae							
40	*Parus elegans*	Elegant Tit	Philippine Endemic	x		x	
Family Rhabdornithidae							
41	*Rhabdornis mystacalis*	Stripe-Headed Rhabdornis	Philippine Endemic			x	
Family Turdidae							
42	*Copsychus saularis*	Oriental Magpie-Robin	Resident	x	x	x	x
43	*Saxicola caprata*	Pied Chat	Resident		x	x	x
Family Sylviidae							
44	*Megalurus timoeriensis*	Tawny Grassbird	Resident		x	x	x
45	*Megalurus palustris*	Striated Grassbird	Resident		x	x	x
46	*Orthotomus castanieceps*	Philippine Tailorbird	Philippine Endemic	x	x	x	x
47	*Cisticola exilis*	Bright-Capped Cisticola	Resident		x	x	x
Family Muscicapidae							
48	*Rhipidura javanica*	Pied Fantail	Resident		x	x	
Scientific Name		**Common Name**	**Distribution Status**	**Site 1**	**Site 2**	**Site 3**	**Site 4**
49	*Rhipidura cyaniceps*	Blue-headed Fantail	Luzon Endemic			x	
50	*Hypothymis azurea*	Black-naped Monarch	Resident	x		x	

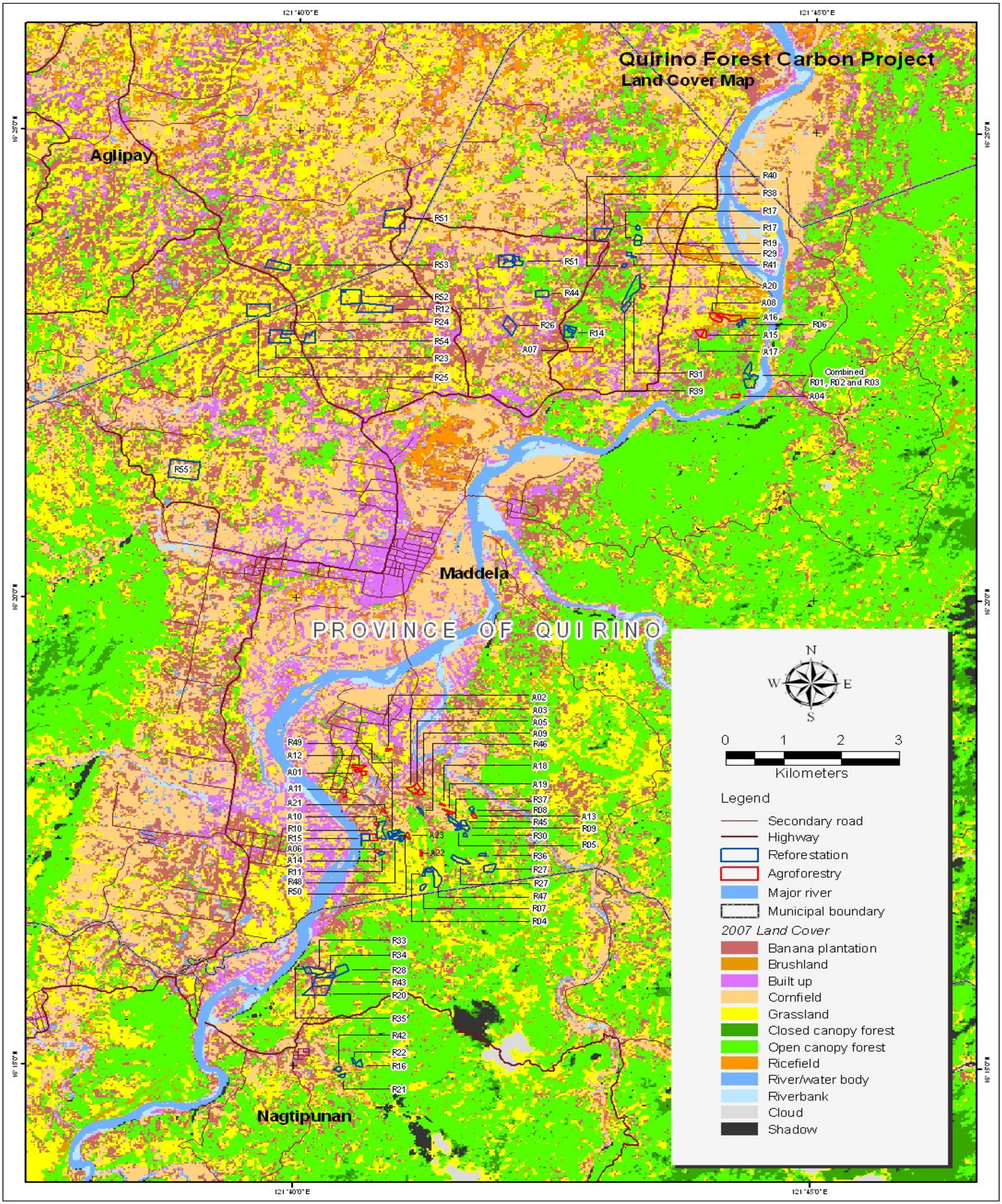
Family Motacillidae							
51	*Anthus novaeseelandiae*	Richard's Pipit	Resident			x	
Family Artamidae							
52	*Artamus leucorynchus*	White-Breasted Wood-Swallow	Resident		x	x	
Family Laniidae							
53	*Lanius schach*	Long-Tailed Shrike	Resident		x	x	x
Family Sturnidae							
54	*Aplonis panayensis*	Asian Glossy Starling	Resident			x	
55	*Acridotheres cristatellus*	Crested Myna	Resident/ Introduced	x	x	x	
Family Nectariniidae							
56	*Nectarinia jugularis*	Olive-backed Sunbird	Resident	x	x	x	x
Family Dicaeidae							
57	*Dicaeum bicolor*	Bicolored Flowerpecker	Philippine Endemic	x			
58	*Dicaeum australe*	Red-keeled Flowerpecker	Philippine Endemic	x	x	x	
59	*Dicaeum pygmaeum*	Pygmy Flowerpecker	Philippine Endemic	x			
60	*Dicaeum hypoleucum*	Buzzing Flowerpecker	Philippine Endemic	x			
61	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	Resident	x		x	
Family Zosteropidae							
62	*Zosterops nigrorum*	Yellowish White-eye	Philippine Endemic	x		x	
Family Ploceidae							
63	*Passer montanus*	Eurasian Tree Sparrow	Resident		x	x	x
Family Estrilidae							
64	*Padda oryzivora*	Java Sparrow	Resident			x	
65	*Lonchura leucogastra*	White-breasted Munia	Resident		x	x	
66	*Lonchura punctulata*	Scaly-breasted Munia	Resident	x	x	x	x
67	*Lonchura malacca*	Chestnut Munia	Resident	x	x	x	

Appendix 7. List of bats captured in the project site.

Scientific Name	**Common Name**	**Distribution and Conservation Status**	**Site 1** Divisoria Sur	**Site 2** San Salvador	**Site 3** Sto. Nino
ORDER CHIROPTERA					
Family Pteropodidae					

1	*Cynopterus brachyotis*	Common Short-nosed fruit bat	Widespread-Abundant	34	14	16
2	*Macroglossus minimus*	Dagger toothed fruit bat	Widespread-Abundant	1		
3	***Ptenochirus jagori***	Musky Fruit Bat	**Endemic-Common**	7		1
4	*Rousettus amplexicaudatus*	Common Rousette	Widespread-Abundant		1	
Family Rhinolopidae						
5	*Rhinolophus cf. arcuatus*	Arcuate Horseshoe Bat	Widespread-Common	3		3
6	***Rhinolophus cf rufus***	Large Rufous Horseshoe Bat	**Endemic - Uncommon**			1
Family Vespertilionidae						
7	*Myotis cf. macrotarsus*	Philippine Large-footed Myotis	Uncommon		1	3
			TOTAL	45	16	24

Appendix 6. Large map o f the project area



Appendix 6. Additional attachement -GPS Readings- Lot parcels coordinates
(In separate file)

Appendix 7. Notarized MOA (In separate file)

Appendix 8. Reforestation Contract with Private Owner
(In separate file)

Appendix 9. Further risk assessment of the project performed as part of VCS Project Description

The risk analysis and buffer determination were conducted by applying the step 1 of "Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination".

Sub-step 1a: Determination of the risk factors applicable to all project types

Risk factor	**Project assessment**	**Risk rating**
Project risk		
Risk of unclear land tenure and potential for disputes	In the case of the Project, Divisoria Sur Agroforestry Farmers Association (DSAFA) and Sto. Nino Integrated Social Forestry Association (STISFA) are the People's Organization that have Community-based Forest Management (CBFM) Agreements with the DENR. The Agreement is valid through 2013, and renewable through 2037, which covers the entire project duration. Before the project activity expands to the full 177ha, the project will involve additional POs, namely the Sangbay-Anak Integrated Farmers Association and a PO to be newly formed in Cofcaville. The land tenure system is in its transition stage. Each individual participant occupying public land has a land tenure instrument from old system, Integrated Social Forestry (ISF). ISF is planned to be incorporated into CBFM. In the appendices, a sample copy of Certificate of Stewardship Contract (Appendix 3) and DENR-DILG Joint Memorandum Circular 98-01 Section 8 (Appendix 4) are provided. Land tenure instrument for Integrated Social Forestry is renewable for a second term of 25 years upon termination of the first 25 year ISF Agreement between the DENR and qualified land holder as provided. The agreement further stipulates that beyond the 25-year second cycle, the tenure can automatically be turn-over to the next heirs of the CSC holder, which means first cycle of 25 year agreement will again start. Beyond the second 25 year cycle, a bridging instrument of tenure will adopt the Tree for Legacy Program which the government considers as one among the best innovations in tree farming and	Low

	building green infrastructures both in the urban and rural landscapes. The system adopts a more secure instrument of tree ownership. Tree ownership will be ensured with the Issuance of Tree Certificates which are officially recorded and kept at the municipal and provincial Registry of Deeds. In the project the relevant certificates to be issued will be the Certificate of Tree for Posterity as this component of the Tree for Legacy Program stipulates that the tree owned will permanently be maintained with the owner. On top of his ownership, will benefit on usufruct privileges like collecting fruits and other products without due damage to the biomass of the trees owned. There are several parcels under private landownership (i.e., Alienable and Disposable, or A & D category). The landowners of such parcels are contributing their parcels to the project on their free will. The participating private landowners will be signing an agreement document with the Project (Appendix 5).	
Risk of financial failure	One of the pitfalls in project implementation in the Philippines is the collapse of development efforts initiated by the project once the funding ends. One reason for this is the short duration of these projects (typically 3-5 years) which is not enough to institutionalize the changes introduced. Rather than using the initial funding to cover the reforestation and agroforestry activities on the entire project area for only a few years, the Project is set up to cover all necessary operations for the part of project area for 20 years. Twenty years should allow ample time for community development to be firmly grounded. The revenue as result of successful marketing of the VCUs will be used to expand the activities on the remaining project area. Inadequate and unstable household income to support food and basic needs of the family can lead project participants to divert their attention and abandon the project. To address this risk, project partner-institutions like the local government units at the municipal and provincial levels are encouraged to allocate resources from their development funds to support the participants in terms of complementary livelihood, technical and	Low

	marketing assistance. Finally, the project will be implemented in partnership with Palacian Economic Development Association Inc (PEDAI), a local NGO based in Quirino with the mission of supporting local livelihoods by providing technical and financial support through microlending program as the facilitator for the project implementation process. Funding support for this Project comes primarily as grant from MoreTrees, a Japanese carbon offset provider.	
Risk of technical failure	The technology is primarily involved in planting of tree species, maintenance and management of smallholder lots, and will be also provided by CIP and DENR.	Low
Risk of management failure	CIP will be responsible for the overall implementation of this project as a project manager establishing the project implementation mechanism with various local stakeholders. Under its Sierra Madre Biodiversity Corridor (SMBC) strategy, CIP will collaborate with DENR, LGUs within the project site and the local communities involved. CIP Country Office in Manila through its Executive Director and the technical and operations support units provide project oversight and policy support, with the responsibility for project execution being designated to the SMBC Program Manager. To provide technical backstopping are five (5) SMBC technical staff members who have accumulated actual field experience in executing the different activities of the project. As the need arises or deemed appropriate, local NGO-partners of CIP who are capable as subgrantees maybe engaged to execute the reforestation and agroforestry field activities. Furthermore, CIP receives appropriate technical, managerial and coordination assistance from CI-Headquarters and CI-Japan.	Low
Economic risk		
Risk of rising land opportunity costs that cause reversal of sequestration and/or protection	The parcels to be reforested or to be used for agroforestry in the Project are currently used for marginal agriculture and grazing due to low productivity of the land. The field surveys and interviews with stakeholders indicated that the only realistic and credible alternative available to the project participants is to continue the current marginal agricultural practices. The cost structure of	Low

	corn farming is also available.	
Regulatory and social risk		
Risk of political instability	Philippines is a democratic society and within the proposed project area no on going insurrection, national disobedience or signs of political instability were present, and Quirino Province as a whole is politically stable. Quirino Forestry Management Plan is long-term plan and not subject to change by change in leadership. Quirino is the first province that passed logging moratorium.	Low
Risk of social instability	In addition to the above discussion, the level of awareness for natural resource conservation is high. The project will reinforce the awareness through community education activities. Poverty is a source of concern for forest sustainability. The project will broaden livelihood options, as well as provide financial mechanism.	Low
Natural disturbance risk		
Risk of devastating fire	No devastating fire events have been recorded in the area. To further lower the risk, the project will implement fire prevention as described in section 1.9. Before the summer season, firelines/firebreaks will be established per compartment. The size of the firebreak should be at least 5-meter minimum to 8 meters maximum in width depending on the slope of the area for the firebreak to be constructed.	Low
Risk of pest and disease attacks	Pest and pathogens are not a consideration for the project. The proposed use of native species for reforestation mitigates the risks of pest and disease occurrence for the proposed sites. Some minor pathogen may reduce fruits yield, but unlikely to negatively impact growth of the species.	Low
Risk of extreme weather events (e.g. floods, drought, winds)	Indigenous species shall be used as they naturally adapt to local conditions. Agroforestry species will also be selected based on species suited to local climate and conditions. Agroforestry sites will have windbreaks established. All parcels are not in low-lying areas; thus they are not prone to flooding (parcels are far from rivers).	Low
Geological risk (e.g. volcanoes, earthquakes, landslides)	There have not been significant landslides recorded in the area. Sierra Madre in Quirino is not volcanic.	Low

The overall project risk, based on the above, is considered low risk.

