Final Thesis

Developing and implementing a monitoring and evaluating system for the reforestation projects of The Mabuwaya Foundation in the Philippines

Hogeschool VAN HALL LARENSTEIN

ONDERDEEL VAN WAGENINGEN UR

MABUWAYA FOUNDATION, INC. 2003

Final Thesis

Developing and implementing a monitoring and evaluation system for the reforestation projects of The Mabuwaya Foundation in the Philippines

Name: Cornee Diepeveen; corneediepeveen@live.nl
Student number: 900115101

Date: 05 January 2015

Supervisor at Van Hall Larenstein:
Erika van Duijl; erika.vanduijl@wur.nl

Supervisor at Mabuwaya Foundation:
Jan van der Ploeg; vanderploegjan@hotmail.com
Merlijn van Weerd; merlijnvanweerd@yahoo.com

Study: Forest and nature management
Major: Tropical Forestry
Major coordinator: Peter van der Meer; peter.vandermeer@wur.nl

The picture on the front page is made in the NARRA-Project by Cornee Diepeveen.

PREFACE

With this final thesis I want to help the Mabuwaya Foundation with their reforestation projects. I am going to do this by developing and starting with the implementation of a monitoring and evaluation system. This system should give them knowledge about the current state of the reforested areas and insights on different methods to preserve current successes and/ or improve less successful results.

My motivation on taking this subject as my final thesis is the fact that I can help an organization with reaching their goal on creating and preserving a habitat for a beautiful and endangered animal species, the Philippine crocodile. Another reason for my choice is the chance of going to South East Asia. I think this region is very interesting for me as a tropical forester. Not only for preserving the tropical forests that is left, but also for developing methods and systems to help organizations with 'creating' new forests. This project may be useful for other organizations as well.

AKNOWLEDGEMENTS

Without the help of many people I could not have done this thesis research. A special thanks goes to Van Hall Larenstein University and Mabywaya Foundation Inc. for offering me the possibility to go to the Philippines and conduct this research. I want to thank Merlijn van Weerd, Jan van der Ploeg, Maritess Balbas, Ronald Addatu and Dominic Rodriguez from the Mabuwaya Foundation Inc. for all their help and time; Erika van Duijl from van Hall Larenstein University for being my supervisor in the Netherlands; Jouel Battung Taggueg from ISU Cabagan CFEM for being my supervisor in the Philippines; Marc for being my field assistant and translator and everyone from CCVPED.

I also want to give thanks to the other students, Lien Vermeersch, Lotte Wijnants, Maja de Belder and Silke Peeraer, who were conducting their research at Mabuwaya Foundation Inc. at the same time, for making the time in Cabagan more fun, cozy and easy.

TABLE OF CONTENTS

ABBREVIATIONS AND SYMBOLS USED

A&D = alienable and disposal
C. = central
CBFM = Community-Based Forestry Management
CEP = Coastal Environmental Program
CFP = Community Forest Program
cm = centimeter
CTF = Communal Tree Farming
DENR = Department of Environment and Natural Resources
DBH = Diameter at Breast Height
E. = East
FAR = Family Approach to Reforestation
FLMP = Forest Land Management Program
FOM = Forest Occupancy Management
FSP = Forestry Sector Project
GIS = Geographical Information System
GPS = Global Positioning System
ha = hectare
IGM = Inspeccion General de Montes
IRMP = Integrated Rainforest Management Project
ISFP = Integrated Social Forestry Program
LIUCP = Low Income Upland Communities Project
m = meter
masl = meter above sea level
mm = millimeter
Mt. = mountain
NGP = National Greening Program
NGO = Non-Governmental Organization
NIPAS = National Integrated Protected Areas System
PO = Peoples Organization
PROPEM = Program for Forest Ecosystem Management
RRMP = Regional Resources Management Project
St. Dev. = Standard deviation
UDP = Upland Development Project

% = percentage
= number

LIST OF FIGURES AND TABLES

1. INTRODUCTION

1.1 General introduction

Despite all the efforts made by several stakeholders in forest land rehabilitation and immoderate funding from national and international organizations, reforestation projects in Region II in the Philippines have not been very successful. One of the reasons is the very low survival rate of the planted seedlings. It is hard to find areas where the forest cover was restored by these projects. (Masipiqueña et al 2009)

Various specific reasons can be pointed out for the many failures, starting with unavoidable factors. Some failures could not have been avoided. In some cases it was caused by fires because of abnormal weather conditions like a lack of rainfall. Water is an important factor, during the initial growing periods of plants. However some species can adapt well to these extreme conditions. This shows another possible reason for the failures. The tree species used appeared to be unsuitable for the soil and climate conditions of the plantation site. This can be solved by starting with small trail plots before using the species in a large-scale plantation. In this region the species most often used for reforestation projects are Narra (*Pterocarpus indicus*), Mahogany (*Swietenia macrophylla*) and Yemane (*Gmelina arborea*). Other species also often used are: Black wattle (*Acacia mangium*), Earleaf acacia (*Acacia auriculiformis*), Eucalyptus species, Albizia falcataria and Teak (*Tectona grandis*). (Masipiqueña et al 2009; Durst 1981)

Survival rate of seedlings is also affected by how the planting stock is handled. Knowledge about planting stock types and use of fertilizers should be well known by everybody involved in replanting activities. There should be a clear time schedule and all activities need to be carried out very efficiently because rainfall is seasonal. A realistic management plan of all activities for the whole project cycle is necessary to have. (Masipiqueña et al 2009)

Fire and free roaming cattle are the biggest threats for the plantations. Fires can be controlled by making firebreaks to keep fires from outside out of the plantations and fire patrols should be conducted during the dry season. Damage by roaming cattle can be controlled by completely fencing the entire plantation site. These fences are expensive and need to be checked regularly. The high costs which come with these regulations are mostly the cause it is not done properly. (Masipiqueña et al 2009; Sakurai 2006)

Another problem is the lack of ability to monitor and evaluate processes during the reforestation cycle. Because of this it is not possible to intervene with solutions for problems as fire, grazing or pests without making the project a failure immediately. Monitoring is important because with monitoring you can detect problems earlier, you can make progress reports for donors and you are pressed to visit the project site. Observe the progress with your own eyes always gives a better view. It is important to monitor the progress. With tree plantations this can be the tree growth. With tree growth not only the size of the trees is meant, also side effects like damage by animals or humans and competition between species.

However, also successes can be seen in projects with ‘reforestation’ as goal. According to Mangabat et al. a positive outcome can be seen in a project in the North East of Luzon where the government worked together with a NGO to motivate local farmers to reforest parts of their land. (Mangabat et al 2009). The success of this project can be seen as a result of using the right conditions which are described by Pasicolan et al. These success conditions are the practice of intercropping, the farmers' direct need for tree products and other uses, assured access or property rights, wood products market prospects, the farmers' economic situation, the farmers' enterprising attitude, building on local options and collective or neighborhood co-operation. (Pasicolan et al 1997)

Successes in reforestation projects in the Philippines depend on different drivers. These drivers are (1) survival rate of trees, (2) actual planted area compared to the target area, (3) area remaining intact compared to the actual planted area, (4) mean annual increments for total volume and above ground biomass, (5) tree species diversity, (6) soil erosion and landslides frequency, (7) jobs, (8) market access, (9) cash income and (10) food security. (Hai Dinh Le et al 2014, Hai Dinh Le et al 2012)

1.2 This study

This study took place near the town of San Mariano, located in the Isabela province. See *Figure 11* (*Appendix 1*) for a map with the location of the project marked in a red square. The land area of Isabela province is just over 10,500 square kilometers, which is around 3% of the total land area of the Philippines. The biggest number of Philippine crocodiles occur in this province. Because this species is critically endangered, Mabuwaya Foundation Inc. has three areas allocated to be reforested and hereby create or protect a natural habitat for these crocodiles. Only there are some problems in achieving this goal. The problems concerning these reforestation projects are Imperata grasslands and poor soils (pers. comm. J. van der Ploeg, M. van Weerd and M. Balbas). This study is conducted in one of these areas: The NARRA-Project. This area is chosen by the Mabuwaya Foundation Inc. as most appropriate area to make this monitoring system for, since it is the oldest rainforestation area of the foundation.

The NARRA-Project was initiated by the Mabuwaya Foundation Inc. in 2004. The research area is a rainforestation area in combination with a crocodile sanctuary. Rainforestation is the name given to reforestation projects throughout the Philippines. The goal of these projects is to get the rainforests back. The research area is located between the villages of San Isidro and Dunoy. These villages are part of San Mariano in the Isabela province. In *Figure 5* it is located in the zone which is called 'foothills'. The Mabuwaya Foundation Inc. is working together with the people from the local communities. The Peoples Organization (PO) is responsible for maintaining the project area. This includes collecting seedlings/ wildlings from the forest, maintaining the tree nursery, planting trees in the project area, sustaining and protecting the project area. Also the caretaker of the project area, who lives in the project area with his family, originally comes from a local community. The PO exists of people from all communities; San Isidro, Malaya and Dunhoy. The chairman is Carlito Pregilliana. Around 50 years ago the area was still rain forest. After the clear cutting the area was used for agriculture. After the rediscovery of the Philippine crocodile in 1999 it was decided to renew the land use purpose into the crocodile sanctuary and rainforestation area as it is today. (pers. comm. Mabuwaya Foundation Inc. staff and local people)

In total 26 hectares was used for this reforestation project. At this moment the project area is around 29 hectares. Two different kind of trees are used, fruit trees (agroforestry land use) and forest trees (reforestation land use). The tree species that are used in the agroforestry part of the area are Soursop (*Annona muricata*), Jack fruit (*Artocarpus heterophyllus*), Mandarin (*Citrus reticulata*) and other citrus species (*Citrus tangerine* and *Citrusfortunella microcarpa*), Rambutan (*Nephelium lappaceum*), Ipil-ipil (*Leucaena leucocephala*) and Kakawate (*Gliricidia sepium*). The agroforestry area covered around 40% of the total area. The reforestation area covered 59% of the total area. Only indigenous tree species were planted using seedlings collected in the forest. Species that are used are Narra (*Melastoma malabarica*), Tindalo (*Pahudia rhomboidea*), Ipil-ipil (*Leucaena leucocephala*), Kamagong (*Diospyros blancoi*) and Molave (*Vitex parviflora*). The other 1% is used for fire lines with Banana trees (*Musa spp.*). (Source: Mabuwaya Foundation Inc.)

Table 1 presents the initial plans of the Mabuwaya Foundation Inc. for the reforestation project using different land use models. In the table the tree species used, number of trees, area per species and total number of trees planted per land use model can be found.

Table 1: Tree species and number of trees per land use model according to the initial plans of the NARRA-Project

Land use model	Species	Scientific name	# of trees per ha	Area (ha)	Total # of trees
Agroforestry	Rambutan	Nephelium lappaceum	400	5.20	2,080
	Jackfruit	Artocarpus heterophyllus		2.34	936
	Soursop	Annona muricata		2.60	1,040
	Citrus	Citrus spp.			
	Kakawate	Gliricidia sepium	2,000	0.26	520
	Ipil-ipil	Leucaena leucocephala			
Reforestation	Narra	Pterocarpus indicus	1,111	10.40	11,554
	Tindalo	Afzelia rhomboidea		3.64	4,044
	Ipil-ipil	Leucaena leucocephala			
	Molave	Vitex parviflora			
	Kamagong	Diospyros blancoi	400	1.30	520
Fire Lines	Banana	Musa spp.	1,000	0.26	260
			TOTAL	26	20,954

Source: Mabuwaya Foundation Inc.

Until this research the NARRA-Project has never been monitored. Only progress reports were made to show the progress of the reforestation activities compared with the initial plans to the donors. *Appendix 7* shows one of these progress reports made by the Mabuwaya Foundation Inc. in 2004.

1.3 Main reforestation problems

1.3.1 Imperata grasslands

For reforestation projects in this area, Imperata grasslands (*Imperata cylindrical*) often is a problem. This is because Imperata is very sensitive to fire. The grass is a very flammable fuel. Three days without rain the grass becomes so dry that the risk of fire is very high. These Imperata grasslands however need fire to regenerate. Another problem with Imperata is that it is hard for other species to compete with the Imperata for water, light and nutrients. Also the toxic substance which is formed and leaking out of the roots can affect some species in their growth. (Friday et al 1999). During the start of the NARRA-Project Imperata grass was a problem as shown in the picture of the project area in 2004 (*Figure 1*).

There are several methods to control Imperata grasslands. According to Turvey (1994) shading, mulching and cultivating is the best way to control Imperata grasslands. Shading can be done by tree species or by using crops. The main objective of this method is to avoid fire, so the Imperata grass will get dry. Mulching can be done to prevent further regeneration in an effective way. With mulching the stems are broken by flattening it with light rollers (Bourgoing et al 1987). Mulching however is very labor intensive and will only work if the stems of the Imperata grass is very dry. The last part to control the Imperata is to cultivate the land. However timing, rotation and persistence are very important to succeed. Timing is important because the Imperata needs to be dry enough to break. If you do not wait long enough the grass will not be dry enough. Rotation is important because the land should be used in order to not give a chance to grow to the Imperata. Persistence is important because it could take years to get rid of the Imperata grass. (Tjitrosoedirdjo 1993).

Various studies confirm that the most important factor of controlling Imperata grasslands is to avoid fire[1]. The Imperata will be less reproductive if fires do not occur (Friday et al 1999; Turvey 1994; Bourgoing et al 1987; Tjitrosoedirdjo 1993).

Figure 1: Imperata grassland in the NARRA-Project area in 2004 (Source: Mabuwaya Foundation Inc.)

1.3.2 Poor soils

About 50 years ago, the area between San Mariano and the Sierra Madre National Park was still covered with forest. Nowadays most of this forest has been converted to cropland. Cropland makes the soil less fertile since they use the fertility to grow and not much fertilizers are used. The reason for the poor soils however is erosion. Since the area is hilly and rains can be heavy during the raining season all the fertile top soil has flushed away. (Pers. Comm. J. van der Ploeg, M. van Weerd and local farmers)

[1] http://www.fao.org/docrep/006/y5031e/y5031e08.htm

1.4 Research objectives

1.4.1 Research objective

The main goal for this research is to develop a monitoring and evaluating system for the NARRA-Project of the Mabuwaya Foundation Inc. in the Philippines. The secondary goal for this research is to assess the reforestation activities of the Mabuwaya Foundation Inc. and its partners.

1.4.2 Research questions

The main research questions are:

- How would an appropriate monitoring system look like?

  A monitoring system for the Mabuwaya Foundation Inc. is appropriate when:
    - Staff and co-workers are competent enough to work with the system
    - The costs are little
    - Equipment is available or easy to lend

- What is the current situation of the reforestation process?

  In order to get a database with information about the reforestation activities, which can be used as baseline for the monitoring system, and as an evaluation on the current reforestation activities, data will be gathered on the following topics:
    - Observations
        - Planting activities
        - Protection activities
        - Competition between plant species
    - Tree measurement surveys
        - Diameter at breast height (DBH) of trees
        - Height of trees
        - Number of trees
        - Planted vegetation vs. natural regrowth

- Have the reforestation efforts been successful?

2. RESEARCH METHODS

2.1 Monitoring system

Before the fieldwork, a proposal of a monitoring system was made on experience of earlier monitoring work in Brazil (Diepeveen 2012) and literature research. According to Kusek (2004) a good monitoring system exist of 10 steps:

1. Conducting a readiness assessment.
2. Agreeing on outcomes to monitor.
3. Selecting key indicators to monitor.
4. Baseline data on indicators.
5. Planning for improvement.
6. Monitor results.
7. Role of evaluation.
8. Report findings.
9. Use findings.
10. Sustaining the monitoring system within the organization.

The initial monitoring system consisted of permanent square sample plots of 20 by 20 meters. However, after the first observation field trip, this method did not seem to be appropriate for this area, because setting out the square sample plots and the measuring of the trees would be too time consuming due to the current vegetation of Tiger grass. Therefore the method was changed to permanent transect lines of 300 meter long and 2 meter width. Within these permanent transect lines the Diameter at Breast Height (DBH) and the height were measured of all trees with a diameter equal to or more than 1 cm. All data was filled in on field forms (see *Table 17 - Appendix 4*). To prevent losing data the field forms were immediately transferred to the digital database which was made in Microsoft Access 2010 when returned from the field. This database is the baseline for the Mabuwaya Foundation Inc. for future monitoring surveys.

Why was chosen to use permanent sample plots? This is done because of the advantages for future monitoring surveys. The first advantage with permanent sample plots is the ability to monitoring the same area and even the same trees every time. Therefore better comparative data is gathered. The second advantage is that it saves time to establish the plots. Only the first time the plots need to be set out.

The following materials were used to gather and analyze the data:
- ESRI ArcGIS 10.1
- Microsoft Access 2010
- Field forms (*Appendix 4*)
- Digital camera
- Compass
- Map of the area
- Measurement tape
- Clinometer
- GPS
- Machetes
- Robe
- Tags
- Fish wire
- Permanent marker
- Pencil
- Bamboo stick

2.2 Collecting of data

The methods that were used to collect the data are observations, tree measurements during three field surveys and dialogues with people from the Mabuwaya Foundation Inc. staff and local communities. Observations were used to get a first indication of the area and to identify the trees. Tree measurements surveys were used to be able to make a database with all the possible information.

2.2.1 Data collected by observations

Data collected by observations was gathered during four field trips. This data consisted of processes that indicate reforestation activities and processes that indicate growth rate of the planted tree species.

Planting activities

Are there still planting activities going on in the project area? This was observed during all the field trips that were conducted and through dialogues with local people.

Protection activities

Measures undertaken to protect the project area against fire, roaming cattle or cutting of trees. This was observed during all the field trips and through dialogues with local people.

Competition between plant species

According to J. van der Ploeg (pers. comm.) competition between Imperata grass and the planted trees is high. Observations during all field trips will clarify how big the percentage of groundcover by Imperata grass is in the project area and how this affects the planted trees. During these observations also other competitors and competition between the planted tree species were indicated.

2.2.2 Data collected by tree measurement surveys

The tree measurement surveys were done by two people. The field assistant and me. The field assistant identified the tree species and measured the DBH and the height of the trees and I wrote all the data down on the field forms. After the first observation field trip, it was decided to make permanent transect lines instead of square plots, because these plots would have taken too much time to establish and to measure all the trees within these plots. *Figure 2* shows a schematic overview of a transect line. A transect line consists of a start point and an end point. The length is 300 meters and the width is 2 meters, 1 meter to both sides.

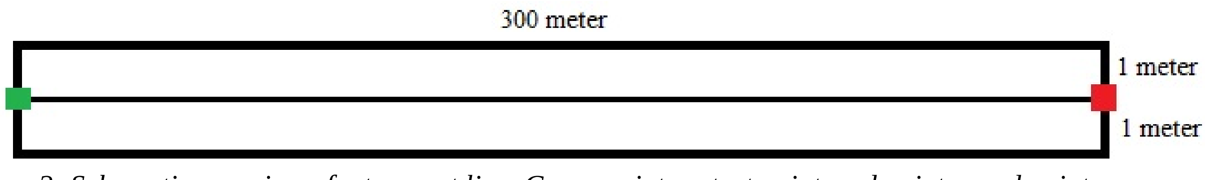

Figure 2: Schematic overview of a transect line. Green point = start point; red point = end point.

In total 8 permanent transect lines were established. This equals 0.48 hectares. The intensity of the amount of sample plots and the plot size was discussed with the project staff. All permanent transect lines are distributed over the area in east-west or west-east direction, depending on the starting point. The spacing used between two permanent transect lines is 80 meters. A map has been made with ArcGIS (a program for managing, analyzing and illustrating spatial data) by using coordinates that were collected by walking around the area and shooting waypoints with a GPS. Coordinates of the start- and end points of the permanent transect lines were noted so all lines can be found in the field.

See *Table 2* for a table with the coordinates and *Figure 4* for the map. Transect line 1 is the one located most south, transect line 8 is the one located most north.