Sub-step 1b: Determination of the risk factors associated with the specific project types

Risk factor	Project assessment	Risk Rating
Project longevity/Commitment period	**Medium-term commitment with harvesting** Under ISF or later CBFM, the CSC holders pledge to maintain the forest during the first 25 year ISF Agreement and further 25 year second cycle, the earliest expiration of the second cycle of the CSC will be 2037. Beyond the second 25 year cycle, a bridging instrument of tenure will adopt the Tree for Legacy Program which the government considers as one among the best innovations in tree farming and building green infrastructures both in the urban and rural landscapes. The system adopts a more secure instrument of tree ownership. Tree ownership will be ensured with the Issuance of Tree Certificates which are officially recorded and kept at the municipal and provincial Registry of Deeds. In the project the relevant certificates to be issued will be the Certificate of Tree for Posterity as this component of the Tree for Legacy Program stipulates that the tree owned will permanently be maintained with the owner, therefore, the project lifetime is indefinitely longer than 30 years, until when the tenure holder are required to maintain the forest, from the first plantation in 2007.	**High**
Ownership type and user rights	**Established NGO or conservation agency owner; or owner-operated private land / Rented or tenant-operated land** Rights to the emission removals will belong to the People's Organizations, namely, the Divisorla Sur Agroforestry Farmers Association (DSAFA), the Sto. Nino Integrated Social Forestry Association (STISFA), and Sangbay Integrated Farmers Association (SAIFA) which will be transferred to and be registered by the donor of the project according to the Memorandum of Agreement of the Project.	**Low-Medium**
Technical capability	**Proven technologies and ready access to relevant expertise** The following technical skills have been identified to be required for the successful implementation of the project, and members of the management team who possess and provide these skills have also been identified. - Nursery operation and seedlings preparation,	**Low**

	propagation of indigenous species - Forest/Agroforestry establishment, care and maintenance; seedling planting and maintenance - Agroforestry farm planning and implementation - Surveying and mapping - Community organization for planning - Community capacity building	
Financial capacity	**Financial backing from established financial institutions, NGOs and/or governments**	**Low**
	The initial funding will secure all project activities for the first 41 hectares until 2029. The donor, MoreTrees, will be providing funding to cover operations for additional 136 hectares (total 177 hectares) on annual basis. The source of funds is their fund-raising activities to their partners. This will include marketing of VCUs expected ex ante within the current verification period. The funds will be supplemented by their other fund-raising activities also during the initial period of high-cost, low-VCU. The operationalization of the incentive fund will support long-term sustainability by supporting livelihood of participating communities. This fund is envisioned to be revolving, in that the funds that generate the fund are derived from the project activities (credit marketing, agroforestry, etc.) and the funds from the fund may be used for activities, which in turn, will bring back more funds.	
Management capacity of project developer	**Substantial previous project experience (≥ 5 projects) with on-site management team**	**Low**
	CI has been implementing similar projects around the world, and these experiences are being shared within the organization through visits and discussions to share knowledge in different countries. Locally its pool of technical staff has rich experiences in community organizing, reforestation and agro-forestry projects and activities. It has also its own expertise on land use management and land use change analysis and has high levels of experience in protected area establishment and management. Sierra Madre Biodiversity Corridor (SMBC) implements similar reforestation, agroforestry and community development project in Peñablanca Protected Landscape and Seascape (PPLS) in northern Luzon Island with funding from	

	Toyota Mortor Corporation, Japan. The Department of Environment and Natural Resources (DENR), the project's major partner, have organized and implemented a number of national, regional and local forestry projects, accumulating rich experience in coordinating and/or implementing reforestation and agroforestry projects. Other local partner- NGOs involved in the project have established complete and operationally effective organization/management systems, have technical capacity and rich experience in working with communities, community mobilization, project planning and implementation, and to some extent some working knowledge on forest carbon projects. CIP has been providing support in the last 10 years for the rehabilitation of forests within the Sierra Madre Biodiversity Corridor (SMBC), focusing on the forests of three protected areas namely: the Peñablanca Protected Landscape and Seascape, Northern Sierra Madre Natural Park, and Quirino Protected Landscape, to restore the habitat and ecosystem services that will have positive impact on local climate, biodiversity and the communities. Oversight and policy and technical support is being provided by the office of the Country Executive Director and other technical units within CIP. The SMBC Program Manager is responsible for the project execution and is supported by 5 technical staff in the execution of different project activities. Furthermore, the project team will also be receiving additional technical, managerial and coordination assistance from CI branch offices, including the CI-Headquarters Office in Arlington, Virginia (USA) and CI-Japan.	
Future income	**Appropriate management plan, and financial analysis demonstrates that likely income stream(s) will finance future management activities (e.g., carbon finance to be used for project management, tending operations, etc.)**	**Low**
	Management plan and the cash flows for the 177 hectares show sustainable management plan and future income.	
Future/current opportunity costs	**Alternative land uses are unlikely to become attractive in the future**	**Low**
	The parcels to be reforested or to be used for agroforestry in the Project are currently used for	

	marginal agriculture and grazing due to low productivity of the land. The field surveys and interviews with stakeholders indicated that the only realistic and credible alternative available to the project participants is to continue the current marginal agricultural practices. The cost structure of corn farming is also available.	
Endorsement of project or land-use activity by local population and local/national political establishment	**Endorsement given and not likely to change in the future**	**Low**
	The arrangement for the project is included in the MOA concluded among the DENR region 02, the provincial government of Quirino, the municipal government of Maddera (Maddela-LGU), the Devisoria Sur Agroforestry Farmers Association (DSAFA), the Sto. Nino Integrated Social Forestry Association (STISFA), PEDAI, CI, and Moretrees inc.	

Most of the risk factors were shown to have low ratings, though risk relating to Project longevity/Commitment period was rated as high.

Sub-step 1c: Based on the above assessments, determine the overall risk classification for the project.

In both assessment in sub-step 1a and sub-step 1b, most of the risk factors were classified as low rating with a few medium and high rating. Therefore, it is reasonable to classify overall risk as "<u>low – medium</u>". Buffer was determined as <u>20%</u> accordingly.

Appendix 10. Cost Benefit Analysis

LAND USE OPTION	COST/HA	TOTAL YIELD	NET BENEFIT	Non discounted BCR
CORN	20,440	30,000.00	9,560.00	1.47
RICE	12,750	22,750.00	10,000.00	1.78
BANANA	25,000	96,000.00	71,000.00	3.84
AGROFORESTRY	35,264	81,486.32	46,222.28	2.31

BCR=Benefit Cost Ratio

Appendix 11. Minutes of Meeting with STISFA

Minutes of the Meeting conducted during the consultation with the PO members of Sto.Nino Integrated Social Forestry Association (STISFA)

Date: October 28, 2009
Venue: Sto.Nino Barangay Hall
PRESENT:

1. Mr. Angel Gambol – Chairman STISFA
2. Mr. Bernardo Balbero-Brgy. Kagawad/STISFA Member
3. Mr. Jimmy Tolentino- Brgy. Kagawad/STISFA Member
4. Mr. Rolly Pacle-STISFA Member
5. Mr. Ben Guillermo-PEDAI Staff
6. For. Yolando Binag-PNRE Officer
7. Mr. Luzon T. Salvador-PEDAI Technical Assistant
8. Ms.Star Pasion- CI Staff

The meeting started at around 1:30 pm with an opening prayer. Immediately the prayer, Mr. Salvador gave an introduction about the purpose of the meeting which is to update the members of STISFA specially those farmer-members who are included in the list of participants within the initial 41-ha of the Forest Carbon Project.
After the discussing the purpose of the meeting, he called the attention of the PO Chairman, Mr. Gilbert Gambol regarding the members who did not attend the meeting. Mr. Gambol answered that he informed the members but then most of them were busy on this day and they just requested them that whatever discussion made among the group will be re-echoed to them. Mr. Gambol further stress out that the members are already asking when they will plant.

Mr. Salvador answered that one purpose of this meeting is to visit the temporary nursery because by next week the seedlings will be delivered.

Ms. Pasion announced the names of those members who are included in the 41-ha initial project and those members who are included in the 136 ha.

Mr. Gambol requested for a hard copy of the list of the names.

Ms. Pasion assured that she will give the hard copy thru Mr. Buddy Castillo (CIP Field assistant)

Mr. Rolly Pacle asked why he was not in the list of those members who have agroforestry when infact he was assured before by Mr. Lajola that his area will also be planted with Agroforestry.
He even said that if he will not have an agroforestry he will withdraw his reforestation area.

Ms. Pasion said that they will check again his lot but she said that perhaps his areas for the agroforestry was not eligible. She gave an assurance that those participants with reforestation area but doesn't have agroforestry shall still be given agroforestry seedlings for them to plant in their other areas not included in the 177 ha. This action will be the counterpart or say part of the livelihood assistance of PEDAI. This was already assured to us by Ms. Elizabeth Nicolas-PEDAI Executive Director

Mr. Salvador asked the members what other issues do they have with regards to the project implementation?

Mr. Gambol answered: So far Sir, its just the assurance that those members who don't have agroforestry shall also be given agroforestry seedlings and reiterated that the members are already eager to plant.

Mr. Balbero followed it up that we should start planting now because in Quirino this is actually the best time to plant.

Mr. Salvador: Informed the group that in the reforestation there will be thinning which is actually tantamount to cutting but to a limited number. The project shall have a thinning schedule which means this will be an added incentives for the participants because those trees that will be subjected to thinning can be used into other products. But right now this is still under discussion from among CI staff and perhaps by next week Ms. Pasion could give an update on this matter.

Mr. Balbero reacted that if this will push thru Sir, more members will be attracted. If we imagine the 3x3 meters spacing once the plantation reaches 5 or say 7 years the trees will look like a toothpick (jokingly stated) if there will be no thinning.

Ms. Pasion: She gave an assurance that she will discuss it the CI mngt group about this issue. She said that there will be second round of validation by the same group-the Rainforest Alliance to validate/confirm how did we answered all the corrective action requests in the project design. This will be on November 5-7, 2009. We don't know yet if they will just visit the areas or they will interview the group again.

Mr. Balbero: Sir we have a problem regarding the end of our ISF contracts. Most of us are about to end, if I remember it right the earliest will be on 2013? Our problem is the renewal because since we have our contract we didn't pay yet our tax on our ISF area. As one of our colleagues here he went to the treasurer's office to pay his tax for the ISF but then didn't continue because the assessment is Ps9,000.00 which is very difficult on his part to pay. Can you please help us on this matter? Can we request for an amnesty for not paying the tax? And can be request for an exemption from paying the tax starting this year considering that we will be part of the carbon project?

PNREO BINAG answered that this is want they should do. Draft or make a resolution, a PO resolution requested for an amnesty and submit it to the Municipal Local Chief Executive. I think this is acceptable and also request if you can have a tax exemption especially those members who will be joining the MoreTrees project.

Mr. Balbero: Ok sir thank you and please guide us perhaps CI and PEDAI in the drafting the request?

Mr. Gambol: We are hopeful that PEDAI will give us additional source of livelihood once the carbon project will start.

Ms. Pasion: ok Chairman we will discuss more on this. We will be back next week for the delivery of the seedlings.

Mr. Guillermo extend their gratitude to all for attending the meeting even if they are busy in their farms.

The Meeting is adjourned at 3:40pm

Appendix 12. List of species recorded in intact forest

A. Flora
B. Birds
C. Mammals
D. Amphibians and Reptiles

A. Species of **flora** documented during the biological survey in Mt. Lataan, Barangays Disimungal, Nagtipunan and Mungiao Mountains, Barangay Matmad, Nagtipunan, Quirino 2002 and 2003.

Genus	Species	Endemicity	DAO 15	IUCN 2008
ACANTHACEAE				
Hemigraphis	primulaefolia (Nees) Fern.-Villar	Non-endemic		
ACTINIDIACEAE				
Saurauia	luzoniensis Merr.	Endemic		
ALANGIACEAE				
Alangium	sp.			
AMARYLLIDACEAE				
Curculigo	sp.			
ANACARDIACEAE				
Dracontomelon	sp.			
Semecarpus	cuneiformis Blanco	Non-endemic		
ANNONACEAE				
Dasymaschalon	clusiflorum (Merr.) Merr.	Endemic		
Goniothalamus	elmeri Merr.	Endemic		
Goniothalamus	sp. 2			
Goniothalamus	sp. 1			
Mitrephora	reflexa Merr., cf.	Endemic		
Mitrephora	Fragrans, cf.	Endemic	VU	VU
Mitrephora	multifolia Elmer ex Weeras. & RMK Saunders,cf.,	Endemic		
Mitrephora	lanotan (Blanco) Merr., cf,	Endemic	VU	VU
Phaeanthus	ebracteolatus (C. Presl) Merr.	Endemic		
Platymitra	Arborea (Blanco) Kessler	Endemic		
Xylopia	densifolia Elmer, cf,	Endemic		
APOCYNACEAE				
Alstonia	macrophylla Wall. ex	Non-		-

	G.Don	endemic		
Alstonia	scholaris (L.) R. Br.	Non-endemic		-
Alyxia	concatenata (Blanco) Merr,	Endemic		
Alyxia	luzoniensis Merr.	Endemic		
Ichnocarpus?	sp.			
Kibatalia	elmeri Woodson	Endemic	VU	VU
Parameria	laevigata (Juss.) Moldenke	Non-endemic		
Voacanga	Globosa (Blanco) Merr.	Endemic		
AQUIFOLIACEAE				
Ilex	halconensis Merr. [now considered to be =I. malaccensis Loes.]	Non-endemic		
ARACEAE				
Alocasia	sp. 2			
Amorphophallus	sp. 1			
Amydrium	sp.			
Arisaema	sp.			
Epipremnum	pinnatum (L.) Engl.	Non-endemic		
Pothoidium	lobbianum Schott	Non-endemic		
Rhaphidophora	sp. 4			
Rhaphidophora	stenophylla Elmer [=R. banosensis PC Boyce]	Endemic		
Schismatoglottis	sp. 2			
ARALIACEAE				
Arthrophyllum	ahernianum Merr.	Non-endemic		
Osmoxylon	sp. 2			
Polyscias	nodosa (Blume) Seem.	Non-endemic		
Schefflera	Elliptica (Blume) Harms	Endemic		
Schefflera	luzoniensis Merr.	Endemic		
Schefflera	sp. 2			
Schefflera	sp. 3			
ARAUCARIACEAE				
Agathis	philippinensis Warb.	Non-endemic	VU	VU
ARISTOLOCHIACEAE				
Aristolochia	sp. 1			
Aristolochia	tagala Cham., cf.	Non-		

		endemic		
ASCLEPIADACEAE				
Dischidia	sp. 1			
ASPLENIACEAE				
Asplenium	colubrinum H. Christ	Non-endemic		
Asplenium	Lepturus J. Sm. ex C. Presl	Endemic		
Asplenium	nidus L.	Non-endemic	VU	
Asplenium	pellucidum Lamk.	Non-endemic		
Asplenium	phyllitidis Don	Non-endemic		
Asplenium	polyodon Forst.	Non-endemic		
Asplenium	robustum Blume	Non-endemic		
Asplenium	Tenerum Forst.	Non-endemic		
Asplenium	unilaterale Lamk.	Non-endemic		
Asplenium	vulcanicum Blume	Non-endemic		
BEGONIACEAE				
Begonia	apayaoensis Merr., cf.	Endemic		
Begonia	castilloi Merr.	Endemic	OWS	
Begonia	dolichotricha Merr.	Endemic		
Begonia	lagunensis Elm.,cf,	Endemic		
Begonia	loheri Merr.	Endemic		
Begonia	sp. 2			
BIGNONIACEAE				
Radermachera	pinnata (Blanco) Seem.	Non-endemic		
BLECHNACEAE				
Blechnum	orientale L.	Non-endemic		
BORAGINACEAE				
Carmona	retusa (Vahl) Masam.	Non-endemic		
BURSERACEAE				
Canarium	Asperum Benth. ssp. asperum	Non-endemic		-
Canarium	gracile Engl.	Endemic		

Canarium	hirsutum Willd. Ssp. hirsutum var. hirsutum	Non-endemic		
CAPRIFOLIACEAE				
Sambucus	Javanica Reinw.	Non-endemic		
CECROPIACEAE				
Poikilospermum	acuminatum (Trec.) Merr.	Non-endemic		
CELASTRACEAE				
Microtropis	Curranii Merr.	Non-endemic		
Microtropis	platyphylla Merr.	Non-endemic		
CHEIROPLEURIACEAE				
Cheiropleuria	Bicuspis (Blume) C. Presl	Non-endemic		
CLETHRACEAE				
Clethra	canescens Reinw. ex Blume var. novoguineensis (Kaneh. & Hatus.) Sleum.	Non-endemic		
COMBRETACEAE				
Terminalia	nitens C. Presl	Endemic		VU
COMMELINACEAE				
Pollia	sp.			
COMPOSITAE				
Vernonia	lancifolia Merr.	Endemic		
Vernonia	sp. 1			
CORNACEAE				
Mastixia	pentandra Blume subsp. philippinensis (Wang.) Matthew	Endemic		
Mastixia	tetrapetala Merr.	Endemic		
CUNONIACEAE				
Weinmannia	negrosensis Elmer	Endemic		
CYATHEACEAE				
Cyathea	atropurpurea Copel.	Endemic	EN	
Cyathea	heterochlamydea Copel.	Endemic	EN	
Cyathea	integra J. Sm. ex Hook.	Endemic	EN	
Cyathea	sp. 1			
Cyathea	sp. 2			
CYPERACEAE				
Carex	sp. 2			

Fimbristylis	sp. 1			
Hypolytrum	nemorum (Vahl) Spreng.	Non-endemic		
Mapania	palustris (Hassk. Ex Steud.) Fern.-Villar	Non-endemic		
Paramapania	Rostrata Uittien	Endemic		
Scleria	sp. 1			
DAVALLIACEAE				
Davallia	denticulata Mett. ex Kuhn	Non-endemic		
Davallia	repens (L. f.) Kuhn	Non-endemic		
Leucostegia	immersa (Wall.) C. Presl	Non-endemic		
DENNSTAEDTIACEAE				
Lindsaea	fissa Copel.	Endemic		
Lindsaea	obtusa J. Sm. ex Hook.	Non-endemic		
Lindsaea	pulchella (J. Sm.) Mett. ex Kuhn	Non-endemic		
Lindsaea	repens (Bory) Thwaites	Non-endemic		
Microlepia	sp.			
Tapeinidium	biserratum' (Blume) Alderw.	Non-endemic		
Tapeinidium	luzonicum (Hook.) Kramer	Endemic		
Tapeinidium	pinnatum (Cav.) C. Chr.	Non-endemic		
DICKSONIACEAE				
Culcita	straminea (Labill.) Maxon	Endemic		
Cibotium	cumingii Kunze	Non-endemic		
DILLENIACEAE				
Dillenia	marsupialis Hoogl.	Endemic		
Dillenia	philippinensis Rolfe	Endemic	OWS	VU
DIOSCOREACEAE				
Dioscorea	sp. 2			
DIPTERIDACEAE				
Dipteris	conjugata Reinw.	Non-endemic		
DIPTEROCARPACEAE				
Anisoptera	thurifera (Blanco) Blume	Non-endemic		-
Dipterocarpus	validus Blume	Non-		CR

		endemic		
Hopea	acuminata Merr.	Endemic	CR	CR
Shorea	contorta Vidal	Endemic	VU	CR
Shorea	guiso Blume	Non-endemic		CR
Shorea	palosapis (Blanco) Merr.	Endemic		CR
Shorea	polysperma (Blanco) Merr.	Endemic	VU	CR
DRYOPTERIDACEAE				
Arachniodes	Amabilis (Blume) Tindale	Non-endemic		
Arachniodes	coniifolia (Moore) Ching	Non-endemic		
Arachnioides	tripinnata (Goldm.) Sledge	Non-endemic		
Ctenitis	sierramadrensis sp. nov., ined.	Endemic		
Ctenitis	Silvatica Holtt.	Endemic		
Diplazium	fructuosum Copel.	Endemic		
Diplazium	polypodioides Bl.,cf,	Non-endemic		
Pleocnemia	sp.			
Polystichum	horizontale C. Presl	Non-endemic		
EBENACEAE				
Diospyros	cauliflora Blume	Non-endemic	CR	VU
Diospyros	hebecarpa Cunn. ex Benth. [syn. pellucida Hiern,]	Non-endemic		
ELAEOCARPACEAE				
Elaeocarpus	forbesii Merr., cf.	Endemic		
Elaeocarpus	monocerus Cav.	Endemic		
Elaeocarpus	submonoceras Miq. subsp.--	Endemic		
Elaeocarpus	sp. 2			
ERICACEAE				
Diplycosia	Luzonica (A. Gray) Merr.	Endemic		
Rhododendron	vidalii Rolfe	Endemic		
Vaccinium	barandanum Vidal	Endemic		
Vaccinium	caudatum Warb.	Endemic		
Vaccinium	cumingianum Vidal	Endemic		
Vaccinium	Indutum Vidal	Endemic		
Vaccinium	jagorii Warb.	Endemic		
Vaccinium	platyphyllum Merr.	Endemic		
Vaccinium	tenuipes Merr.	Endemic		

ERYTHROPALACEAE				
Erythropalum	scandens Blume	Non-endemic		
EUPHORBIACEAE				
Acalypha	cardiophylla Merr.,cf. [=A. caturus Blume]	Non-endemic		
Alchornea?	sp.			
Antidesma	edule Merr.	Endemic		
Antidesma	pleuricum Tul.	Endemic		
Aporosa	banahaensis (Elmer) Merr.	Possibly also in Sabah		
Aporosa	symplocifolia Merr.	Endemic	OWS	VU
Blumeodendron	subrotundifolium (Elmer) Merr.	Non-endemic		
Bridelia	sp.			
Claoxylon	arboreum Elmer	Endemic		
Claoxylon	euphorbioides (Elmer) Merr.	Endemic		
Claoxylon	sp. (check brachyandrum Pax & Hoffm.)			
Claoxylon	subviride Elmer	Endemic		
Cleistanthus	sp. 1			
Drypetes	convoluta Airy Shaw	Endemic		
Drypetes	ellipsoidea, cf. [=D. celebica (Boerl. & Koord.) Pax & Hoffm.	Non-endemic		
Glochidion	album (Blanco) Boerl.	Non-endemic		
Glochidion	benguetense Elmer, cf.	Endemic		
Glochidion	trichophorum Merr., cf.	Endemic		
Macaranga	caudatifolia Elmer	Endemic	OWS	VU
Macaranga	grandifolia (Blanco) Merr.	Endemic		VU
Mallotus?	sp.			
Melanolepis	multiglandulosa (Reinw. ex Blume) Reichb.f. & Zoll.	Non-endemic		
Neotrewia	cumingii (Muell.-Arg.) Pax & Hoffm.	Non-endemic		
Omalanthus	macradenius Pax & Hoffm.	Endemic		
Phyllanthus	cordatulus C. Robinson	Endemic		
Sauropus	villosus (Blanco) Merr.	Non-endemic		
FAGACEAE				

Castanopsis	philipensis (Blanco) Vidal	Endemic	OWS	
Lithocarpus	ovalis Blanco, cf.	Endemic	OTS	VU
Lithocarpus	solerianus (Vidal) Rehd., cf.	Endemic		
Lithocarpus	vidalii (Fern.-Villar) Rehd., cf.	Endemic		
Lithocarpus	sp. 1			
Lithocarpus	sp.1., cf.			
Lithocarpus	sp. 2			
FLACOURTIACEAE				
Casearia	sp. 1			
Homalium	sp. 1			
GESNERIACEAE				
Aeschynanthus	philippinensis (Kuntze) C.B. Clarke	Endemic		
Agalmyla	rubra (Merr.) B.L. Burtt	Endemic		
Agalmyla	sp. 1			
Cyrtandra	macrodiscus Kraenzl., cf,	Endemic		
Cyrtandra	villosissima Merr.	Endemic		
Agalmyla	clarkei (Elmer) Hilliard & B.L. Burtt	Endemic		
Lysionotus	pauciflorus Maxim.			
Rhynchotechum	Discolor (Maxim.) B.L. Burtt	Non-endemic		
GRAMINAE				
Oplismenus	sp.			
GRAMINEAE-BAMBUS.				
Dinochloa	acutiflora (Munro) S. Dransfield [formerly Schizostachyum diffusum (Blanco) Merr.]	Non-endemic		
GRAMMITIDACEAE				
Acrosorus	triangularis (Scort. ex Bedd.) Copel.	Non-endemic		
Calymmodon	gracilis (Fee) Copel.	Non-endemic		
Ctenopteris	macra (Copel.) Copel. vel aff.	Non-endemic		
Grammitis	jagoriana (Mett.) Copel.	Non-endemic		
Scleroglossum	minus (Fee) C. Chr.	Non-endemic		
GROSSULARIACEAE				

Polyosma	lavandulacea Schulze-Menz?	Endemic		
GUTTIFERAE				
Calophyllum	blancoi Planch. & Triana	Non-endemic		
Calophyllum	soulattri Burm. f.	Non-endemic		
Garcinia	oligophlebia Merr.,cf,	Endemic		
Garcinia	vidalii Merr., cf,	Endemic		
Kayea	paniculata (Blanco) Merr.	Endemic		
Mammea	sp.			
HYMENOPHYLLACEAE				
Cephalomanes	apiifolium (C. Presl) K. Iwats.	Non-endemic		
Cephalomanes	grande (Copel.) K. Iwats.	Non-endemic		
Cephalomanes	javanicum (Blume) Bosch	Non-endemic		
Cephalomanes	maximum (Blume) K. Iwats.	Non-endemic		
Cephalomanes	obscurum (Blume) K. Iwats.	Non-endemic		
Cephalomanes	Pallidum (Blume) K. Iwats.	Non-endemic		
Crepidomanes	maximum (Blume) K. Iwats.	Non-endemic		
Crepidomanes	meifolium (Bory ex Willd.) K. Iwats.	Non-endemic		
Hymenophyllum	acanthoides (Bosch) Rosenst.	Non-endemic		
Hymenophyllum	angulosum H. Christ	Endemic		
Hymenophyllum	reinwardtii (Bosch) Copel.	Non-endemic		
Hymenophyllum	serrulatum (C. Presl) C. Chr.	Non-endemic		
HYPERICACEAE				
Cratoxylum	sumatranum (Jack) Blume	Non-endemic		
ICACINACEAE				
Gomphandra	cumingiana (Miers) F. Villar.,cf,	Non-endemic		
Gomphandra	oblongifolia Merr.,cf,	Endemic		
Platea	excelsa Blume var. borneensis (Heine) Sleum.	Non-endemic		

LABIATAE				
Plectranthus	scutellarioides (L.) R. Br.	Non-endemic		
LAURACEAE				
Cinnamomum	myrianthum Merr.cf,	Endemic		
Cinnamomum	sp. 2			
Cryptocarya	teysmanniana Miq., cf.	Non-endemic		
Litsea	anomala Merr.	Endemic		
Litsea	fulva (Blume) Fern.-Villar	Non-endemic		
Litsea	tomentosa Blume	Non-endemic		
Litsea	urdanetensis Elmer	Endemic		
Neolitsea	paucinervia Merr.	Endemic		
Neolitsea	vulcanica Elmer [=Neolitsea villosa (Blume) Merr.]	Non-endemic		
LEEACEAE				
Leea	congesta Elmer	Endemic		
Leea	guineensis G. Don	Non-endemic		
Leea	magnifolia Merr.	Endemic		
Leea	quadrifida Merr., cf,	Endemic		
LEGUMINOSAE-CAES				
Bauhinia	integrifolia Roxb. ssp. & var. cumingiana (Benth.) K & SS Larsen	Non-endemic		
Cynometra	sp. 1			
LEGUMINOSAE-MIM				
Archidendron	clypearia (Jack) Nielsen	Non-endemic		
Archidendron	sp.			
LEGUMINOSAE-PAP				
Derris	philippinensis Merr.	Endemic		
Ormosia	paniculata Merr.	Endemic		
Spatholobus	gyrocarpus (Wall.) Benth.,cf.,	Non-endemic		
Strongylodon	elmeri Merr.	Endemic	VU	
LOGANIACEAE				
Fagraea	ceilanica Thunb.	Non-endemic		
LOMARIOPSIDACEAE				
Bolbitis	heteroclita (C. Presl) Ching	Non-		

		endemic		
Bolbitis	quoyana (Gaudich.) Ching	Non-endemic		
Bolbitis	rhizophylla (Kaulf.) Hennipm.	Non-endemic		
Elaphoglossum	luzonicum Copel.	Non-endemic		
Elaphoglossum	ophioglossoides (Goldm.) Holttum	Endemic		
Teratophyllum	articulatum (J. Sm.) Mett.	Non-endemic		
Teratophyllum	arthropteroides (H. Christ) Holtt.	Endemic		
LORANTHACEAE				
Amyema	acuta (Tiegh.) Danser	Endemic		
Cyne	banahaensis (Elmer) Danser	Endemic		
LYCOPODIACEAE				
Lycopodium	Cernuum L.	Non-endemic		
Lycopodium	salvinioides (Herter) Tagawa	Non-endemic	EN	
Lycopodium	serratum Thunb.	Non-endemic		
MAGNOLIACEAE				
Magnolia	candollii (Blume) H. Keng var. candollii	Non-endemic		
Magnolia	candollii (Blume) H. Keng var. angatensis (Blanco) Noot.	Non-endemic		
MARANTACEAE				
Donax	cannaeformis (G. Forst.) K. Schum.	Non-endemic		
Phacelophrynium	interruptum (Warb.) K. Schum.	Endemic		
MELASTOMATACEAE				
Astronia	cumingiana Vidal var. cumingiana	Endemic		
Astronia	cumingiana Vidal var. bicolor (Merr.) Maxw.	Endemic		
Astronia	ferruginea Elmer	Endemic		
Astronia	lagunensis Merr.	Endemic		
Astronia	pulchra Vidal	Endemic		
Astronia	williamsii Merr. ex C.Robinson, cf.	Endemic		