Table 2: Coordinates of the start and end points of the transect lines

	Start point		End point	
ID	**North**	**East**	**North**	**East**
TL1	16,9822	122,1484	16,9822	122,1456
TL2	16,9829	122,1437	16,9829	122,1465
TL3	16,9836	122,1485	16,9836	122,1457
TL4	16,9844	122,1438	16,9844	122,1466
TL5	16,9851	122,1476	16,9851	122,1449
TL6	16,9858	122,1431	16,9858	122,1459
TL7	16,9866	122,1467	16,9866	122,1440
TL8	16,9873	122,1425	16,9873	122,1452

This method was chosen after the first field trip in which data was gathered. In this field trip 24 transect lines of 100x2 meter were set out in a random way, covering the project area. However, this way would have made it very difficult to find the transect lines back in future monitoring surveys. The starting point are marked with a thick blue robe on the tree or vegetation closest to the start point (*Figure 3*).

.

Figure 3: The start point of one of the transect lines marked with a thick blue robe. (Made by Cornee Diepeveen)

Tree species

The tree species were identified by the field assistant. He identified the trees by looking at the bark, leaves and flowers if available. Sometimes he also used the smell of the bark. If he did not recognize a tree I took pictures of the leaves and the bark and we gathered some leaves. First we asked the our host in the field and Manung Carlito if they recognized the species. If not I took the leaves with me to Cabagan where I could ask it to the people of CFEM (Forestry department of the Isabela State University (ISU)). For the scientific names of the tree species the internet[2] was used.

[2] www.wikipedia.com

Diameter at Breast Height (DBH)

The diameter was measured of all the trees in the transect lines with a diameter equal to or bigger than 1 centimeter. Due to the absence of a diameter tape a normal measurement tape was used. It was calculated that the circumference should be 3.2 cm to have a diameter of 1 cm. However, the starting point that was used was a circumference of 3 cm. That's why the smallest diameter in the database is 0.95 cm instead of 1 cm. All the data was noted in the field form under heading "DBH". *Appendix 4* shows an empty field form that was used (*Table 17*).

Height

Trees with a height of 3 meters or less were measured with a tall bamboo stick with carvings at every 50 cm up to 3 meter. Trees that were higher were measured with a clinometer if it was possible to reach the recommended distance from the tree and still be able to see the top of the tree. If this was not the case the field assistant climbed the tree to measure the height with the bamboo stick. All the data was noted in field forms under heading "Height".

Planted trees vs. natural regrowth

Not only data on the tree characteristics was gathered. Also information about natural regrowth of planted tree species and natural regrowth of not planted tree species was gathered.

Number of trees

After every fieldtrip the collected data was put in the database. The database was made with Microsoft Access 2010. In this database it was easy to count all the trees. The number of trees that were found in the transect lines were also recalculated to the number of trees per hectare.

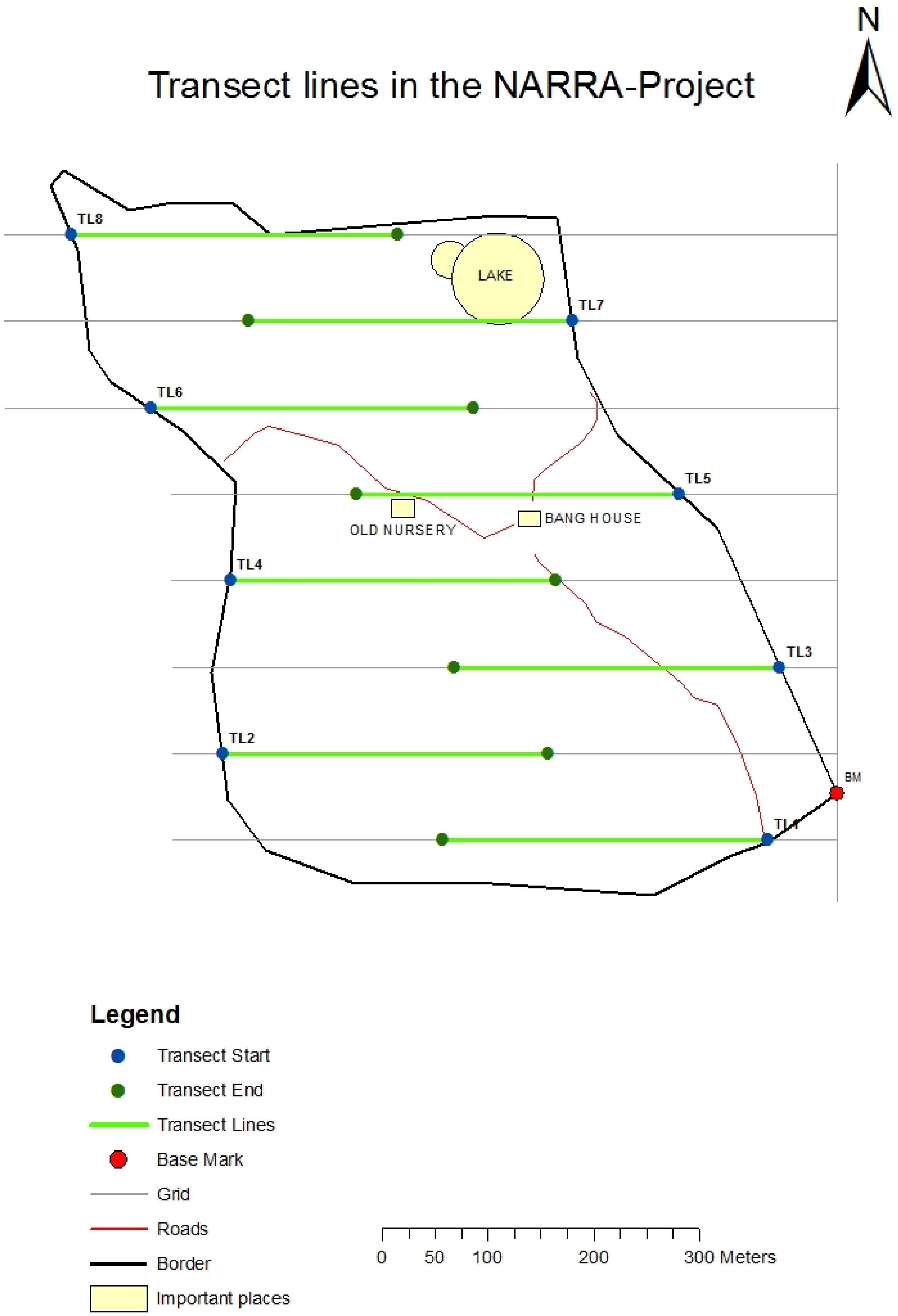

Figure 4: Map of the NARRA-Project with the transect lines, base mark and important places.

3. RESEARCH AREA

3.1 General background research area

The research area is located in the Cagayan Valley of northern Luzon. The Cagayan Valley is covered by the administrative region II, *Figure 12* (*Appendix 2*). In this chapter information is given about the region and reforestation projects are described and discussed.

The Cagayan Valley is located in the north east of the Philippines. It is known for its variety of natural habitat types including mangrove forest, beach forest, lowland dipterocarp rain forest, limestone forest, forest over ultrabasic rocks, montane forest and grassland. All of these habitats are encountered over a distance of just 50 to 70 kilometer when crossing the region in east-west direction. The research area can be found in the rea that is called ‘foodhills’, on the west side of the mountain range. The Cagayan river is the longest river of the Philippines and flows from south to north. In the river’s floodplains the most major towns of the region are located, also the capital city, Tuguegarao, is located in the floodplains of the river. These floodplains are surrounded by Sierra Madre Mountains in the east, the Caraballo Mountains in the south and the Cordillera Mountains in the west. *Figure 5* shows a cross section of the Sierra Madre mountain range with its elevation and main vegetation types. (Weerd et al 2009)

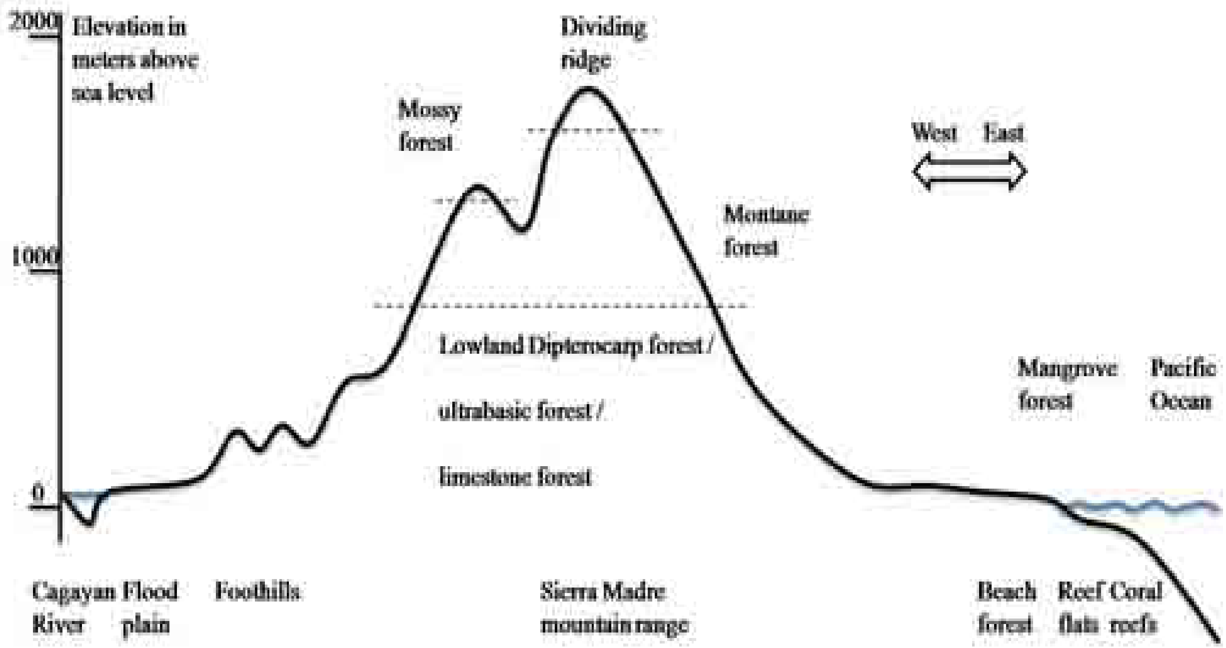

Figure 5: Cross section of the Sierra Madre with its main vegetation types and elevation (Weerd et al 2009)

The Cagayan Valley has a tropical climate which is dominated by the northeast (November to April) and the southwest (May to October) monsoons with a dry period between February and May. Rainfall is influenced by many typhoons which occur between May and January. The strongest typhoons occur between July and October with possible wind speeds of up to 290 kilometer per hour and a 24 hour rainfall of up to 800 mm. The mean annual rainfall differs from the coastal zones and the inland. In the coastal zones the mean annual rainfall is 3,500 mm and in the inlands it is ‘only’ 1,650 mm.