Creochiton	bracteata (Quisumb. & Merr.) Veldk.	Endemic		
Medinilla	annulata C.Robinson	Endemic		
Medinilla	banahaensis (Elmer) Merr.	Endemic	EN	
Medinilla	Coriacea Merr.	Endemic		
Medinilla	cumingii Naud.	Endemic		
Medinilla	dolichophylla Merr.	Endemic	VU	
Medinilla	halconensis Merr.	Endemic		
Medinilla	Merrittii Merr.	Endemic		
Medinilla	microcephala Regalado	Endemic		
Medinilla	multiflora Merr.	Endemic		
Medinilla	Pendula Merr.	Endemic	EN	
Medinilla	pycnantha Quisumb. & Merr.	Endemic		
Medinilla	ramiflora Merr.	Endemic		
Medinilla	Setigera (Blume) Miq.	Non-endemic		
Melastoma	malabathricum L.	Non-endemic		
Memecylon	densiflorum Merr.	Endemic		
Memecylon	lanceolatum Blanco, cf.	Non-endemic		
Memecylon	ramosii Merr., cf.	Endemic		
MELIACEAE, unidentified				
Aglaia	costata Merr.,cf,	Endemic		
Aglaia	edulis (Roxb.) Wall.	Non-endemic	VU	-
Aglaia	Elliptica Blume	Non-endemic		
Aglaia	rimosa (Blanco) Merr.	Non-endemic	VU	-
Aglaia	sp. 1			
Aglaia	tomentosa Teijsm. & Binn.	Non-endemic		-
Aphanamixis	polystachya (Wall.) R.N. Parker	Non-endemic	VU	VU
Chisocheton	ceramicus (Miq.) C. DC.	Non-endemic		
Chisocheton	patens Blume	Non-endemic		
Chisocheton	pentandrus(Blanco) Merr.	Non-endemic		
Dysoxylum	excelsum Blume	Non-		

		endemic		
Dysoxylum	parasiticum (Osb.) Kosterm.	Non-endemic		
Reinwardtiodendron	humile (Hassk.) Mabb.	Non-endemic		
Vavea	amicorum Benth.	Non-endemic		
MENISPERMACEAE				
Tinospora	sp. 1			
MONIMIACEAE				
Matthaea	sancta Blume	Non-endemic		-
MORACEAE				
Artocarpus	sericicarpus Jarrett	Non-endemic		
Ficus	punctata Thunb. [syn. F. aurantiacea Griff. var. parvifolia (Corner) Corner]	Non-endemic		
Ficus	cumingii Miq.	Non-endemic		
Ficus	villosa Blume [syn. F. grossivenis Miq.]	Non-endemic		
Ficus	Ampelas Burm. [syn. F. irisana Elmer]	Non-endemic		
Ficus	magnoliifolia Blume	Non-endemic		
Ficus	melinocarpa Blume	Non-endemic		
Ficus	nervosa Roth ssp. pubinervis (Blume) CC Berg	Non-endemic		
Ficus	variegata Blume	Non-endemic		
Ficus	sulcata Elmer	Endemic		
Ficus	warburgii Elmer	Endemic		
Ficus	sp. 1			
MYRISTICACEAE				
Gymnacranthera	farquhariana (Hook. f. & Thomson) Warb.	Endemic		
Horsfieldia	ardisiifolia (A. DC) Warb.	Endemic		VU
Knema	stellata Merr. var. cryptocaryoides (Elmer) de Wilde	Endemic		
Myristica	sp. 1			

MYRSINACEAE				
Ardisia	tomentosa C Presl [syn. A. philippinensis (A. DC) Mez]	Non-endemic		
Ardisia	pyramidalis (Cav.) Pers.	Non-endemic		
Ardisia	saligna Mez	Endemic		
Ardisia	squamulosa C Presl [syn. A. verrucosa C Presl]	Doubtfully Endemic		
Ardisia	sp. 2			
Ardisia	sp. 4			
Ardisia	sp. 5			
Discocalyx	cybianthoides (A. DC) Mez, cf.	Non-endemic		
Discocalyx	effusa Mez?	Endemic		
Discocalyx	luzoniensis Merr., cf.	Endemic		
Discocalyx	sp. 2			
Discocalyx	sp. 3			
Discocalyx	sp. 4			
Embelia	philippinensis A. DC	Non-endemic		
Maesa	haenkeana Mez, cf.	Endemic		
MYRTACEAE				
Eugenia	sargentii Merr. [syn. Jossinia sargentii (Merr.) Merr.]	Endemic		
Jossinia	heterophylla (Merr.) Merr.	Endemic		
Syzygium	astronioides (C.Robinson) Merr.	Endemic		
Syzygium	attenuatum (Miq.) Merr. & Perry vel aff.	Non-endemic		
Syzygium	bordenii (Merr.) Merr.	Non-endemic		
Syzygium	calcicolum (Merr.) Merr.	Non-endemic		
Syzygium	calubcob (C.Robinson) Merr.	Non-endemic		
Syzygium	curranii (C.Robinson) Merr.	Non-endemic		
Syzygium	claviflorum (Roxb.) Cowan & Cowan	Non-endemic		
Syzygium	curranii (C.Robinson) Merr.	Endemic		
Syzygium	densinervium (Merr.) Merr.	Endemic	OTS	
Syzygium	longiflorum C. Presl	Non-endemic		

Syzygium	longipedicellatum (Merr.) Merr.	Endemic		
Syzygium	mainitense (Elmer) Merr.	Endemic		
Syzygium	merrittianum (C.Robinson) Merr.	Endemic		
Syzygium	Pallidum Merr.	Endemic		
Syzygium	phanerophlebium, cf.,	Endemic		
Syzygium	rigidifolium Merr.	Endemic		
Syzygium	sp. 2			
Syzygium	sp. 3			
Syzygium	sp. 9			
Tristaniopsis	oblongifolia (Merr.) Peter G. Wilson & Waterhouse	Endemic		
NEPENTHACEAE				
Nepenthes	alata Blanco	Non-endemic		-
Nepenthes	ventricosa Blanco	Endemic	EN	-
NEPHROLEPIDACEAE				
Nephrolepis	hirsutula (Forst.) C. Presl	Non-endemic		
OLEACEAE				
Chionanthus	sp.1			
Olea	borneensis Boerl.	Non-endemic		
OLEANDRACEAE				
Oleandra	maquilingensis Copel.	Endemic		
ORCHIDACEAE				
Amesiella	monticola Cootes & D.P. Banks	Endemic	CR	CR
Appendicula	xitriophora Reichb. f.	Endemic		
Bulbophyllum	Alsiosum Ames?	Endemic		
Bulbophyllum	sensile Ames, cf.	Endemic		
Bulbophyllum	vagans Ames & Rolfe, cf.	Endemic		
Bulbophyllum	sp. 1			
Bulbophyllum	sp. 5			
Ceratostylis	philippinensis Rolfe	Endemic		
Ceratostylis	sp. 2			
Cheirostylis?	sp.			
Coelogyne	sp. 1			
Cryptostylis	sp. 1			
Dendrobium	sp. 1			

Dendrochilum	convallariaeforme Schauer	Endemic		
Dendrochilum	longibulbum Ames, cf.	Endemic		
Dendrochilum	Tenellum (Nees & Mey.) Ames	Endemic		
Dendrochilum	tenue (Ames) Pfitz., cf.	Endemic		
Dendrochilum	sp. 3			
Dendrochilum	sp. 4			
Dendrochilum	sp. 5			
Dendrochilum	sp. 9			
Didymoplexis?	sp.			
Epigeneium	treacherianum (Reichb. f. ex Hook. f.) Summerh.	Endemic	VU	VU
Eria	aporoides Lindl.	Endemic		
Eria	dagamensis Ames, cf.	Endemic		
Eria	microchila Ames, cf.	Endemic		
Eria	vanoverberghii	Endemic		
Eria	ventricosa Leavitt, cf.	Endemic		
Eria	whitfordii Leavitt	Endemic		
Eria	woodiana Ames, cf.	Endemic		
Flickingeria	eurora (Ames) Hawkes	Endemic		
Flickingeria	sp. 3			
Galeola	sp.			
Grastidium	sp.			
Genus Indet. 2	sp.			
Liparis	elmeri (Ames) Schltr., cf.	Endemic		
Liparis	sp. 1			
Malaxis	sp. 1			
Malaxis	sp. 2			
Phaius?	sp.			
Robiquetia	sp. 1			
Sarcanthus	turbineus Ames.,cf,	Endemic		
Thelasis	sp. 1			
Thrixspermum?	sp.			
Vanda	sp.			
Zeuxine	sp. 1			
PALMAE				
Heterospathe	sp. 1			
Pinanga	maculata Porte *ex* Lem.	Endemic		
Pinanga	philippinensis Becc.	Endemic		
Pinanga	sierramadreana Fernando	Endemic		
Calamus	sp.			

PANDANACEAE				
Freycinetia	cumingiana Gaudich.	Endemic		
Freycinetia	Ensifolia Merr.	Endemic		
Freycinetia	sphaerocephala Gaudich.	Endemic		
Freycinetia	formosana Hemsl. [syn. F. subflagellata Elmer]	Non-endemic		
Freycinetia	williamsii Merr.	Endemic		
Freycinetia	sp. 2			
PIPERACEAE				
Piper	asterostigmum Quisumb.	Endemic		
Piper	aurilimbum C. DC	Endemic		
Piper	elliptibaccum C. DC	Endemic		
Piper	caninum Blume [syn. P. haenkeanum Opiz]	Non-endemic		
Piper	interruptum Opiz	Non-endemic		
Piper	philippinum Miq.	Non-endemic		
Piper	sablanum (C. DC) Quisumb.	Endemic		
Piper	simile Quisumb.	Endemic		
Piper	toppingii C. DC	Endemic		
Piper	Caninum Blume [syn. P. viminale Opiz]	Non-endemic		
Piper	sp. 1			
POLYPODIACEAE				
Drynaria	descensa Copel.	Endemic		
Goniophlebium	persicifolium (Desv.) Bedd.	Non-endemic		
Goniophlebium	terrestre Copel.	Endemic	VU	
Lecanopteris	sarcopus (Teysm. & Binn.) Copel.	Non-endemic		
Lemmaphyllum	accedens (Blume) Donk	Non-endemic		
Lepisorus	longifolius (Blume) Holttum	Non-endemic		
Leptochilus	ellipticus (Thunb.) Noot.	Non-endemic		
Leptochilus	macrophyllus (Blume) Noot.	Non-endemic		
Microsorum	longissimum (J. Sm.) Fee	Non-endemic		
Microsorum	monstrosum (Copel.) Copel.	Non-endemic		

Selliguea	albidosquamata (Blume) Parris	Non-endemic		
Selliguea	pyrolifolia (Goldm.) Hovenkamp	Non-endemic		
PROTEACEAE				
Helicia	Robusta (Roxb.) R. Br. ex Wall.	Non-endemic		
PTERIDACEAE				
Pteris	micrantha Copel., cf,	Endemic	OWS	
RAFFLESIACEAE				
Rafflesia	Aurantia Barcelona, Co & Balete	Endemic		
RHAMNACEAE				
Ziziphus	angustifolius (Miq.) Hatus. ex Steen.	Non-endemic		
ROSACEAE				
Prunus	marsupialis Kalkm.	Endemic		-
Rhaphiolepis	philippinensis (Vidal) Kalkm.	Non-endemic		
RUBIACEAE				
Aidia	acuminata (Blume) Wong	Non-endemic		
Argostemma	bryophilum K. Schum.	Non-endemic		
Argostemma	solaniflorum Elmer	Non-endemic		
Argostemma	timorense Benn.	Non-endemic		
Argostemma	sp. 1			
Canthium	ellipticum (Merr.) Merr.	Endemic		
Canthium	subcapitatum (Merr.) Merr.	Endemic		
Diplospora	fasciculiflora (Elmer) Elmer	Endemic		
Discospermum	whitfordii (Elmer) Ali & Robbrecht	Endemic		
Oldenlandia	auricularia (L.) K Schum. [syn. Hedyotis auricularia L.	Non-endemic		
Oldenlandia	benguetensis (Elmer) Elmer [syn. Hedyotis benguetensis Elmer]	Non-endemic		
Lasianthus	fordii Hance	Non-endemic		
Lasianthus	sp. 1			
Mussaenda	milleri Elmer	Endemic		
Mussaenda	Nervosa Elmer	Endemic		

Myrmecodia	tuberosa Jack	Non-endemic		
Neonauclea	media (Havil.) Merr., cf.	Endemic		
Ophiorrhiza	sp.			
Psychotria	acuminatissima Elmer	Endemic		
Psychotria	diffusa Merr.	Endemic		
Psychotria	loheri Elmer, cf.	Endemic		
Psychotria	pallidifolia Merr.	Endemic		
Psychotria	Pilosella Elmer	Endemic		
Psychotria	plumeriaefolia Elmer, cf.	Endemic		
Psychotria	weberi Merr.	Endemic		
Psychotria	sp. 1			
Psychotria	sp. 2			
Tarenna	scaberula Merr.	Endemic		
Tarenna	luzoniensis (Vidal) Bremek.	Endemic		
RUTACEAE				
Citrus	hystrix DC	Widely naturalized, native range & habitat not certain		
Melicope	acuminata (Merr.) TG Hartley	Endemic		
Melicope	semecarpifolia (Merr.) TG Hartley	Non-endemic		
Micromelum	minutum (G. Forst.) Seem.	Non-endemic		
SABIACEAE				
Meliosma	simplicifolia (Roxb.) Walp.	Non-endemic		
SAPINDACEAE				
Allophylus	cobbe (L.) Raeusch.	Non-endemic		
Dimocarpus	fumatus (Blume) Leenh. ssp. philippinensis Leenh.	Endemic		
Guioa	Discolor Radlk.	Endemic		
Lepidopetalum	perrottetii (Cambess.) Blume	Endemic		
Lepisanthes	fruticosa (Roxb.) Leenh.	Non-endemic		
Lepisanthes	tetraphylla (Vahl) Radlk.	Non-endemic		
Mischocarpus	pentapetalus (Roxb.) Radlk.	Non-		

		endemic		
Pometia	pinnata Forst.	Non-endemic		
SAPOTACEAE				
Palaquium	bataanense Merr.,cf.	Endemic		
Palaquium	globosum H.J. Lam	Endemic		
Palaquium	Merrillii Dubard	Endemic		
Palaquium	sp. 1			
Palaquium	sp. 2			
Palaquium	sp. 4			
Pouteria	sp. 1			
Pouteria	sp. 2			
Pouteria	sp. 4			
SCHIZAEACEAE				
Lygodium	circinnatum(Burm.) Sw	Non-endemic		
SELAGINELLACEAE				
Selaginella	alligans Hieron.	Endemic		
Selaginella	cupressina (Willd.) Spring	Non-endemic		
Selaginella	fenixii Hieron.	Endemic		
Selaginella	involvens (Sw.) Spring	Non-endemic		
Selaginella	jagorii Warb.	Endemic		
SIMAROUBACEAE				
Brucea	mollis Wall.	Non-endemic		
SMILACACEAE				
Smilax	bracteata C. Presl	Non-endemic		
Smilax	lanceifolia Roxb. var. lucida (Merr.) T Koyama [syn. S. lucida Merr.]	Endemic		
SOLANACEAE				
Solanum	sp.			
STAPHYLEACEAE				
Turpinia	sp. 1			
STERCULIACEAE				
Leptonychia	banahaensis (Elmer) Merr.	Endemic		
Pterospermum	diversifolium Blume	Non-endemic		
Pterospermum	sp.			
Sterculia	rubiginosa Vent.	Non-		

		endemic		
SYMPLOCACEAE				
Symplocos	cochinchinensis (Lour.) Moore	Non-endemic		
Symplocos	lancifolia Sieb. & Zucc.	Non-endemic		
Symplocos	odoratissima Choisy ex Zoll.	Non-endemic		
Symplocos	vidalii Rolfe	Endemic		
THEACEAE				
Adinandra	Elliptica C. Robinson	Endemic		
Adinandra	Luzonica Merr.	Endemic		
Camellia	megacarpa (Elmer) Cohen-Stuart	Endemic		
Cleyera	japonica Thunb. *emend.* Sieb. & Zucc. var. montana (Merr.) Kobuski	Endemic		
Eurya	flava Merr. *ex* Melchior	Endemic		
Eurya	nitida Korth., cf.	Non-endemic		
Gordonia	subclavata Burkill	Endemic		
Gordonia	sp. 1			
THELYPTERIDACEAE				
Chingia	ferox (Blume) Holttum	Non-endemic		
Mesophlebion	crassifolium (Blume) Holttum	Non-endemic		
Pneumatopteris	laevis (Mett.) Holttum	Endemic		
Pronephrium	clemensiae (Copel.) Holtt.	Endemic		
Pronephrium	rhombeum (H. Christ) Holttum	Non-endemic		
THYMELAEACEAE				
Wikstroemia	brachyantha Merr.	Non-endemic		
TILIACEAE				
Grewia	stylocarpa Warb.	Non-endemic		
ULMACEAE				
Gironniera	celtidifolia Gaudich.	Non-endemic		
URTICACEAE				
Dendrocnide	luzoniensis (Wedd.) Chew, cf.	Endemic		
Elatostema	microphyllum Elmer	Endemic		

Elatostema	podophyllum Wedd.	Endemic		
Elatostema	sp. 1			
Elatostema	sp. 2			
Elatostema	sp. 3			
Leucosyke	sp.			
Procris	frutescens Blume	Non-endemic		
Villebrunea	Trinervis Wedd.	Non-endemic		
VERBENACEAE				
Callicarpa	erioclona Schauer	Non-endemic		
Clerodendrum	mindorense Merr.	Endemic	VU	
Viticipremna	philippinensis H.J. Lam	Endemic		
VITACEAE				
Tetrastigma	laxum Merr.	Endemic		
VITTARIACEAE				
Antrophyum	sessilifolium (Cav.) Sprengel	Non-endemic		
Vittaria	elongata Sw.	Non-endemic		
Vittaria	ensiformis Sw.	Non-endemic		
WINTERACEAE				
Drimys	Piperita Hook. f.	Non-endemic		
ZINGIBERACEAE				
Adelmeria	paradoxa (Ridley) Merr.	Endemic		
Alpinia	Haenkei C. Presl, cf.	Endemic		
Amomum	sp. 1			
Amomum	sp. 2			
Amomum	sp. 3			
Amomum	sp. 4			
Amomum	sp. 5			
Plagiostachys	philippinensis Ridl., cf.	Endemic		
Vanoverberghia	sepulchrei Merr.	Endemic	OTS	
Zingiber	sylvaticum Elmer, cf.	Endemic		

B. Listing of **Bird** species recorded based Quirino province based on the biological survey conducted in the province of Quirino from 2002 to 2007 (Population Status and Distribution Status based on "A Guide to the Bird of the Philippines" by R. S. Kennedy, et al. and Conservation Status based on "Threatened Birds of the Philippines" by N.J. Collar, N.A.D. Mallari, and B.R. Tabaranza)

#	Scientific Name	Common Name	Distribution Status/ Endemicity	National Red List (DAO 15)	IUCN 2008
	Family Accipitridae				
1	*Spilornis cheela*	Crested Serpent Eagle	resident, breeding		
2	*Pithecophaga jefferyi*	Philippine Eagle	**Philippine endemic**	CR	CR
3	*Spizaetus philippensis*	Philippine Hawk-Eagle	**Philippine endemic**	VU	VU
4	*Haliastur Indus*	Brahminy Kite	**Resident**		
5	*Ichthyophaga ichthyaetus*	Grey-headed Fish-Eagle	**Resident**		
6	*Pernis celebensis*	Barred Honey Buzzard	**Resident**		
	Falconidae				
7	*Falco peregrinus*	Peregrine Falcon	resident, migratory		
8	*Microhierax erythrogenys*	Philippine Falconet	Philippine endemic		
	Phasianidae				
9	*Gallus gallus*	Red Junglefowl	Resident		
	Rallidae				
10	*Rallina eurizonoides*	Slaty-legged Crake	Resident		
	Family Columbidae				
11	*Ptilinopus merrilli*	Cream-bellied Fruit Dove	**Luzon endemic**		NT
12	*Ptilinopus occipitalis*	Yellow-breasted Fruit Dove	**Philippine endemic**		
13	*Phapitreron leucotis*	White-eared Brown Dove	**Philippine endemic**		
14	*Phapitreron amethystine*	Amethyst Brown Dove	**Philippine endemic**		
15	*Ducula aenea*	Green Imperial Pigeon	resident, breeding		
16	*Ducula poliocephala*	Pink-bellied Imperial Pigeon	**Philippine endemic**	NT	NT
17	*Chalcophaps indica*	Common Emerald dove	resident, breeding		
18	*Macropygia phasianella*	Reddish-cuckoo Dove	resident, breeding		
19	*Streptopelia chinensis*	Spotted Dove	Resident		
20	*Gallicolumba luzonica*	Luzon Bleeding heart	Luzon Endemic		

		Pigeon			
	Family Psittacidae				
21	*Bolbopsittacus lunulatus*	Guaiabero	**Philippine endemic**		
22	*Loriculus philippinensis*	Colasisi	**Philippine endemic**		
	Family Cuculidae				
23	*Phaenicophaeus cumingi*	Scale-Feathered Malkoha	**Luzon endemic**		
24	*Phaenicophaeus superscilìosus*	Red Crested Malkoha	**Luzon endemic**		
25	*Centropus viridis*	Philippine Coucal	**Philippine endemic**		
26	***Centropus unirufus***	Rufous Coucal	**Luzon endemic**		
27	*Centropus bengalensis*	Lesser Coucal	**Resident**		
28	*Cacomantis variolosus*	Brush Cuckoo	resident, breeding		
29	*Cacomantis merulinus*	Plaintive Cuckoo	resident, breeding		
30	*Cuculus fugax*	Hodgson's Hawk-Cuckoo	Resident		
	Caprimulgidae				
31	*Caprimulgus manillensis*	Philippine Nightjar	Resident		
32	*Eurostopodus macrotis*	Great Eared Nightjar	Resident		
	Family Strigidae				
33	*Otus longicornis*	Luzon Scops Owl	**Luzon endemic**		
34	*Otus megalotis*	Philippine Scops Owl	**Philippine endemic**		
35	*Ninox philippensis*	Philippine Hawk Owl	**Philippine endemic**		
36	*Bubo philippensis*	Philippine Eagle Owl	**Philippine endemic**	VU	VU
37	*Batrachostomus septimus*	Philippine frogmouth	**Philippine endemic**		
	Family Apodidae				
38	*Collocalia esculenta*	Glossy Swiftlet	resident, breeding		
39	*Collocalia mearnsi*	Philippine Swiftlet	**Philippine endemic**		
40	*Collocalia troglodytes*	Pygmy Swiftlet	**Philippine endemic**		
41	*Collocalia vanikorensis*	Island Swiflet	resident, breeding		
42	*Apus pacificus*	Fork-tailed Swift	resident, breeding		
	Family Hemiprocnidae				
43	*Hemiprocne comata*	Whiskered Tree swift	resident, breeding		
	Family Trogonidae				
44	*Harpactes ardens*	Philippine Trogon	**Philippine endemic**		

	Family Alcedinidae				
45	*Actenoides lindsayi*	Spotted Wood-Kingfisher	**Luzon endemic**		
46	*Alcedo cyanopecta*	Indigo-banded Kingfisher	**Luzon endemic**		
47	*Ceyx melanurus*	Philippine Dwarf-Kingfisher	**Philippine endemic**	VU	VU
48	*Halcyon chloris*	White-Collared Kingfisher	**Resident**		
49	*Halcyon smyrnensis*	White-throated Kingfisher	**Resident**		
	Family Meropidae				
50	*Merops viridis*	Blue-throated Bee-eater	resident, breeding		
	Family Bucerotidae				
51	*Buceros hydrocorax*	Rufous Hornbill	**Philippine endemic**	NT	
52	*Penelopides panini manilae*	Tarictic Hornbill	**Luzon endemic**		
	Family Capitonidae				
53	*Megalaima haemacephala*	Coppersmith Barbet	resident, breeding		
	Family Picidae				
54	*Dendrocopus maculates*	Philippine Pygmy Woodpecker	**Philippine endemic**		
55	*Dryocopus javensis*	White-bellied woodpecker	resident, breeding		
56	*Chrysocolaptes lucidus*	Greater Flameback	resident, breeding		
57	***Mulleripicus funebris***	Great Slaty Woodpecker	Endemic		
	Family Pittidae				
58	*Pitta kochi*	Whiskered Pitta	**Luzon endemic**	VU	VU
59	*Pitta erythrogaster*	Red-bellied Pitta	resident, breeding		
	Hirundinidae				
60	*Hirundo tahitica*	Pacific Swallow	Resident		
	Family Campephagidae				
61	*Corocina striata*	Bar-bellied Cuckoo-shrike	resident, breeding		
62	***Coracina coerulescens***	Blackish Cuckoo-Shrike	Luzon endemic		
63	*Lalage nigra*	Pied Triller	resident, breeding		
64	*Pericrocotus flammeus*	Scarlet Minivet	resident, breeding		
	Family Pycnonotidae				
65	*Pycnonotus urostictus*	Yellow-wattled Bulbul	**Philippine endemic**		
66	*pycnonotus goavier*	Yello vented bulbul	**resident**		
67	*Hypsipetes philippinus*	Philippine Bulbul	**Philippine**		

			endemic		
	Family Dicruridae				
68	*Dicrurus balicassius*	Balicasiao	**Luzon endemic**		
	Family Oriolidae				
69	*Oriolus isabelae*	Isabela Oriole	**Luzon endemic**		CR
71	*Irena cyanogaster*	Philippine Fairy-Bluebird	**Philippine endemic**		
72	*Oriolus chinensis*	Black-naped Oriole	**resident**		
	Family Corvidae				
73	*Corvus enca*	Slender-billed Crow	resident , breeding		
74	*Corvus macrorhynchos*	Large billed crow	Resident		
	Family Paridae				
75	*Parus elegans*	Elegant Tit	**Philippine endemic**		
	Family Sittidae				
76	*Sitta frontalis*	Velvet-fronted Nuthatch	resident , breeding		
	Family Rhabdornithidae				
77	*Rhabdornis mystacalis*	Stripe-headed Rhabdornis	**Philippine endemic**		
	Family Timaliidae				
78	*Napothera rabori*	Rabor's Wren Babbler	**Luzon endemic/ Near Threatened**		
79	*Stachyris dennistouni*	Golden-crowned Babbler	**Luzon endemic/ Near Threatened**		
80	***Stachyris whiteheadi***	Chestnut-faced Babbler	**Luzon Endemic**		
	Family Turdidae				
81	***Copsychus luzoniensis***	White-browed Shama	**Luzon endemic**		
82	*Copsychus saularis*	Oriental Magpie	**Resident**		
83	*Zoothera andromedae*	Sunda Ground-thrush	resident, breeding		
84	*Zoothera dauma*	Scaly Ground-thrush	migrant		
85	*Turdus chrysolaus*	Brown-headed Thrush	migrant		
86	*Brachypterix Montana*	White-browed Shortwing	resident		
87	*Saxicola caprata*	Pied Bushchat	Resident		
88	*Megalurus palustris*	Striated Grassbird	Resident		
	Family Sylviidae				
89	***Phylloscopus cebuensis***	Lemon-Throated Leaf Warbler	Philippine endemic		
90	*Orthotomus castaneiceps*	Philippine Tailorbird	**Philippine endemic**		
91	*Orthotomus cuculatus*	Mountain Tailorbird	resident, breeding		
92	*Orthotomus derbianus*	Grey-backed Tailorbird	**Luzon endemic**		
93	*Cisticola exilis*	Bright capped Cisticola	**Resident**		
	Family Muscicapidae				

94	*Muscicapa griseisticta*	Grey-streaked Flycatcher	migrant		
95	*Ficedula hyperethra*	Snowy-browed Flycatcher	resident, breeding		
96	*Ficedula westermanni*	Little Pied Flycatcher	resident, breeding		
97	*Cyornis herioti*	Blue-breasted Flycatcher	**Luzon endemic**		
98	*Cyornis rufigastra*	Mangrove Blue Flycatcher	Resident		
99	*Culicicapa helianthea*	Citrine Canary-Flycatcher	resident, breeding		
100	*Rhiphidura cyaniceps*	Blue-headed Fantail	**Luzon & West Central Visayas endemic**		
101	*Rhiphidura javanica*	Pied Fantail	Resident		
102	*Eumyas panayensis*	Mountain Verditer-Flycatcher	Resident		
	Family Monarchidae				
103	*Terpsiphone cinnamomea*	Rufous Paradise-Flycatcher	**Philippine endemic**		
104	*Hypothymis azurea*	Black-naped Monarch	resident, breeding		
105	*Hypothymis coelestis*	Celestial Monarch	**Philippine endemic**		
	Family Pachycephalidae				
106	*Pachycephala philippinensis*	Yellow-bellied Whistler	**Philippine endemic**		
107	*Pachycephala albiventris*	Green-backed Whistler	**Philippine endemic**		
	Artamidae				
108	*Artamus leucorynchus*	White-Breasted Wood-Swallow	Resident		
	Sturnidae				
109	*Acridotheres cristatellus*	Crested Myna	Resident		
	Family Motacillidae				
110	*Motacilla alba*	White Wagtail	Migrant		
	Family Nectariniidae				
111	*Anthreptes malacensis*	Plain-throated Sunbird	resident, breeding		
112	*Nectarinia sperata*	Purple-throated Sunbird	resident, breeding		
113	*Nectarinia jugularis*	Olive-Backed Sunbird	resident		
114	*Aethopyga shelleyi*	Lovely Sunbird	**Philippine endemic**		
115	*Aethopyga pulcherrima*	Metallic-winged Sunbird	**Philippine endemic**		
	Family Dicaeidae				
116	*Prionochilus olivaceous*	Olive-backed Flowerpecker	**Philippine endemic**		

117	*Dicaeum bicolor*	Bicolored Flowerpecker	**Philippine endemic**		
118	*Dicaeum australe*	Red-keeled Flowerpecker	**Philippine endemic**		
119	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	resident, breeding		
120	*Dicaeum pygmaeum*	Pygmy Flowerpecker	**Philippine endemic**		
121	*Dicaeum hypoleucum*	Buzzing Flowerpecker	**Philippine endemic**		
	Family Zosteropidae				
122	*Zosterops meyeni*	Lowland White-eye	**Luzon endemic**		
123	*Zosterops Montana*	Mountain White-eye	resident, breeding		
124	*Zosterops nigrorum*	Yellowish White-eye	**Philippine endemic**		
	Family Estrildidae				
125	*Lonchura leucogastra*	White-bellied Munia	resident, breeding		
126	*Lonchura Malacca*	Chestnut Munia	resident, breeding		
127	*Locnhura punctulata*	Scaly breasted Munia	Resident		
128	*Passer montanus*	Eurasian Tree Sparrow	Resident		
	Family Hirundinidae				
129	*Hirundo rustica*	Barn Swallow	migrant		
	Family Sturnidae				
130	*Sarcops calvus*	Coleto	Philippine endemic		

C. Listing of **Mammal** species recorded based on the biological survey conducted in the province of Quirino from 2002 to 2007 (Population Status and Distribution Status based on "Fieldiana: A Synopsis of the Mammalian Fauna of the Philippine Island" by L.R. Heaney, et al.; Conservation Status based on "Philippine Red Data Book" by WCSP).