January is the coldest month of the year with an average temperature of 19 degrees Celsius. The hottest month is May with an average temperature of 35.9 degrees Celsius. The temperatures are slightly lower in the coastal zones and in the mountains. (Weerd et al 2009)

3.2 General background of forestry in the Philippines

The general background on the forests in the Philippines is divided in three subjects. Firstly the development of forest cover from the colonial times till now, secondly on the types of forests which occur in the Philippines and finally on the forest policy in the Philippines.

3.2.1 Development of forest cover

In 1521, when the first Spanish colonizers arrived in the Philippines, the country had a forest cover of 90 per cent of the total land area. This was approximately 27 million hectares of forest. After almost four centuries this percentage of forest cover dropped to 70 per cent in 1900. In the following 50 years this percentage dropped even more to 49.1 per cent (Pulhin 2002). In this period of 50 years from 1900 till 1950, the loss of forest cover is estimated at 10 million hectares. From the 1950's through to 1973 there was an annual rate of deforestation as high as 173,000 hectares per year (Boado 1988). But this was not even the highest decline in forest cover. The highest decline of forest cover took place during the Marcos regime. According to the Forest Management Bureau a total of 5,4 million hectares of the total land area were covered with forest, which is which is roughly 18 percent of the total land area in 1998 (Forest Management Department 1998). *Table 3* shows the current estimate of forest cover, which is 7,17 million hectares. This stands for 24.27 per cent of the total land area. This table also shows the classification of the forest with the total forest cover and percentage of the total land area.

Table 3: Forest cover in the Philippines divided in forest area in forestland and forest area in alienable and disposable (A&D) lands (ha) with the percentage of the total land area

	Forest area in forestland (ha)	% of total land area	Forest area in A&D lands (ha)	% of total A&D area	Total forest cover (ha)	% of total land area
Total	**6,521,548**	**22.08**	**646,852**	**2.19**	**7,168,400**	**23.89**
Closed forest	2,495,833	8.45	65,039	0.22	2,560,872	8.54
Open forest	3,578,526	12.12	452,069	1.53	4,030,588	13.44
Mangrove	165,425	0.56	81,937	0.28	247,362	0.82
Plantation	281,764	0.95	47,814	0.16	329,578	1.10

Source: Forest Management Bureau (2009)

3.2.2 Forest types

The forest in the Philippines is divided in 11 different types. *Table 4* shows these types with the elevation, dominant plants and distribution over the country. The places that are mentioned under ' distribution', except for the mountains, can be found in *Figure 11* (*Appendix 1*).

Table 4: Forest types of the Philippines with the elevation at which they occur, the dominant plants and the distribution in the country

Type	Elevation (masl)	Dominant plants	Distribution
Lowland evergreen rainforest	0-1,000	Dipterocarps, palms, legumes, orchids	All over the country
Lower montane forest	1,000-1,500	Lithocarpus, Liliaceous	All highlands in the country
Upper montane forest	1,500-2,400	Agathis, Phyllocladus, Podocarpus, Dacrydium, Vaccinium	Mt. Pulog, Mt. Apo, Mt. Halcon, Mt. Kitangalad
Sub-alpine forest	2,400+	Rhododendron, Vaccinium, Dacaspermum	Mt. Apo, Mt. Pulog
Pine forest	1,000+	Pinus Insularis, Pinus Merkusii	Benguet, Zambalas, Mindoro, C. Cordillera
Forest over limestone	0-900	Veithia, Dracaena, Sterculia, Hoya, orchids	Pangasinan, Bulacan, Samar, Palawan, Cebu
Forest over ultrabasic soils	0-900	Scaevola, Brackenridgia, Phyllanthus, Execarpus	Palanan, Palawan, Surigao, Zambales
Semi-deciduous	1,000+	Pterocarpus, Vitex, Garuga	W. Cordillera, Palawan
Beach forest	<10	Barringtonia, Reythrina, Acacia, Prosopis, Casuarina	All over the country along beaches
Mangrove/ nipa	<10	Rhizophoaceae, Nypa	Estuaries, coasts
Freshwater swamp	0-200	Legumes, Cyperaceae, Therminalia, Metroxylon	Inland waters

Source: DENR-UNEP 1997:34-35 (Cited from Pulhin 2002)

3.2.3 Forest Policy

Forest policy in the Philippines has been revised continuously to suit the priorities and needs in relation with goods and services (Pulhin 2002). In the Spanish colonial era the land and resources were placed under state control and regulation (Sajise 1998). Three objectives were set up in the case of forest policy: the provision of timber for Spanish civil needs, the generation of government revenue and the perpetuation of the forest resource (Boado 1988). The traditional rights to ownership and claims of indigenous communities were undermined with these regulations. The rights to forest utilization were given to a few privileged individuals. This led to the conversion of lowland rainforest into agricultural plantations (Borlagdan et al 1997). In 1863 the Inspeccion General de Montes (IGM) was created to manage the utilization of forest resources. The IGM assisted in the release of forest land to private interests. The land had to be monitored and officially certified as alienable and disposal before it could be sold. Everything of this had to be publicized (Borlagdan, Guiang and Pulhin 1997). Even with this forest policy the impact of forest exploitation was relatively small, since the Spanish colonizers only controlled a small part of the country and the pressure on the forest was very small due to a low human population density (Boado 1988).

In 1898 when the Americans took over the control over the Philippines the government asserted ownership over forests and forest land. Since that time mechanized logging began by American logging companies (Boado 1988). The IGM was changed into the Forestry Bureau under the United

States Commonwealth Government in 1900. The only difference with the IGM was the recognition of local needs. The Forestry Act allowed local people who lived in or nearby the forest to cut and collect products such as timber and firewood from timber concession areas (Makil 1982). In 1917 the Forest Law established communal forests and pastures for the use of local communities. However the forest land stayed under state control (Makil 1982). The Forestry Act became the regulatory mechanism in Philippine forestry and remained the basis for all forest management until 1975 (Boado 1988).

After World War II not much changed in the forest policy until 1953 when the Philippine Selective Logging System (PSLS) was introduced. This system encouraged sustainable forest management and regulated felling procedures. In the same year the government adapted the Homestead Act which promoted import and export substitution policies (Borlagdan, Guiang and Pulhin 1997). After Marcos became president in 1965, deforestation increased rapidly. Therefore several programs which enhanced the involvement of individuals and communities in forest management were started. The Forest Occupancy Management (FOM) in 1975, the Family Approach to Reforestation (FAR) in 1976 and Communal Tree Farming (CTF) in 1978 are examples of these programs. In 1978 also the Program for Forest Ecosystem Management (PROPEM) was introduced. This obliged all citizens of the Philippines to plant one tree every month for five years (Boado 1988; Sajise 1998; Pulhin 1997).

In 1982 the CTF, FOM and FAR were merged into one program called the Integrated Social Forestry Program (ISFP). This program aimed to “democratize the use of public forests and to promote more equitable distribution of the forest bounty”. Qualified individuals and communities were allowed to manage and cultivate upland areas. In return for this they had to protect and reforest the areas (Sajise 1998). All forest policy scenarios which were implemented after 1986 lean towards a more people-oriented forestry program. In 1987 this led to the National Reforestation Program (NFP), which involved communities, families, NGO’s and corporations in management initiatives (Vitug 2000). After the Marcos regime was toppled in 1986, the new democratic administration established a system of protected areas and the recognition of the rights of cultural minorities by two policy instruments: the Certificate of Ancestral Land Claims, which restated the rights of indigenous people to their ancestral lands, and the National Integrated Protected Areas System (NIPAS). The NIPAS Act of 1992 encouraged community participation in the designation of protected area boundaries and in the management of protected areas (Sajise 1998). In 1993 the Department of Environment and Natural Resources (DENR) established the Community Forestry Program (CFP). This program had several objectives: the initiation of community-based forestry, the utilization of natural resources and protection of the remaining primary forest with the help of local communities (Sajise 1998). The Community-Based Forestry Management (CBFM) program was established as the national strategy for sustainable forest management and social equity by the DENR Department Administrative Order in 1996. Several programs which seek for public participation as crucial element in forest management have been integrated in the CBFM. These programs are: Integrated Social Forestry Program (ISFP), Upland Development Project (UDP), Forest Land Management Program (FLMP), Community Forestry Program (CFP), Low Income Upland Communities Project (LIUCP), Regional Resources Management Project (RRMP), Integrated Rainforest Management Project (IRMP), Forestry Sector Project (FSP), Coastal Environmental Program (CEP) and Recognition of Ancestral Domains/Claims (Pulhin 1997, Sajise 1998). The main task of CBFM in the beginning was to create and develop an enabling environment which people can manage in a sustainable way.

At this moment the National Greening Program (NGP) is taking place. This program aims to reforest the country by planting 1,5 billion trees within six years (2011 – 2016). This is done at 1,5 million ha throughout the country. Several NGO’s and smaller organizations are working together in this program to reach this goal. The trees that are planted also have other functions. For example trees can be used for their timber, as fuel wood, as industrial crops (like coffee, cacao, bamboo and rubber) or as fruit bearing trees. The most used trees in this program are Narra (*Pterocarpus indicus*), Mahogany (*Swietenia macrophylla*), Bakauan (*Rhizophora spec.*), Rubber (*Hevea brasiliensis*), Coffee (*Coffea spec.*), Cacao (*Theobroma cacao*), Falcata (*Euroschinus falcata*), Gmelina (*Gmelina spec.*), Acacia (*Acacia mangium*) and Nangka (*Artocarpus heterophyllus*). (http://ngp.denr.gov.ph/).

4. RESULTS

4.1 Observation and monitoring results

4.1.1 Observations during the fieldtrips

The first planting of seedlings was done in 2004. During the collection of data, planting activities were still taking place in the project area. This consisted mainly of replanting the previous burned areas. The year before, planting of lines with bamboo was finished. Bamboo is planted in the area around the lake, because a bamboo forest is the natural habitat of the Philippine crocodile. During the field trips several lines with newly planted trees, mainly Narra (*Pterocarpus indicus*) and Marabakit (*Phyllantaceae spp.*), were seen and once people were met while they were planting trees. The trees that are planted are part of a replanting program in the area that was burned in 2007. People from the local community of San Isidro were involved in the replanting of seedlings. They usually worked in teams: one dug the holes, the second one planted the tree and closed the hole and the third one marked the planted trees with a stick and a piece of plastic.

The main protection measure in the area consisted of constructing fire lines to control the fires. Roaming cattle is not seen around the project area, therefore protection against grazing livestock is not necessary. Because the local communities assist in protecting the area, the cutting of trees from the project area is not an issue which needs protective measures.

Especially during the dry season, fires are a problem. Although protection against fires is taken care off by making fire lines and having a caretaker who is around all the time, fires still occur. These fires are results of poor fire management by neighboring farmers. The biggest of these fires took place in 2007 and destroyed around 12 hectares, which is almost 43 percent of the total area. *Figure 6* shows a part of the area that was burned during that fire in 2007. *Figure 7* is a picture made at almost the same place as the picture in figure 6.

Figure 6: A part of the burned area of the NARRA-Project after the fire of 2007 (Source: Mabuwaya Foundation Inc.)

Figure 7: This picture is almost made at the same place as Figure 6. This is the way it looked like in March 2014 (Made by Cornee Diepeveen)

4.1.2 Competition between plant species

Since the planting of trees in the project area started, slowly the Imperata grasslands disappeared. Only very little Imperata grass grows in the area during the collection of data. There is, however, another grass species which is influencing the growth of trees, Tiger grass (*Thysanolaena maxima*). This grass can grow up to 4 meters high and if it gets enough space it will be very dense. Tiger grass especially grows in the south east part of the area but is found everywhere. In the north west region ferns are growing rapidly. The tiger grass and ferns grow very dense, therefore not much light reaches the ground. This means regeneration of tree species is very slow or does not occur at all because of the competition.

In the part of the area near the lake a forest ecology can be found in which competition between trees species takes place. This could be considered as natural competitions which is needed for a more natural forest. No management measures to deal with this competitions have to be made. In the southern parts of the project area, competition between tree species occurs between Malatungao (*Melastoma malabarica*) and other tree species. This is concluded because the density and soil cover by this species is very high. The competition is natural because Malatungao (*Melastoma malabarica*) is a pioneer species. A management measure that can be made is set the planted tree species free.

4.1.3 Sample plot surveys

The data collected from the sample plot surveys are tree species, number of trees, DBH and height. The total number of trees that were found in the eight transect lines is 734. Per hectare this is 1,529 trees. It is not possible to say when each individual tree is planted or started to grow naturally. Although it is certain that the trees are planted after 2004. The smallest trees, which can be found in the southern part of the project area are natural regrowth and probably started to grow after 2008.

Tree species

The survey indicated that in total 47 different tree species appear to be growing in the project area, of which 15 species could not be identified. However, 82.5% of the total number of trees that are found in the area are represented by the five most occurring tree species. This is shown in *Table 5*. Of the 5 most occurring tree species are Narra (*Pterocarpus indicus*) and Marabakit (*Phyllantaceae spp*.) are species that were planted, according to the data about the planted tree species given by the Mabuwaya Foundation Inc. Malatungao (*Melastoma malabarica*) and Agandung (*Euphorbiaceae spp*.) are not planted, but grow naturally in the project area. About Tibig (*Ficus nota*) there is doubt whether it is planted or not. The tree species that are not planted, did not grow in the area before the reforestation activities began. Tree species that are mentioned in *Table 1* but do not occur in *Table 18* are not found in the transect lines. This does not mean the tree species did not survive.

Table 5: Top 5 most occurring tree species in the NARRA-Project with number of trees per species.

Species (Ilocano)	Scientific name	# of trees	# of trees per ha	% of total # of trees
Malatungao	Melastoma malabarica	298	620	40.6
Agandung	Euphorbiaceae spp.	133	277	18.1
Narra	Pterocarpus indicus	108	225	14.7
Tibig	Ficus nota	36	75	4.9
Marabakit	Phyllantaceae spp.	32	66	4.4
	TOTAL	**607**	**1,263**	**82.5**

Growth characteristics

The average DBH of all trees measured is 2.9 cm. The maximum DBH measured of all trees is 20.75 cm and the minimum DBH measured is 0.95 cm. The standard deviation is 2.67. This data of the five most occurring tree species is summarized in *Table 6*. As said in chapter *2.2.2 Data collected by tree measurement surveys* only trees with a diameter of 1 cm and more are measured. However the smallest tree in the database has a diameter of 0.95 cm. This is due to the absence of a diameter tape. Instead a normal measurement tape was used. It was calculated that the circumference should be 3.2 cm to have a diameter of 1 cm. However, the starting point that was used was a circumference of 3 cm. This gives a diameter of 0.95 cm.

Table 6: Top 5 most occurring tree species with average, maximum, minimum and standard deviation of DBH in cm.

Species (Ilocano)	Scientific name	# of trees per ha	Average DBH (St. Dev.) (cm)	Range DBH (cm)
Malatungao	Melastoma malabarica	620	1.62 (0.62)	0.95 - 4.58
Agandung	Euphorbiaceae spp.	277	3.47 (2.91)	0.95 - 16.36
Narra	Pterocarpus indicus	225	4.25 (2.93)	0.95 - 15.02
Tibig	Ficus nota	75	3.28 (2.97)	1.08 - 13.31
Marabakit	Phyllantaceae spp.	66	5.18 (4.28)	1.15 - 20.75

DBH classes that have been made are showing a healthy balance between small trees and bigger trees. This could be questionable because most trees are planted within a time frame of 2 - 4 years, but during the 10 years since the first planting of trees in the project area, several fires and competition between plant species provided a healthy balance between small and big trees. The number of trees that occur in the first DBH class is that high because of replanting's and natural regrowth after fires. These DBH classes and the number of trees in each DBH class can be found in *Table 7*. This also can be done for a not planted species and a planted species (see *Table 8* and *Table 9*).

Malatungao (*Melastoma malabarica*) - All the trees of this not planted species are found in DBH class 1. This means that there is not a healthy balance. This is due to the fact that all trees started to grow around the same time and in the same area in which the same growth factors occur.

Narra (*Pterocarpus indicus*) - The distribution of trees of this planted species shows a healthy balance. This is due to the fact that the trees are planted in different years and also because growth factors, like fertility of the soil, differ from site to site. Near the lake the soil is much more fertile than in the southern part of the area.

Table 7: DBH classes, range of DBH in cm and number of trees per DBH class

DBH class	Range (cm)	# of trees	# of trees per ha
1	>0 And <5	629	1,310
2	>=5 And <10	84	175
3	>=10 And <15	13	27
4	>=15 And <21	7	14

Table 8: DBH classes, range of DBH in cm and number of trees per DBH class for Malatungao (Melastoma malabarica)

DBH class	Range (cm)	# of trees	# of trees per ha
1	>0 And <5	298	620
2	>=5 And <10	0	0
3	>=10 And <15	0	0
4	>=15 And <21	0	0

Table 9: DBH classes, range of DBH in cm and number of trees per DBH class for Narra (Pterocarpus indicus)

DBH class	Range (cm)	# of trees	# of trees per ha
1	>0 And <5	75	156
2	>=5 And <10	27	56
3	>=10 And <15	5	10
4	>=15 And <21	1	2

The average height of all trees measured is 3.3 m. The maximum height measured of all trees is 10.6 m and the minimum height measured is 1.6 m. The standard deviation is 1.25. This data of the five most occurring tree species is summarized in *Table 10*.

Table 10: Top 5 most occurring tree species with average, range and standard deviation of height in m.

Species (Ilocano)	Scientific name	# trees per ha	Average height (St. Dev.) (m)	Range height (m)
Malatungao	Melastoma malabarica	620	2.61 (0.50)	1.60 - 5.10
Agandung	Euphorbiaceae spp.	277	3.88 (1.35)	1.90 - 7.80
Narra	Pterocarpus indicus	225	3.84 (1.45)	1.80 - 8.80
Tibig	Ficus nota	75	3.11 (1.00)	1.60 - 6.00
Marabakit	Phyllantaceae spp.	66	4.32 (1.37)	2.00 - 7.00

Appendix 5 shows a table with the average DBH, average height and number of trees (also per hectare) for each tree species (*Table 18*).

Site differences

In *Table 11* the range of DBH and height of all trees per transect line is shown. There is not a big difference between the transect lines when comparing the average DBH and height. But it is clear that in the south of the area (transect lines 1 and 2) more trees are found with a smaller DBH range and less trees are found in transect lines 7 and 8, however these trees are also a little bit bigger in height. Probably because these transect lines are found nearby the lake, therefore water is also available for the trees during the dry season.

Table 11: Number of trees, average DBH (St. Dev.), DBH range, average height (St. Dev.) and height range per transect line

Transect line ID	# trees per ha	Average DBH (St. Dev.) (in cm)	Range DBH (in cm)	Average height (St. Dev.) (in m)	Range height (in m)
TL1	210	2.38 (1.89)	0.95 - 11.33	2.94 (0.83)	1.6 - 6.0
TL2	145	2.61 (2.06)	0.95 - 9.80	3.10 (1.10)	1.6 - 7.8
TL3	214	2.24 (2.27)	0.95 - 17.19	2.83 (1.05)	1.6 - 8.0
TL4	293	2.82 (2.39)	0.95 - 15.19	3.46 (1.31)	1.8 - 6.6
TL5	127	3.03 (3.41)	0.95 - 20.75	3.08 (1.21)	1.8 - 7.5
TL6	212	3.55 (3.34)	0.95 - 19.10	3.44 (1.39)	1.8 - 7.5
TL7	185	3.01 (2.62)	0.95 - 18.59	3.44 (1.38)	1.6 - 10.6
TL8	139	3.97 (3.11)	1.02 - 16.36	3.94 (1.29)	2.0 - 8.8

Differences are more clear when looking at the differences between a planted tree species and a natural growing tree species. This is shown in *Table 12*. In table 10 the planted tree species is Narra (*Pterocarpus indicus*) and the natural growing tree species is Malatungao (*Melastoma malabarica*).