#	Scientific Name	Common Name	Distribution Status/ Conservation Status	National Red List (DAO 15)	IUCN 2008
	Family Pteropodidae				
1	*Ptenochirus jagori*	Philippine Musky Fruit Bat	**Philippine endemic**		
2	*Cynopterus brachyotis*	Common Short-nosed Bat	native, non-endemic		
3	*Haplonycteris fischeri*	Philippine Pygmy Fruit Bat	**Philippine endemic**		
4	*Otopteropus cartilagonodus*	Luzon Pygmy Fruit Bat	**Luzon endemic**		
5	*Rousettus amplexicaudatus*	Common rousette	**non endemic**		
	Family Rhinolophidae				
6	*Hipposideros diadema*	Diadem Roundleaf Bat	native, non-endemic		
7	*Hippsideros ater*	Dusky Roundleaf Bat	non endemic		
8	*Hipposideros obscurus*	Philippine Forest Roundleaf Bat	Philippine endemic		
9	*Hipposideros lekaguli*	Large Asian Roundleaf Bat	non endemic		
10	*Rhinolophus virgo*	Yellow-faced Horseshoe Bat	Philippine endemic		
11	*Rhinolophus* cf. *arcuatus*	Arcuate Horshoe Bat	native, non-endemic		
12	*Coelops hirsutus*	Philippine Tailless Roundleaf Bat	Philippine endemic		
	Vespertilonidae				
13	*Kerivoula cf papillosa*				
14	*Murina cyclotis*	Round-eared Tube-nosed Bat	non endemic		
15	*Myotis horsefieldi*	Common Asiatic myotis	non endemic		
16	*Myotis cf macrotarsus*	Philippine large-footed myotis	non endemic		
17	*Miniopterus australis*	Little bent winged bat	non endemic		
18	*Pipistrellus javanicus*	Javan Pipistrelle	non endemic		
	Family Cercopithecidae				
19	*Macaca fascicularis*	Long-tailed Macaque	native, non-		

			endemic		
	Family Muridae				
20	*Rattus everetti*	Common Philippine Forest Rat	**Philippine endemic**		
21	*Rattus exulans*				
22	*Bullimus luzonicus*	Large Luzon Forest Rat	**Luzon endemic**		
23	*Apomys sp.*	Forest Mouse	**Luzon endemic**		
24	*Chrotomys sp.*	Striped Mouse	**Luzon endemic**		
25	*Phloeomys pallidus*	Northern Luzon Giant Cloud Rat	**Luzon endemic**		
	Family Viverridae				
26	*Paradoxurus hermaphroditus*	Common Palm Civet	native, non-endemic		
27	*Viverra tangalunga*	Malay Civet	native, non-endemic		
	Family Suidae				
28	*Sus philippensis*	Philippine Warty Pig	**Philippine endemic**	**VU**	**VU**
	Family Cervidae				
29	*Cervus mariannus*	Philippine Brown Deer	**Philippine endemic**	**VU**	**VU**

D. Listing of **Amphibian** and **Reptile** species recorded in Quirino province based on the biological survey conducted in the province of Quirino from 2002 to 2007 (Population Status and Endemicity of Amphibians based on "Philippine Amphibians, An Illustrated Guide" by A.C. Alcala and W.C. Brown", Population Status and Endemicity of Reptiles based on "A Guide to Philippine Flora and Fauna" by A. C. Alcala; Conservation Status based on "Philippine Red Data Book" by WCSP; Family name of snakes based on "A Field Guide to the Snakes of Borneo" by R.B. Stuebing and R.F. Inger).

#	Scientific name	Common Name	Distribution Status/ Conservation Status	National Red List (DAO 15)	IUCN 2008
	AMPHIBIANS				
	Family Ranidae				
1	*Occidozyga laevis*	Puddle Frog	native non-endemic		LC
2	*Platymantis corrugatus*	Rough-backed Forest Frog	**Philippine endemic**		LC
3	*Platymantis dorsalis*	Common Forest Frog	**Philippine endemic**		LC
4	*Platymantis luzonensis*	Luzon Forest Frog	**Luzon endemic**		NT
5	*Rana everetti*	Everett's Frog	**Philippine endemic**		DD
6	*Limnonectes macrocephala*	Giant Philippine Frog	**Philippine endemic**		NT
7	*Rana similis*	Variable-backed Frog	**Philippine endemic**		NT
8	*Rana luzonensis*	Luzon Frog	**Luzon endemic**		NT
9	*Platymantis sp. 1*	Forest Frog			
10	*Platymantis sp. 6*	Forest Frog			
11	*Patymantis cf taylori*	Taylor's Forest Frog	Philippine endemic		EN
12	*Platymantis cf mimulus*		Philippine endemic		NT
13	*Polypedates leucomystax*	Banana frog	White-Lipped Tree Frog		LC
14	*Hoplobatrachus rugulosus*	Taiwanese frog	non-endemic		LC
15	*Rhacophorus bimaculatus*	Asiatic Tree Frog	native non-endemic		VU
	Family Microhylidae				
16	*Kaloula cf kalingensis*	Narrow-mouthed Frog	Philippine endemic		VU
17	*Kaloula walteri*	Narrow-mouthed Frog	Philippine endemic		DD
	Bufonidae				
18	*Bufo marinus*	American Bull Frog	native, non-endemic		LC
	REPTILES				
	Family Agamidae				
19	*Draco spilopterus*	Flying Philippine Dragon	non-endemic		LC
	Family Scincidae				
20	*Eutropis (Mabuya) multicarinata (indeprensa)*	Two-striped Mabouya	non-endemic		LC
21	*Eutropis (Mabuya)*	Common Mabouya	non-endemic		LC

	multifasciata				
22	*Sphenomorphus cf. jagori*	Jagor's Sphenomorphus	**Philippine endemic**		LC
23	*Sphenomorphus steerei*	Steere's Sphenomorphus	**Philippine endemic**		LC
24	*Sphenomorphus cumingi*	Cuming's Sphenomorphus	Philippine endemic		LC
25	*Lipinia sp.*	Slender Tree Skink			
26	*Lamprolephis smaragdina*	Spotted-green Tree skink	non endemic		LC
27	**Family Varanidae**				
28	*Varanus olivaceous*	Gray's monitor	**Philippine endemic**	VU	VU
29	*Varanus salvator*	Variable Malay Monitor	native non-endemic		
	Family Gekkonidae				
30	*Luperosaurus kubli*	Flap-legged Gecko	Philippine endemic		DD
31	*Cosymbotus platyurus*	Flat-bodied House Gecko	non-endemic		LC
32	*Brachymeles cf bonitae*	Stub-limbed Burrowing Skink	Philippine endemic		LC
	Family Phytonidae				
33	*Python reticulates*	Reticulated Python	native non-endemic	OTS	LC
	Family Colubridae				
34	*Dendrelaphis caudolineatus luzonensis*	Lined Slender Arboreal Snake	subspecies - Luzon endemic		LC
35	*Elaphe erythrura*	Common Rat Snake	non-endemic		LC
36	*Boiga angulata*	Philippine Blunt-headed Tree Snake	**Philippine endemic**		LC
37	*Calamaria sp.*	Worm Snake			
	Family Crotalidae				
38	*Trimeresurus flavomaculatus*	Philippine Pit Viper	**Philippine endemic**		LC
39	*Trimeresurus* sp. 1	Viper			
40	*Trimeresurus* sp. 2	Viper			

Appendix 13. The DENR-adopted Biodiversity Monitoring System

(Manual – Hardcopy only; provided as a soft bound copy)

Appendix 14. Biodiversity Assessment and Monitoring Plan

Forest Carbon Project
Quirino Protected Landscape

Conservation International – Philippines
August 2009

Quirino Forest Carbon Project

Biodiversity Assessment and Monitoring

The Sierra Madre Biodiversity Corridor, covering approximately 1.7 Million hectares, is one of the most biologically important areas in the Philippines. It includes 15% of the remaining closed canopy dipterocarp forests in country as well as 47% of the remaining mossy forests. Aside from the diverse habitat types, the corridor is also home to the endangered Philippine eagle and Philippine crocodile.

Part of the Sierra Madre Biodiversity Corridor is the Northern Sierra Madre Natural Park, the largest protected area under the National Integrated Protected Area System (NIPAS) of the country. The Park is one of the few areas in Asia that contain a high concentration of threatened species. A total of 70 globally threatened or near-threatened species of wildlife have been recorded in the Park. In addition, it harbors the largest remaining lowland forest in the Philippines.

There are no systematic studies on the threats to the natural forests and the biodiversity resources of the target project area. However, experience in the Northern Sierra Madre Natural Park in nearby Isabela province shows that the main causes of forest destruction are logging (large and small-scale), shifting cultivation, agricultural development, land tenure issues, and land speculations (NORDECO/DENR, 1998). Interviews with local people reveal that the same causes are operating in the project area.

Brushland and grassland areas, which are main parts of the project area together with cropland, are the end result of deforestation and decades of upland farming. They are usually of small trees and grasses such as *Imperata cylindrical* (*cogon* in the Philippines and Satan's tail in the US) and *Themeda sachharum* (*talahib* in the Philippines). They have low soil fertility and high erosion rates. For years, the government has been trying to rehabilitate them through reforestation activities. However, government efforts have had little success due to several technical and socio-economic factors. One of these is that lack of incentives by the various stakeholders to keep the trees alive which in turn is partly due to the lack of participation of local people.

In addition, reforestation of barren lands will significantly reduce the rate of soil erosion and degradation in the watershed. The soil conservation benefits of tree plantations and agro-forestry systems are well-documented in the Philippines (Cruz, 1982; Lasco, 1987).

The intention of the biodiversity component of the project is to assess the project impact on biodiversity conservation, watershed rehabilitation and their contribution to socio-economic benefits to the local community and provide an avenue for local partners capacity building, documenting and sharing project implementation experiences, lessons and challenges. This component is expected to take on as a joint effort between DENR, LGU and CI in terms of hands-on field level participation, research and in applying innovative science-based methodologies. This monitoring plan outlines the methodology and the indicators on the biodiversity assessment that will be monitored throughout the project duration.

The biodiversity assessment and monitoring component aims to monitor the impact of the project to biodiversity by monitoring changes in the abundance and diversity fauna species within the project area throughout the duration of the project.

A. Biodiversity Assessment

The following indicators are identified to show the trends in biodiversity characteristics over time within the project site.

Indicator	Data Set	Method	Remarks
1. Species Richness/Composition	Total number of species	Biodiversity Assessment/Transect and survey results	Baseline setting for each taxonomic group and habitat type
2. Number of globally threatened species	List of globally threatened species (IUCN Red List/www.redlist.org)	Transect and survey results	Can show importance of habitat type for the conservation of species of both global and national importance.
3. Number of endemic species	List of restricted range species	Transect and survey results	
4. Number of globally threatened endemic species	List of restricted range species included in the IUCN Red List	Transect and survey results	

The monitoring will be conducted by Conservation International – Philippines together with local communities and DENR. Fauna monitoring will be focused only on birds and bats. These two groups of animals were chosen since they are important indicators of biodiversity and their habits make them practically measurable using the least amount of equipment and effort. They can be easily detected and composition, distribution and abundance of birds and bats are highly influenced by habitat availability. Monitoring sites will be selected in areas where each type of project activities (reforestation and agroforestry) will be conducted. Biodiversity monitoring will be carried out annually to monitor impact of project activities to include plants, birds, and bats. For plants, monitoring will be conducted annually to document floristic changes. Braun-Blanquet Releve Method will be used. A combination of transect and mist-netting will be used for birds while only mist-netting will be used to monitor bats. These methods will allow us to detect changes in relative abundance among sites or habitats and determine response species in changes in habitat/forest structure within the project site. Specific indicators for change in biodiversity are shown below.

Indicator	Data Set	Method	Remarks
Change in habitat type boundaries/ Change in total area of a particular habitat type	Remote sensing data/ vegetation maps and monitored throughout the duration of the project	Manual methods using overlay maps, or GIS where feasible and fixed point photography	Can show expansion and retreat of habitats. Shows whether habitat is being gained or lost over the monitoring area.
Change in number and composition of species	Numbers, presence or absence. Sampling will be done twice a year during dry and wet season	Transect surveys, mist netting, harp trapping and using capture mark recapture method	Indicates overall change in species population size composition per habitat type
Change in abundance and distribution of keystone/indicator/and other species of special interest	Numbers, presence or absence. Sampling will be done twice a year during dry and wet season	Transect surveys, mist netting, harp trapping and using capture mark recapture method	Can indicate changes in species range due to changes in environmental factors (ecological processes)

It is expected that the project will enhance the native biodiversity through the creation and/or enhancement of forested habitats, which will over time increase the numbers and richness of both plant and animal species relative to the current condition in the project area. Increase in the occurrence of endemic species and the maintenance of the populations of threatened species is expected including the subsequent decrease in grassland and other non-forest tolerant species.

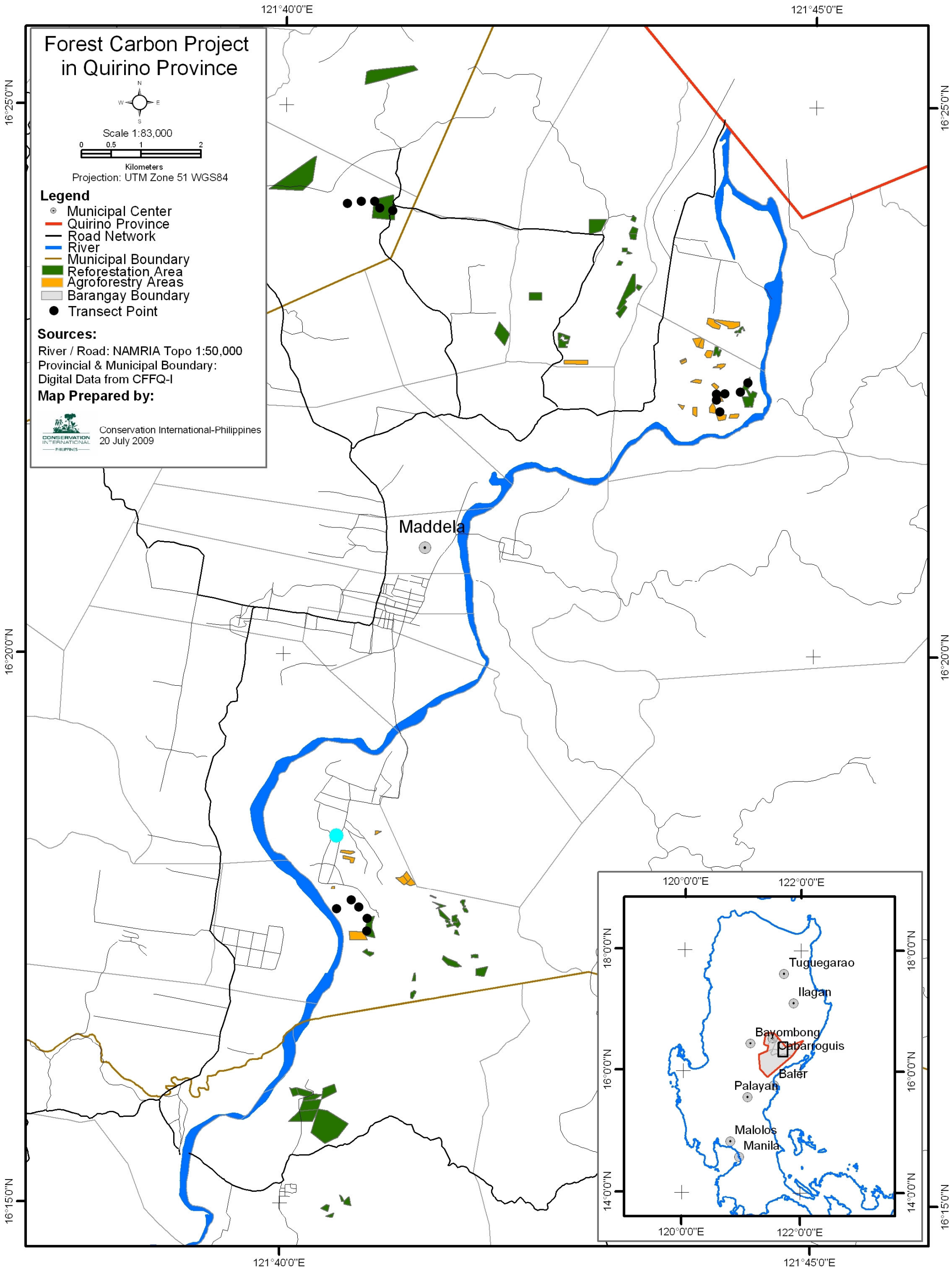


Figure ___. Map showing the monitoring sites and transect points for birds

A.1 Methodology

A.1.1 Transect Survey for Birds

A standard one or about 2-km transect route will be established for the avifaunal inventory. The transect route will be traversed by one observer traveling by foot at a walking speed of 15 minutes for every 250 meters of the transect line. The observer records the following parameters in a standard data sheet: species name; number of individuals; if seen or heard; habit during observation (perched, flying, feeding, etc.), if seen singly or in a group; feeding singly, as a group or in mixed flocks; and, if possible, species of feeding tree. All species that will be recorded are noted in a transect sheet (Appendix 1). Transect surveys will be done during early morning starting from 5:30 am to 8:30 am and late afternoon (3 to 5 pm) for the duration of the survey work. Nomenclature and classification of birds will be based on Kennedy et al. (2000). Population and threatened status follows IUCN 2000 Red List for Threatened Animals (Hilton-Taylor, 2002) and Mallari et al (2000).