Malatungao (*Melastoma malabarica*) - On transect line 1, 2, 3 and 4 many trees of this species occur. This can probably be explained by the fires in the past. The average DBH and height are almost the same in each transect line, however in transect line 7 and 8 only a few trees of this species grew.

Narra (*Pterocarpus indicus*) - On transect line 2 and 4 the average DBH and height are smaller compared to the other transect lines and in transect line no Narra was found. Probably because the fires that occurred in this area in the past. Not many trees were found in the transect lines, because you could see they were planted in lines throughout the project area and the transect lines did not follow these lines.

Table 12: Comparison between Narra (Pterocarpus indicus) and Malatungao (Melastoma malabarica) per transect line with number of trees, average DBH (cm) and average height (m)

Transect line	Species (Ilocano)	Scientific name	# of trees	# of trees per ha	Average DBH (cm)	Average height (m)
TL1	Malatungao	Melastoma malabarica	48	100	1.65	2.63
TL1	Narra	Pterocarpus indicus	6	12	6.41	4.48
TL2	Malatungao	Melastoma malabarica	41	85	1.80	2.70
TL2	Narra	Pterocarpus indicus	6	12	3.80	3.55
TL3	Malatungao	Melastoma malabarica	63	131	1.45	2.48
TL4	Malatungao	Melastoma malabarica	59	122	1.64	2.49
TL4	Narra	Pterocarpus indicus	12	25	2.28	2.81
TL5	Malatungao	Melastoma malabarica	31	64	1.39	2.52
TL5	Narra	Pterocarpus indicus	4	8	6.57	5.35
TL6	Malatungao	Melastoma malabarica	32	66	1.79	2.84
TL6	Narra	Pterocarpus indicus	35	72	4.06	3.55
TL7	Malatungao	Melastoma malabarica	14	29	1.52	2.71
TL7	Narra	Pterocarpus indicus	25	52	3.57	3.87
TL8	Malatungao	Melastoma malabarica	10	20	2.11	2.98
TL8	Narra	Pterocarpus indicus	20	41	5.61	4.66

For the five most occurring tree species per transect line with number of trees, average DBH and average height see *Table 19* (*Appendix 6*). In the southern part of the area, on transect lines 1, 2, 3, 4 and 5 the most common tree species is Malatungao (*Melastoma malabarica*) followed by Tibig (*Ficus nota*), Narra (*Pterocarpus indicus*) or Agandung (*Euphorbiaceae spp.*). The common tree species on transect line 6 is Narra (*Pterocarpus indicus*) followed by Malatungao (*Melastoma malabarica*) and on transect line 7 and 8 the most common tree species is Agandung (*Euphorbiaceae spp.*) followed by Narra (*Pterocarpus indicus*).

4.2 Monitoring system

This is the final proposal of a monitoring system that can be used by Mabuwaya Foundation Inc. to monitor and evaluate the progress of their reforestation projects.

How would an appropriate method for monitoring and evaluating reforestation projects in the Philippines look like?
A simple and clear monitoring system should consist of four phases. The preparatory phase, the fieldwork phase, the analyzing of data phase and the future management phase.

Phase 1: Preparation

Background information on the area that has to be monitored is important, because without information like proposed activities, expected results, number of trees planted and species used it is not possible to monitor or evaluate the progress. For future reforestation projects it is recommended to keep track of which species are planted in what part of the project area. An area can be divided in parts in order to make it easier to what is done where in the area. An example can be seen in *Figure 8*. Also the number of trees per species should be recorded. As important as the recordings of the trees that are planted during the start of the project are the recordings of replanted trees. In case of low survival rates because of diseases, fires or other natural factors, new trees are planted. The number of trees and the species of these new planted trees also should be recorded. This is easily done by making a table. For an example of a table with this information see *Table 13*.

Table 13: Example of table with recordings about (re)planted tree species, number of species per ha and area where they are planted

Tree species	Scientific name	# of trees per ha planted (2014)	Area	# of trees per ha replanted (2015)	# of trees per ha replanted (2016)
Narra	Pterocarpus indicus	1,111	3	500	200
Marabakit	Phyllantaceae spp.	1,000	12	500	150
Mandarin	Citrus reticulata	400	6	150	-
..	..	..	..	..	..
..	..	..	..	..	..

A map of the area is important, because in this way you can get a better view of the area. If there is no digital map available, it is necessary to make one. This is possible by walking around the area while shooting waypoints with a GPS on logic places like corners. Also shoot waypoints at important or recognizable points in the area, for example houses, streets, nursery and creeks. The waypoints consists of coordinates. However, the coordinates should be part of a coordination system which are recognizable by the GPS. These coordinates can be put in the computer. With a GIS program like ESRI ArcGIS 10.1 it is possible to make a map with these coordinates, but also open source GIS programs like QGIS (before Quantum GIS), GRASS GIS or SAGA GIS can be used.

This map will also be used to create the transect lines. The easiest way to do this is by making your own raster on top of the map. Before drawing the raster it is necessary to decide how many transect lines should be made, if the transect lines should be made in a certain direction and how much space between the transect lines should be made. For example it was decided to use 8 transect lines in the direction east - west (or west - east) and with a distance of 80 meters between the different transect lines. In this case the first line that should be drawn is the north - south line. This is done outside the borders of the area. Than the first east - west line is drawn, this line represents the place of a transect line. This line can be drawn anywhere because it is possible to move it, provided it is connected to the north - south line and crossing the borders of the project area. This line can be copied to save time. Measure the distance of 80 meters and put the second line there. Now copy both lines, this way it is not necessary to measure the 80 meters between every line. If there are too much lines, or not enough, it is possible to change the number of lines or the distance between the lines. After this is finished make a line at any place in your drawing. Measure it to the distance of your transect line and make it a specific color. Copy this line as often as is needed and place them on top of the east - west lines. Indicate the start- and endpoint. Staring points should be chosen wisely, so it is easy to find them in the field. All coordinates of the start- and endpoints should be written down. For an example see *Figure 4*.

To finish the preparation it is necessary to think about all the materials that are needed. If they are available check if they are still working or complete. If not available, not working or not complete it is necessary to buy, lend or restore them. Inform the workers about the procedures and explain everything in detail.

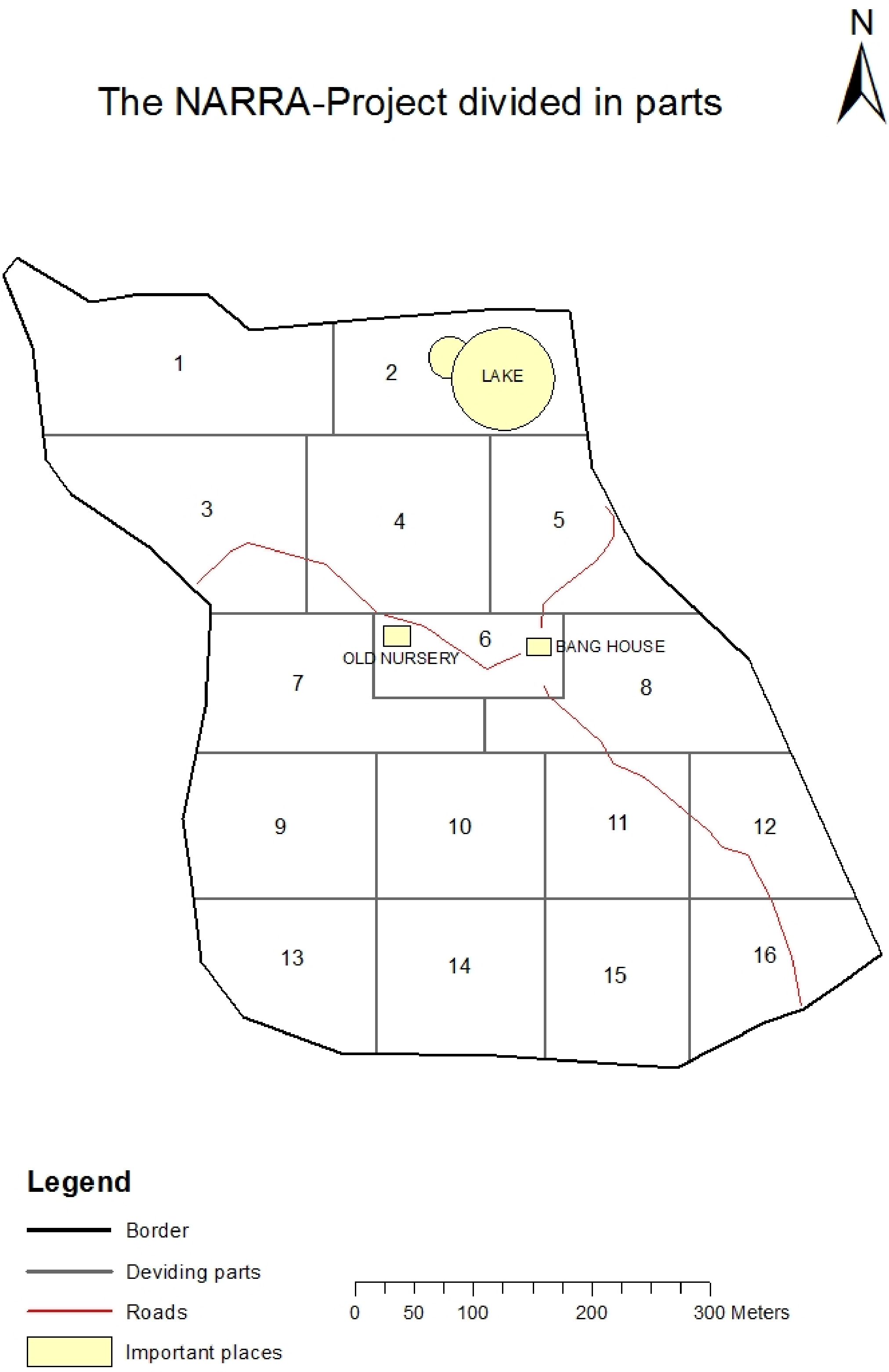

Figure 8: Example of how the NARRA-Project can be divided in parts

Phase 2: Fieldwork

The fieldwork phase starts with finding the starting point of the transect lines. The first tree in the transect line as close as possible to the starting point should be marked clearly. This will save time in the future with finding the starting point. The first time the monitoring will be done, it is probably necessary to cut your way through bushes, weeds and grasses. Use another piece of paper to describe these bushes, weeds and grasses (height, density). This can be done at certain points within the transect line by making 1 by 1 meter plots (See *Figure 9* for an example). To remember where in the transect line which small plot was made, a waypoint should be shot in the middle of this plot. The name of this waypoint should be mentioned with the description.