A.1.2 Mist-netting of Birds and bats

Mist-nets will be used to catch birds and volant mammals such as bats. Nets will be kept open during the day to catch birds and left open at night to capture nocturnal birds and bats. Black nets with an average mesh size of 36 mm and an average height and length of 2.5 meters and 12 meters, respectively, will be employed. Nets will be set-up 2-3 meters high while the bottom edges of the net were set around 0.3 meter above the ground. Mist-netting stations will be strategically placed normally along mountain ridges, although single or double mist-nets were also placed along forest streams and clearings that are possible flyways of understory birds and bats. Nets will be checked three to five times during the day, especially during early morning for netted bats and nocturnal birds, at noon, and late afternoon (before dusk) and guarded in the evening for two hours (6-8 pm) for insectivorous bats.

A.2 Species Identification

Species captured will be identified to the species level. Basic information such as sex, age, molt (birds), body measurements, weight and reproductive condition was recorded in a standard field catalogue sheets. Standard measurements vary for each animal captured. For birds, this includes total length (TL), forearm or wing length (FL/WL), tail to vent (TV), tarsus, gape, and bill; for bats, tail length (TL), forearm (FA), hind foot (HF), ear, total length (TL), leaflet width (for insectivorous bats) (Appendix 2a and 2b). Identification, nomenclature and classification were based from Ingle and Heaney (1992) for bats and Kennedy *et al.* (2000) for birds. All measurements were recorded using a standard catalogue worksheet (Appendix 3).

B. Biodiversity Monitoring System

The Biodiversity Monitoring System (BMS) developed and adopted by the Department of Environment and Natural Resources (DENR) to monitor biodiversity within protected areas will be used for the project. BMS is a field based monitoring system aimed to identify trends of biodiversity at a given time. It involves simple, cost-effective, and standardized methods (such as field diaries, focus group discussion, transect surveys, photo documentation) in monitoring the trends in population of indicator/priority species and land uses in protected areas; systematically generate up-to-date information necessary for effective and efficient management of protected areas. By design, the BMS involves local communities and other stakeholders in the generation of information, which is expected to be not only cost effective way of monitoring, but also to contribute to more sound conservation outcome (Danielsen, 2007).

The backbone of the BMS is the regular collection of data on natural biological resources and their utilization to determine trends in numbers and use of the natural resources. The intention of the BMS is to improve the information available to decision makers in order to ensure that the area is maintained in accordance with the management objectives and that biodiversity is being conserved (NORDECO & DENR, 2001).

The first step in carrying out the BMS is the identification of the resource uses and species to be monitored together with the local communities. This will help facilitate the monitoring activities as communities frequently observed these species or are resources commonly being used by the community. The four BMS methods are Focus Group Discussion, Field Diary, Photo Documentation and Transect Walk. A summary of information gained from all four methods can supplement and support each other. Description of the different methods mentioned below is lifted from the BMS Resource Book for Trainers.

B.1 Focus Group Discussion

The objective of the focus group discussion is to generate data from the community on the trends in use of natural resources in the area, trends in status of selected resources, number of household benefiting from the use of resources. The information is largely based on the communities own perception but with continuous data gathering and number of participants in the discussion can provide a picture of the general trends. The method is conducted every quarter with the volunteer community monitoring group identified in each of the selected barangays.

B.2 Field Diary

The Field Diary method comprises standard recording of routine observations on resource use, habitats and wildlife following a simple data sheet during regular patrols, or whenever the areas/sites are visited. This will encourage people to be observant of changes in the use of the natural resources, threats and abundance of species identified at the beginning of the BMS establishment. Data recorded in the diary includes people encountered and their activities such as fuel wood gathering, charcoal and if possible include quantity, use, market price etc.

B.3 Photo Documentation
Fix-point photography from the ground level will be conducted quarterly. It will monitor major changes in the vegetation of the area. The monitoring frequency will be reduced to once a year after significant changes are not observed quarterly. This method requires people with working knowledge on the operations of a camera. In this case, the DENR can provide the technical support for the project together with local communities.

B.4 Transect Walk
The transect walk is similar to the field diary method. However, the transect line will be established permanently and at least 2 kilometers in length and will be traversed by the same person every quarter in order for the data to be comparable. This can be done by DENR staff as the lead person together with the community members to train them in identifying species encountered. Data collected in this method includes number of people, species of wildlife and their number.

C. Work plan and Schedule

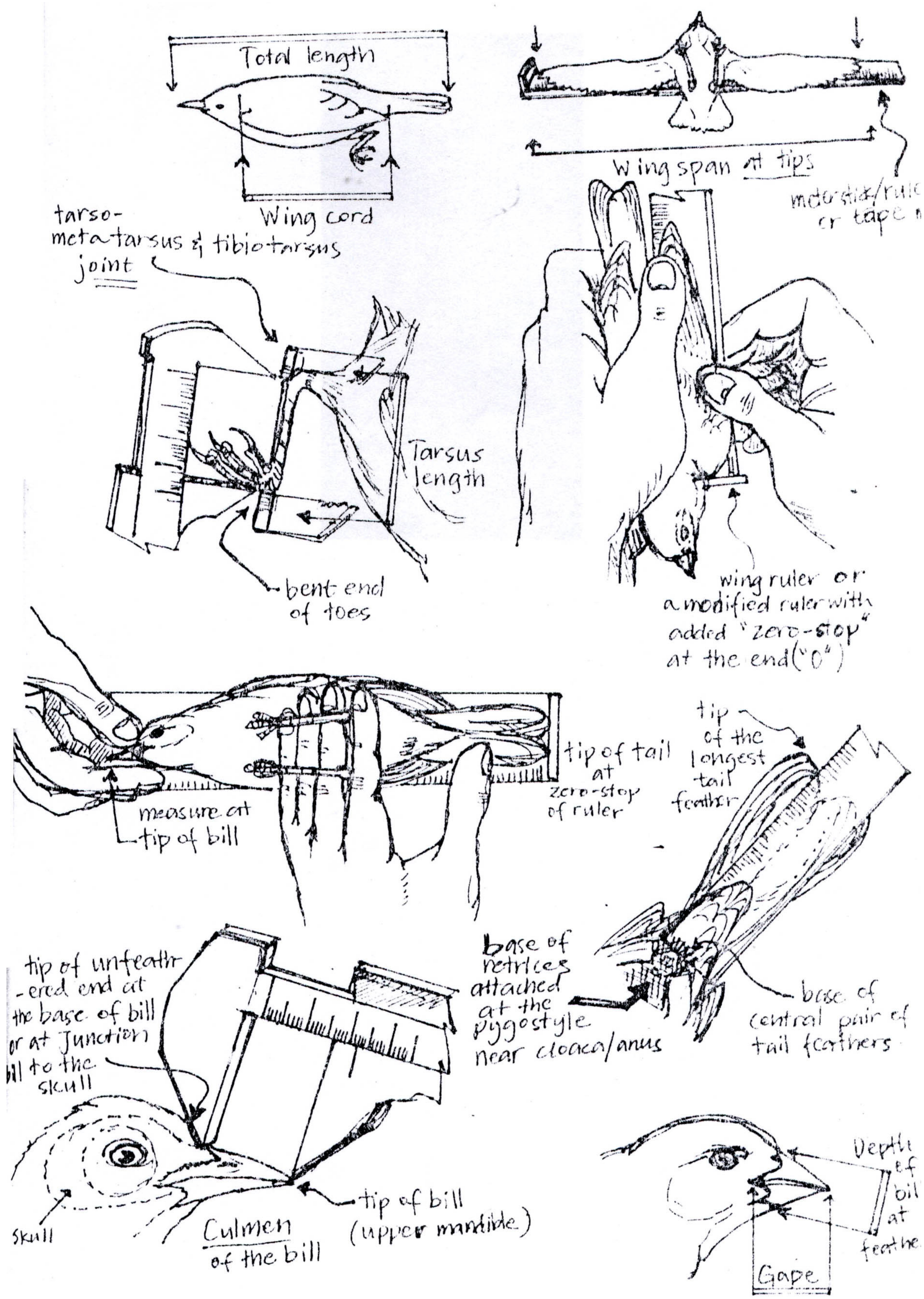
RESEARCH ITEM	**2009**						**2010**											
	J	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Biodiversity																		
1. Biodiversity Assessment and Monitoring																		
Development of Work plan and Identification of Appropriate Methodology	x	x																
Identification of Monitoring Sites	x	x		x														
Identification of field supplies and equipment to be purchase					x													
Conduct Bi-Annual field survey and data gathering for fauna and once a year for flora										x	x					x	x	
Analysis of Data											x	x					x	x
Report writing and consolidation of data analyzed												x						x
Final Report												x						x
2. Biodiversity Monitoring System (BMS)																		
BMS Training for Community (Barangay Officials, Bantay Gubat) and PA Staff and Park Rangers				x														

1. Field Diary (CFGs)						x			x			x			x			x
2. Focus Group Discussion (CMGs)						x			x			x			x			x
3. Photo Documentation						x			x			x			x			x
4. Transect						x			x			x			x			x

Appendix 1. Transect Data Sheet for Birds

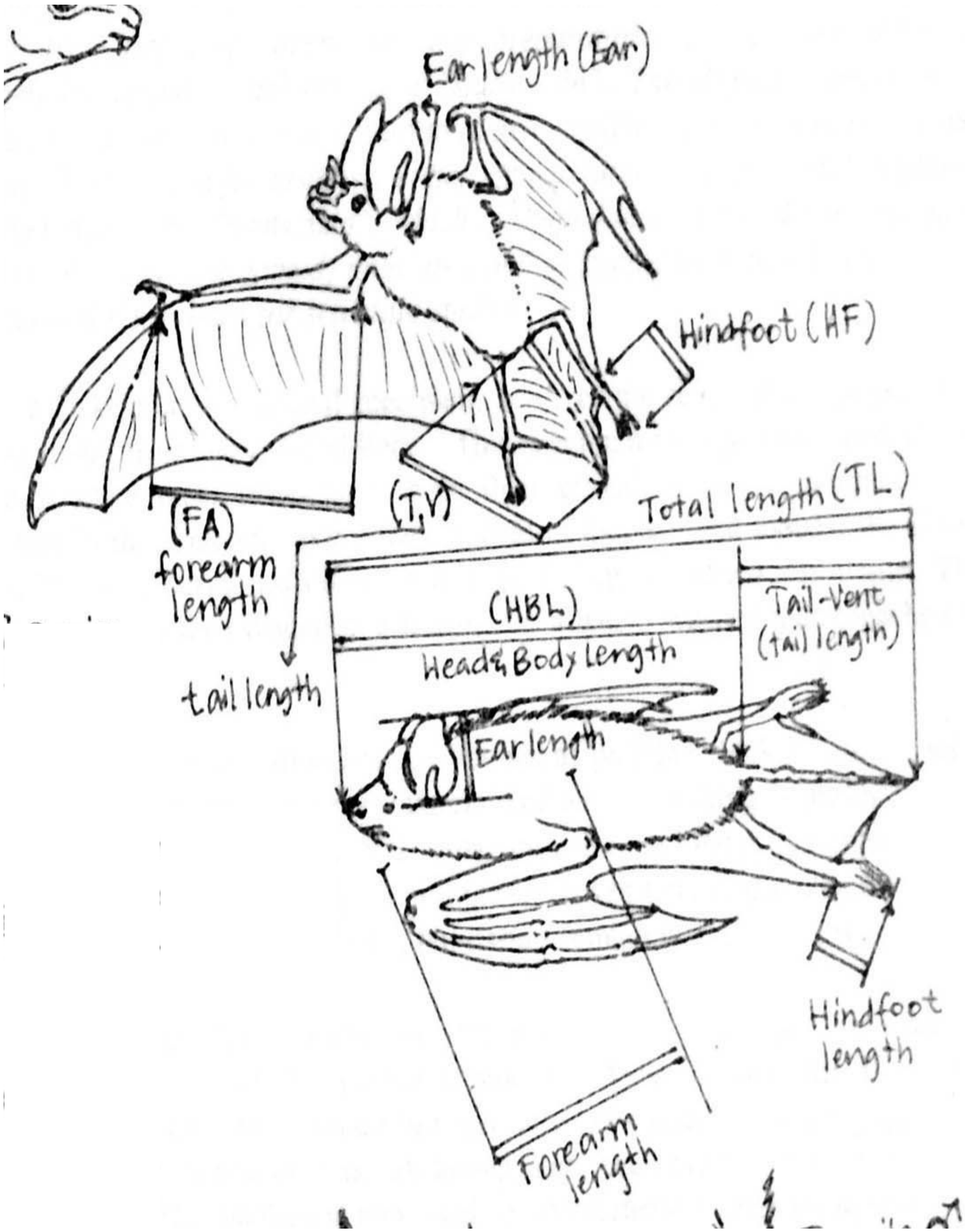
Date:		Locality:			
Observer:		Coordinates:	N		E
Weather Condition:			Time Started:		Time Ended:
Brief description of survey site/ Habitat Type:					
Species	Number of individuals observed	Transect point	Time (hrs.)	Perpendicular Distance (m)	Remarks (S=seen, H=heard, F=flying; P=perched) Habitat strata (1=ground layer, 2=sub-canopy, 3=canopy)

Appendix 2a. Standard measurements for captured birds.



29

Appendix 2b. Standard Measurements for captured bats.