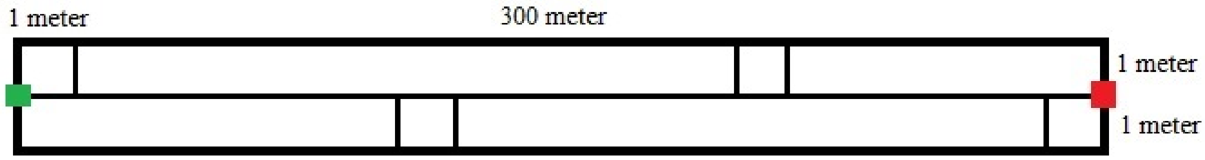

Figure 9: Schematic overview of a transect line with the smaller plots in which other data like bushes, weeds, grasses and soil will be gathered

Measuring the DBH can be done with a diameter tape. This is a measurement tape with a special scale balance to measure the diameter of a certain object. If there is no diameter tape available it is also possible to use a normal measurement tape. In this case you measure the circumference. The circumference can be converted to the diameter with the following formula:

$$Diameter = \frac{Circumference}{\pi}.$$

For example: A measurement tape was used to measure the circumference of a tree. The circumference of this tree was 20 cm. The diameter of this tree will be: $\frac{20\text{ cm}}{\pi}$ = 6.4 cm.

Measuring the height of a tree can be done in a few ways depending on the height and the presence and density of other vegetation. If the tree is small you can for example use a bamboo stick with markings on every 50 cm or a bamboo stick with a measurement tape made on it. It is also possible to use an indication point like a person. When you know how tall that person is, it is not difficult to guess the height of the tree. This method is good enough to use if the tree is not higher than 3 meters. If the tree is tall it is possible to use a clinometer. However, the clinometer is only efficient to use when the surrounding vegetation is open enough to see the tree you want to measure from a distance of 20 meters. When the vegetation is too dense other methods have to be chosen.

In the transect lines all trees with a DBH equal to or bigger than 1 should be measured. Of these trees the height and the DBH is measured and written down on the field forms. All trees that are measured should be tagged clearly. Information on the tags should at least contain: 1. The number of the sample plot, 2. Code of the species name and 3. The number of the tree. In this case also the trees are easy to find during future monitoring surveys. This will make it easier to compare the trees with previous monitoring surveys, because the number of the tree noted on the tag, should be the same as in the database. All long lasting materials can be used as tags, as long they do not disturb the growth of the trees.

In case of a following monitoring session, after two years for example, the same data will be collected. DBH and height of all trees that are tagged will be measured. Also the DBH and height of all 'new' trees will be measured. New trees are trees which have grown since the last monitoring session and are now equal than or bigger as 1 cm DBH. These new trees will be tagged as well. A new description of bushes, weeds and grasses will also be made to compare with previous monitoring sessions. The bushes, weeds and grasses can be an indication about the influence of the management.

The following materials can be used to gather data. For measuring the DBH of a tree you need a diameter tape. If this is not available a measurement tape will be sufficient enough. For measuring the height a bamboo stick can be used for the smaller trees and a clinometer can be used to measure the taller trees. If the density of the vegetation is to dense for using a clinometer other ways to measure the height can be used. The DBH and height of the trees that are measured should be written down on field forms (*Appendix 4*). For tagging the trees it is possible to use plastic tags that are described with permanent marker and are fixed around the trees with fish wire. However it would be better to use tags that are made of metal.

Phase 3: Analyzing data

After every field work trip it is necessary to digitalize the data, because field forms can be lost or because of weather conditions they could be hard to read. Digitalizing the data as soon as possible after the field trip will help to get all the data correctly in the database.

For this database is chosen to use Microsoft Access because it is users friendly and clear. The database should be well organized. Not too much information in one table. With Microsoft Access it is easy to make several tables and link them together. In this way it is always easy to read the data. Examples of the inventory tables can be found in *Table 14* and *Table 15*. Other tables that are made or can be made are a table with information about each transect line (name, ID, date, start and end time, conducted by, additional information) and a table with coordinates (start point and end point per transect line). In order to make it easier to compare all the different types of data, it is recommended to make different tables for each type of data (DBH, height, other vegetation).

Table 14: Example of the data base table "Inventory" of the year 2014

Inventory (2014)							
Tree ID	**Tree #**	**Species (Ilocano)**	**Scientific name**[3]	**DBH (cm)**	**Height (m)**	**Transect line**	**DBH class**
1	1	Narra	..	6.81	5.1	TL1	2
2	2	Malatungao	..	2.10	2.5	TL1	1
3	3	Narra	..	10.89	5.5	TL1	3
4	4	Malatungao	..	1.53	2.6	TL1	1
5	5	Narra	..	2.29	2.8	TL1	1
6	6	Malatungao	..	1.34	2.7	TL1	1
7	7	Tibig	..	3.31	3.9	TL1	1
8	8	Salingogon	..	3.95	3.7	TL1	1
9	9	Narra	..	4.58	4.0	TL1	1
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..

[3] Because of a lack of space the scientific names are not mentioned in the table. However in the database this should be done as well.

Table 15: Example of the data base table "Inventory" from the year 2016

Inventory (2016)								
Tree ID	**Tree #**	**Species (Ilocano)**	**Scientific name[4]**	**DBH (cm)**	**Height (m)**	**Transect line**	**DBH class**	**Additional information**
1	1	Narra	..	..	..	TL1	..	
2	2	Malatungao	..	..	..	TL1	..	Dead
3	3	Narra	..	..	..	TL1	..	
4	4	Malatungao	..	..	..	TL1	..	
5	5	Narra	..	..	..	TL1	..	
6	6	Malatungao	..	..	..	TL1	..	
7	7	Tibig	..	..	..	TL1	..	Tag removed
8	8	Salingogon	..	..	..	TL1	..	
9	9	Narra	..	..	..	TL1	..	
..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	

Phase 4: Future management

The monitoring sessions should be done every two years. Especially in the time in which the trees should be growing the most, which is the first 10 years. The monitoring of the transect lines should not take more than one week. With two people it is possible to monitor two transect lines a day, taking into account that it could be difficult to find the start point and that it is necessary to clear the transect lines again, because of regrowth of weeds and bushes. Trees that are not tagged but have the needed requirements should be measured and noted as well, because in this way it is possible to compare regrowth of new trees.

Protecting the project area against fires will be very important in the future. Fire lines need to be made and maintained. When a fire does occur try to stop it, however, a human life is more important. Therefore no great risks should be taken. After a fire it is necessary to replant the area.

All staff should get knowledge about monitoring in case the one responsible for the monitoring is not able to do so anymore.

[4] Because of a lack of space the scientific names are not mentioned in the table. However in the database this should be done as well.

5. CONCLUSIONS

How would an appropriate monitoring system look like?
An appropriate monitoring system should consist of:

- Background information that is complete
- A map of the area (preferred to be digital)
- A plan for the gathering of data
- An easy to read database
- An organization management plan

What is the current situation of the reforestation process?
The most important conclusions is the natural regrowth in the project area. In total 47 tree species were found of which only 5 tree species were planted. During the collecting of data different situations in the reforestation process were seen in the project area. The first situation is a healthy process according to the succession in a forest. This situation can be found in the northern part of the project area. The current height is 10.6 meters. In the southern part of the area the reforestation process goes very slow compared to the northern part. This is because the several fires that affected the growth of the trees. The current height is around 8 meters.

Have the reforestation efforts been successful?
The reforestation efforts made by the Mabuwaya Foundation Inc. and by the people living in the villages close to the project area have been a success. When the current situation of the project area is compared with the situation as it was at the start of the project, it is clear that there is a big difference. Now trees are growing and 'new' tree species are starting to grow as well. The problem with the cogon grass has been overcome and the same will happen with the tiger grass and the poor soils. Signs of animals, wild pig and birds, living in the area have been seen.

6. DISCUSSION

After the orientation field trip it was decided to use transect lines instead of plots to gather the data. During the first 'data gathering' field trip 24 transect lines were made and all data was gathered. The transect lines that were made were 100 meters long. However, these transect lines were made very randomly, scattered throughout the area. This would made it difficult to find the transect lines back for future monitoring. After this first field trip the map with the transect lines was made (*Figure 4*). The gathering of the data however could have been done in a better way. The DBH was gathered in the second field trip and the height was measured in the third field trip. The tagging of the trees was done with 5 students of the Isabela State University (campus Cabagan) in the fourth field trip. It would have been better if everything was done in the same field trip and with the help of the same person(s) to avoid mistakes which probably occur in the data. With these mistakes I mean the tree species and missing data for some trees. They species names are not all in the same language, because my field assistant in the first three field trips used the Ilocano names and the students wo accompanied me in the fourth field trip were using the common Filipino names.

The fact that tree species that were planted not occur in the database does not mean these tree species did not survive. It is possible the trees were not big enough at the time of measuring or they are just not found in the transect lines. If the Mabuwaya Foundation Inc. wants to know how many tree species of the planted ones did survive it is recommended to make a separate database by following all the planting rows.

Shortly after the gathering of the data a fire destroyed around 8 hectares of the NARRA-Project area. This equals 29 percent of the total project area. The fire was caused by a farmer who could not control the fire he made on his land. The precise location can be seen in *Figure 10*. The data provided to the Mabuwaya Foundation trough this study can be used to determine what was lost. With 100 percent certainty it is possible to say transect lines 1, 3, 4 and 6 are partly damaged. Transect line 2 is destroyed completely.