Appendix 3. Sample catalogue sheets for mammals and birds

LOCALITY

FIELD NO. | COLLECTOR | DATE

SPECIES | PREPARATION | SEX | AGE

TL | TV | HF | EAR | FA | WT | COLLECTION METHOD

♂ TESTES POSITION Abd. Scrot. | SIZE L xW mm | EPIDIDYMIS Con. Not. Con. | ACCESSORY GLANDS

♀ MAMMAE NO. Ax. Ab. Ing. | CONDITION Sm Lg. Lact. | VAGINA Perf. Imp. | REPRO. STAGE Nul. Prim. Multi.

PUBIC SYMPHYSIS Closed Slight Open Open | EMBRYOS L R C-R mm | PLACENTAL SCARS L R

HABITAT

REMARKS

CAT. NO.

FIELD NO. | COLLECTOR | DATE

SPECIES | PREPARATION | SEX | AGE

TL | TV | HF | EAR | FA | WT | COLLECTION METHOD

♂ TESTES POSITION Abd. Scrot. | SIZE L xW mm | EPIDIDYMIS Con. Not. Con. | ACCESSORY GLANDS

♀ MAMMAE NO. Ax. Ab. Ing. | CONDITION Sm. Lg. Lact. | VAGINA Perf. Imp. | REPRO. STAGE Nul. Prim. Multi.

PUBIC SYMPHYSIS Closed Slight Open Open | EMBRYOS L R C-R mm | PLACENTAL SCARS L R

HABITAT

REMARKS

CAT. NO.

FIELD NO. | COLLECTOR | DATE

SPECIES | PREPARATION | SEX | AGE

TL | TV | HF | EAR | FA | WT | COLLECTION METHOD

♂ TESTES POSITION Abd. Scrot. | SIZE L xW mm | EPIDIDYMIS Con. Not. Con. | ACCESSORY GLANDS

♀ MAMMAE NO. Ax. Ab. Ing. | CONDITION Sm. Lg. Lact. | VAGINA Perf. Imp. | REPRO. STAGE Nul. Prim. Multi.

PUBIC SYMPHYSIS Closed Slight Open Open | EMBRYOS L R C-R mm | PLACENTAL SCARS L R

HABITAT

REMARKS

CAT. NO.

FIELD NO. | COLLECTOR | DATE

SPECIES | PREPARATION | SEX | AGE

TL | TV | HF | EAR | FA | WT | COLLECTION METHOD

♂ TESTES POSITION Abd. Scrot. | SIZE L xW mm | EPIDIDYMIS Con Not. Con. | ACCESSORY GLANDS

♀ MAMMAE NO. Ax. Ab. Ing. | CONDITION Sm. Lg. Lact | VAGINA Perf. Imp. | REPRO. STAGE Nul. Prim. Multi.

PUBIC SYMPHYSIS Closed Slight Open Open | EMBRYOS L R C-R mm | PLACENTAL SCARS L R

HABITAT

REMARKS

CAT. NO.

Monitoring Plan
Quirino Forest Carbon Project

I. Introduction

The Quirino Forest Carbon Project (QFCP) aims to achieve 'Triple Benefits', namely, to create an alternative source of income for the local communities, protect and improve the habitat for wildlife and plants, while at the same time stabilizing the ecology in critical watershed areas to ensure a steady supply of water. The primary goal of the project is forest restoration and habitat rehabilitation.
The project area constitutes of 108 separate land parcels, with a total area of 177.2 hectares. All but one of the parcels are located on public lands where Certificates of Stewardship Contracts (CSCs) have been issued to individuals in Integrated Social Forestry (ISF) lands, while one parcel is owned by one private land owner. The Project started in 2007, and the crediting period will end in 2029.

3. Reforest 155.0 ha with multiple native species suitable to restore the forest cover and appropriate biophysical conditions at the project site (hereafter, reforestation).
4. Establish 22.3 ha of agroforestry from which the local communities derive additional income and improve the long-term productivity of the farms (hereafter agroforestry).

Funding support for this Project is provided through a grant agreement with moreTrees, a Japanese carbon offset provider, on a non-profit basis. Under the agreement, financial arrangement has been made between moreTrees and CI to cover all necessary operational costs for the entire project area throughout the crediting period. After 2029 the well-capacitated government agency will resume responsibility for forest management to ensure the permanence of the project intervention.
Monitoring activities shall be conducted by the members of the Technical Working Group (TWG). This is composed of the Barangay Captains, PO members, DENR, CI, PNREO, MENRO and PEDAI.

II. Monitoring Design

1. Monitoring the overall performance of the proposed project activity

d) Monitoring of the actual project boundary

The actual project boundary was determined before the start of the Project, recorded in GIS system, and will be monitored periodically throughout the crediting period. All the project participants shall be provided with individual lot map wherein boundaries are properly documented.

e) Monitoring of the forest establishment

The forestation model (reforestation or agroforestry), planted species and planted year for each lot will be recorded. The survival rate of planted trees will be checked and re-planting will be conducted if the survival rate is lower than 80%. Complete enumeration shall be done during he first and second year of the planting seedlings to determine survival and mortality.
Name of species and species list group of each seedlings planted shall be identified and digitized. This is to easily determine the seedling density of each parcels and identify which species shall be replaced.

Natural and anthropogenic disturbances will be recorded by date, locations, species, area affected, and corrective measures implemented. Occurrences of rainfall shall also be recorded and other weather irregularities will be documented. See attached monitoring forms **(FORM A -C)** and reference point location form for reforestation and agroforestry plantations.

2. Monitoring the actual net GHG removals by sinks

g) Stratification

The *ex post* stratification shall be based on the forestation models and the planting years for the monitoring of carbon stock changes in above- and below-ground biomass. However, the boundary of the strata may change during the crediting period if unexpected disturbances that have differing impacts on various parts of an originally homogeneous stratum.
h) Sampling plot number

The monitoring methodology uses permanent sample plots to monitor carbon stock changes in above- and below-ground biomass pools. To reach the targeted precision level of about ±10% of the mean at the 90% confidence level which is a requirement of AR-AMS0007, the number of plots needed in each stratum will be determined by applying the latest methodological tool "Calculation of the number of sample plots for measurements within A/R CDM project activities". However, for the strata S1 and S4, in which numbers of the land lots are small, one sampling plot will be set in each land lot. For the other strata, preliminary 6 sampling plots will be set and used to calculate the number of sample plots required to satisfy the targeted precision level at the first monitoring.

i) Sampling plot size

Different sizes will be applied for the sampling plots in the reforestation strata (S1-S3) and those in the agroforestry strata (S4-S6) because of difference in the tree densities. It is recognized that measurements of 10-15 trees give sufficient precision to obtain average diameter and height of trees, and the sampling plot sizes shall be determined so that the plots include 15 trees inside. In the reforestation strata, in which trees will be planted in density of 1,111 plants per hectare and thinned to approximately 490 plants per hectare, 20 m x 20 m sampling plots will be used, while in the agroforestry strata with 8 m x 8 m spacing, 35 m x 35 m sampling plots will be installed.

j) Plot location

GPS located permanent plots ensure the measuring and monitoring consistently over time. To avoid subjective choice of plot locations (plot centers, plot reference points, movement of plot centers to more "convenient" positions), the sampling plots shall be located randomly and also as evenly as possible.

Permanent plot locations shall be clearly recorded to ensure efficient reoccupation of the plots for later measurements. Markings like clear bright paints shall be used for all the designated permanent plots. At early stage i.e. 1st to 2nd year of the plantation, aluminum tags shall be used, however if aluminum tags are not available, an improvised tag shall be used instead. A map should be ready to indicate the permanent plot locations. See attached **Forms- D and E** to be used for the permanent sampling plots.

The following general standards are required for carbon inventories using permanent sample plots:

1. Accurately describe the sample locations for future revisiting of sample plots.
2. Keep adequate records of all data.
3. Specify standards for stratification and sampling design for every inventory, and adhere to these standards carefully.
4. Take all measurements carefully, using properly adjusted instruments of proven accuracy. Make every effort to eliminate personal bias by using well-understood instructions and factual observation in the field.
5. Calculate sampling errors.
6. Inadequate marking, measurement or recording of data, or the sloppy location of plot centers, may indicate errors or biased location of sample plots. This may cause a sponsoring agency to reject the inventory.

Tools and Equipment to be used:

1. Tree caliper (for seedlings at early age)

2. Diameter tape (for saplings, trees-dbh)

3. compass/clinometer combination for navigation, plotting on the map, bearing and slope measurements
4. GPS

k) Monitoring frequency

Practically, monitoring will be started in 2013 after the Project is registered, and conducted every 5 years. However, PEDAI and CI together with the members of the TWG shall start the monitoring activity on the 1st year of the project on a bimonthly basis and quarterly on the 2nd year. This is to ensure that the established areas both for the reforestation and agroforestry are maintained and protected.

Costing for inventory and monitoring is also essential to take into consideration. The required time and amount of money involve should be documented. The importance of this data is for estimating the cost of sampling in each stratum to determine the optimum allocation of sample plots. (See attached **FORM –F**)

III. Community Impact Monitoring

CI and PEDAI will take the lead of community impact monitoring, and be assisted by project partners. The monitoring will be conducted every five years. Monitoring variables shall consist of the following: information on land use, demography, occupation, types and sizes of agricultural operations, livelihood alternatives. Formal survey using this instrument as well as the monitoring/consultation as described below will be consolidated to provide rigorous assessment of project's community benefits.

The selected and prioritized indicators to lay down parameters for eventual evaluation of project impacts on the community will be initiated at two levels:

I. Community wide or the barangay level to compare across the five project sites:

1. Socio-demographic status
    a. Net migration rate and trends: in-migration, out-migration, circulation in natural resource use areas or dense urban sites
    b. No. of households with built unit less than five years (proxy variable for in-migration)
2. Status and access to basic services
    a. Completion of secondary education
    b. Quality of educational services and facilities (related to environmental quality)
    c. Population-to-barangay health station ratio/ population-to-health workers ratio
    d. No. of households with access to safe drinking water
    e. No. of households with own sanitary toilet
    f. Waste and drainage system

3. Livelihood engagements
    a. Employment by source and income
    b. Population engaged in livelihood activity
    c. Kinds of natural resource used/collected

4. Ecogoveranance
    a. Types of tenurial instrument/ resource-use permits held by a household
    b. Inclusion & implementation of reforestation plans and ordinances

c. Change in practices and values to counter destructive resource use: reliance on illegal logging
d. use of fuelwood and charcoal from natural forest

II. Household level differentiating Farmer- Participants (FP) and non-participants (NP) as comparison group.

1. Economic benefits as increase in income from:
    a. Income from incentive payments for successful establishment and ensured growth of seedlings in reforestation and enhancement planting, and
    b. Benefits shared from harvest of fruit trees in agro-forestry.
2. Capacity building
    a. Training in various techniques in forest establishment and management (SALT, soil and water conservation, mulching, pest control, and marketing)
3. Values, attitudes, and behaviors
    a. Positive changes in environmental values, attitudes, and practices.

IV. Quality Assurance/Quality Control

CI will provide training on forest carbon monitoring initially for the TWG members and later on for the farmer-participants and for the PO members.
PEDAI will conduct the measurement and monitoring activities under supervision of CI.
PEDAI will be responsible for measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the Project. PEDAI will report formally to CI annually on the progress during the past year and issues that have been identified.
CI will provide technical instruction on the activities, conduct informal routine communication with PEDAI for more frequent updates and, if necessary, timely attention, conduct checking and verification of measured and monitored data.
CI will also provide technical consultation and training in the measuring and monitoring of the actual GHG removals by sinks and will be responsible for drafting monitoring report.
As stipulated in the Revised Rules and Regulations for Implementation of Community-Based Forest Management Strategy (DENR Administrative Order No. 2004-29), participatory monitoring and evaluation will be conducted annually by a team composed of representatives from project partners (DENR, LGU, NGOs, POs) and other concerned sectors in which case the Technical Working Group which was formed last November 2010.
As the government-mandated body, the Community, Environment and Natural Resources Officer (CENRO) of DENR will document the POs' activities and outputs pertaining to their organizational, social and economic development and the corresponding influence or impact towards the promotion of sustainable resource use and development. Lessons learned, issues and concerns will be put into CENRO's quarterly summary reports.

INVENTORY FORMS

FORM –A Reforestation and Agroforestry Inventory Form

Crew:________________________ Date: _____mo/______day_____year

Farm No.:____________________ Stratum No.:________________________

Plot No.:_____________________ Plot Radius:_________________________

Tree No.	Species code	Height	DBH	Tree No.	Species code	Height	DBH

FORM- B Farmer Interview Form

Crew:____
Farmer's name:____
Farm No.:__________________________Stratum No.:__________________
Farm Location:____
Approximate date when refo/agro planting was established:__________________
Land use of the plot before the planting was established:
_____fallow____ years ____pasture_____years ___crop___years
___forest
Lot Parcel Size:__________

Tree Component of the Agroforestry Planting:

Species	Spacing	Number Planted	Growth Rate	Problems encountered	Products/ Yield

Crop Component of the Agroforestry planting:

Species	Spacing	Planting Date	Harvest Date	Problems	Products/ Yield

FORM C Reference point location form

Crew:________________________________Date:____mo/_____/day_____/year
Farm Number:_________________________Stratum Number:_______________
Reforestation and Agroforestry Sketch Map for Individual lot parcels:

Estimated length:_____________________________
Estimated width:______________________________

	Species	DBH	Distance to reference pt	Bearing to reference pt.
1st reference tree				
2nd reference tree				

GPS coordinates of the plot reference point=____

FORM-D

PLOT LOCATIONS

Crew___________________________ Date_________________________

Project_________________________ Barangay_____________________

Plot Location Method (circle one) GPS___Compass______

Strata No.	Plot No.	Plot Size	Landmark or Known point	Bearing from Landmark	Planned Position		Actual Position*		Elevation (r	Comments
					Latitude	Longitude	Latitude	Longitude		

- * If different from planned

FORM E. PLOT CARD

Strata number____________ Plot Number________ Waypoint No._________
Vegetation type:__________ Crew Chief_________ Date: ________________

Tree No.	Spp Code	DBH (m)	Height

Next waypoint no.:____________Bearing to next waypoint:________Distance:_______m

Landmarks?

FORM-F INVENTORY COSTS

PARTICULARS	Cost/Man-day	Total Days	Cost
Planning			
Supervision			
Materials			
Transportation			
Other			
Training			
Instructors			
Materials			
Other			
Quarter Point Method Survey			
Supervision			
Materials			
Transportation			
Other			
Permanent Plot Establishment			
Supervision			
Materials			
Transportation			
Other			
Permanent Plot Monitoring			
Supervision			
Materials			
Transportation			
Other			
Total inventory costs			

References:

1. **A Guide for Project: Managing for Impact in Rural Development; IFAD**
2. Baseline and Project Monitoring Plan for the Western Kenya Integrated Ecosystem Management Project WKIEMP), 2006
3. **Conservation International and Toyota Motors Corporation: The Philippine Peńablanca Sustainable Reforestation Project (PPSRP) –Project Design Document for Climate, Community and Biodiversity Standards Second Edition, August 2009**
4. K.G. MacDickenForest Carbon Monitoring Program, Winrock International Institute for Agricultural Development: **A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects**
5. **Jacob Olander and Johannes Ebeling Building Forest Carbon Projects: A Step-by-Step Guide,Version 1.0, November 2010**
6. **Winrock International Prepared for California Energy Commission** (Public Interest Energy Research Program), 2004. METHODS FOR MEASURING AND MONITORING FORESTRY CARBON PROJECTS IN CALIFORNIA