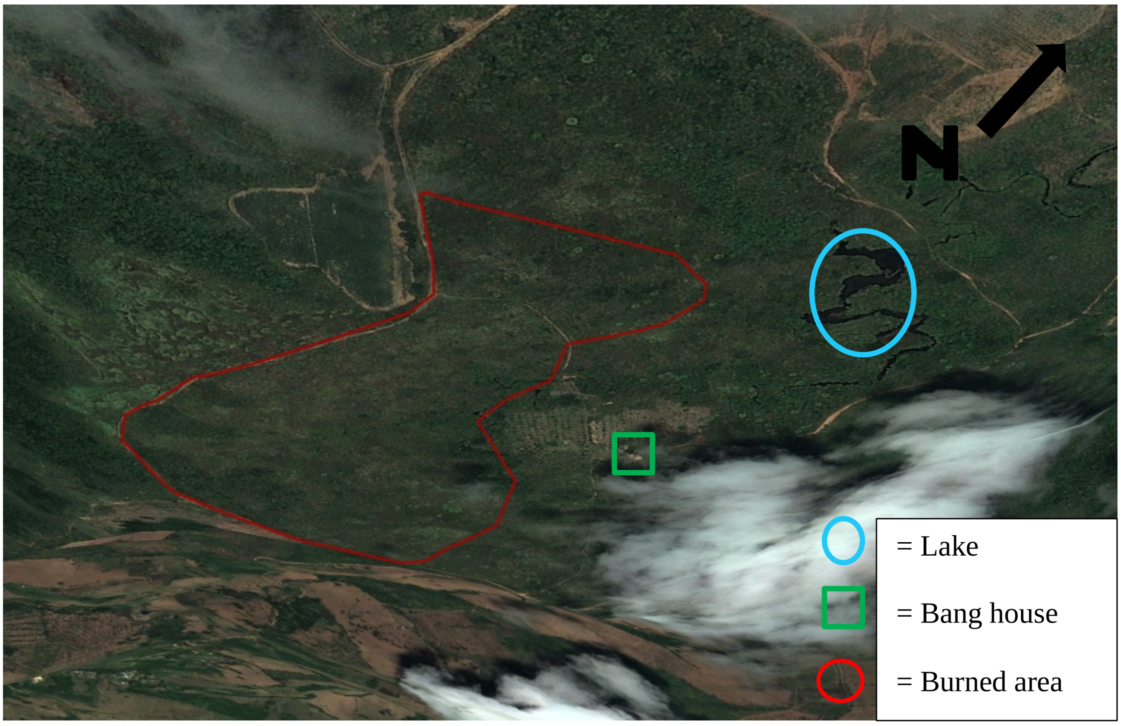

Figure 10: Burned area of the NARRA-Project 2014 (Source: Mabuwaya Foundation Inc.)

7. RECOMMENDATIONS

What should Mabuwaya Foundation Inc. do in the future? First of all it is necessary to check all the tags that were put on the trees. It could be that some tags are removed or not readable anymore. Also should be thought of making tags which are easier to read, lasting longer and better for the environment. The tags should also be checked every year for how much space is left for the trees to grow. If the robe is to tight it should be renewed.

When the trees in the area that was burned after this research was conducted are regrown the transect lines that were damaged should be restored.

The monitoring itself should be conducted at least every two years. The data that will be collected during these monitoring sessions should be put in new tables in the database. These tables can be joined to make it easier to compare.

Since Tiger grass (*Thysanolaena maxima*) is a problem in the project area regarding competition with the planted tree species it is recommended to take action against this Tiger grass. The suggestion is to cut all the Tiger grass in a range of two meters from every planted tree species. In this way you give more space to the tree species and a higher chance to survive. In the long term the tree species will grow taller and the Tiger grass will not be a threat anymore.

Looking into the future I see a difference in tree species composition. This will especially be in the southern part. If the area that was burned lately will be replanted again, I would recommend to use fast growing native tree species but not pioneer species. Species like Ipil-ipil (*Leucaena leucocephala*). And even if the pioneer species like Malatungao (*Melastoma malabarica*) will grow everywhere, it will end up like a real forest. However, to get a forest that looks naturally as soon as possible, it is recommended to give the planted tree species the space to grow without any competition of other (tree) species. There should always be patience in case of reforestation projects, because trees simply do not grow fast. In this project the described future is a real vision on the future provided that there never will be a devastating fire like the last one again. Neighboring farmers should be warned about the consequences of poor fire maintenance and the project area itself should be protected against these fires even better. For example by using a buffer next to the border of around 10 meters. This buffer could be used by the neighboring farmers by planting species that have a harvest time which is later than the species they will plant on their land. In this way they will be more careful with using the slash and burn method on their land. It is also possible to not replant the buffer. In this case it increases the width of the fire line which is naturally there because of the border.

The last recommendation that will be made is: Register everything! For monitoring it is very important to know what the starting point is and what is done where in the meantime. Register all planting activities, replanting as well. Also all activities like fire line making, spacing, weeding and protecting should be registered.

8. REFERENCES

Boado, E.L. 1988. Incentive policies and forest use in the Philippines. In *Public policies and the misuse of forest resources*, edited by R. Repetto & M. Gillis, 165-204. New York: Cambridge University Press

Borlagdan, S.B., E.S. Guiang and J.M. Pulhin. 1997. Community based forest management in the Philippines: A preliminary assessment. Project Report. Quezom City: Institute of Philippine Culture, Ateneo de Manila University

Bourgoing R. and Boutin D. 1987. Method of controlling Imperala using light wooden rollers and establishing 36 cover crops (Pueraria) in young hybrid coconut plantations in a village environment. Oleagineux, 42, 19-23.

Edwards, P., Hindmarsh, R., Merer, H., Bond, M. and Rowland, A. 2008. A three-stage evaluation of a deliberative event on climate change and transforming energy. Journal of Public Deliberation, 4(1), art. 6. Retrieved from http://services.bepress.com/jpd/vol4/iss1/art6.

Diepeveen, C. 2012. *Technical report, Internship, Brazil 2012*. Van Hall Larenstein. Velp, Netherlands

Durst, P. B., 1981. Problems facing reforestation in the Philippines. *In: Journal of forestry. World forestry*. October 1981. Vol. 79(10). p. 686-688.

Innes, J.E. and Booher, D.E. 2003. Collaborative policymaking: Governance through dialogue. In M.A. Hajer&H.Wagenaar (Eds.), Deliberative policy analysis: Understanding governance in the network society (pp. 33–59). Cambridge, MA: Cambridge University Press.

Forest Management Bureau. 2009. Philippines forestry outlook study. Working paper no. APFSOSII/WP/2009/10. Bangkok: FAO

Friday, Kathleen S., M. Elmo Drilling, and Dennis Garrity. 1999. Imperata grassland rehabilitation using Agroforestry and Assisted Natural Regeneration. International Centre for Research in agroforestry, Southeast Asian Regional Research Programme, Bogor, Indonesia

Gastil, J. 2006. How balanced discussion shapes knowledge, public perceptions, and attitudes: A case study of deliberation on the Los Alamos National Laboratory. Journal of Public Deliberation, 2(1), art. 4. Retrieved from http://services.bepress.com/jpd/vol2/iss1/art4.

Hai Dinh Le, Smith, C., Herbohn, J. 2014. What drives the success of reforestation projects in tropical developing countries? The case of the Philippines. In: *Global Environmental Change*. 2014. Vol. 24. p. 334-343.

Hai Dinh Le, Smith, C., Herbohn, J., Harrison, S. 2012. More than just trees: Assessing reforestation success in tropical developing countries. In: *Journal of Rural Studies*. 2012. Vol. 28. p. 5-19

Kusek, J. Z., Rist, R.C., 2004. Ten steps to a result-based monitoring and evaluation system: a handbook for development practitioners. The World Bank. Washington D.C.

Makil, P.Q. 1982. Toward s social-forestry oriented policy: the Philippine experience. Quezon City: Institute of Philippine Culture, Ateneo de Manila University

Mangabat C.B., Snelder D.J., Groot W.T. de. 2009. Tree Adoption in the North-East Philippines Uplands: Analysis of a GO-NGO Partnership. *In: Small-scale Forestry*. 2009. Vol. 8(4). p. 463-478.

Masipiqueña A., Ploeg J. van der and Persoon G. 2009. Reforestation for a better future. *In: Crossing Boundaries*. ISBN: 978-90-810007-6-5. Page 97-105. Cagayan Valley Programme on Environment and Development, Cabagan, Philippines

Nabatchi, T. 2007. Deliberative democracy: The effects of participation on political efficacy (Unpublished doctoral dissertation). Indiana University, Bloomington, IN.

Pasicolan P.N., Haes H.A.U., Sajise P.E. 1997. Farm forestry: an alternative to government-driven reforestation in the Philippines. *In: Forest Ecology and Management*. December 1997. Vol. 99(1-2). p. 261-274.

Pulhin, J.M. 1997. Community forestry in the Philippines: trends, issues and challenges. In *Community forestry at a crossroads : reflections and future direction in the development of community forest* (Proceeding of an International Seminar held in Bangkok, Thailand), edited by M. Victor, C. Lang, & J. Bornemeier, 201-215. Bangkok: Regional Community Forestry Training Center

Pulhin, J.M. 2002. Trends in forest policy in the Philippines. In *Policy trend report 2001/2002*. p. 29-41. Japan: IGES

Sajise, P.E. 1998. Forest policy in the Philippines: a winding trail towards participatory sustainable development. In A step toward forest conservation strategy (1) : Current status on forests in the Asia-Pacific region (Interim Report 1998). The Institute for Global Environmental Strategies (IGES): Tokyo

Sakurai, S., 2006. Plantation forestry in the tropics. *In: Plantation technology in forest science*. p. 53-63. ISBN: 978-4-431-28054-5. Tokyo, Japan.

Stromer-Galley, J. 2007. Measuring deliberation's content:Acoding scheme. Journal of Public Deliberation, 3(1), art. 12. Retrieved from http://services.bepress.com/jpd/vol3/iss1/art12.

Steiner, J., Steenbergen, M.R., Bachtiger, A., & Sporndli, M. 2003. Measuring political deliberation: A discourse quality index. Comparative European Politics, 1, 21–48.

Tjitrosoedirdjo S. 1993. Imperata cylindrica grasslands in Indonesia. In: Vanderbeldt. RJ., ed., Imperata grasslands in southeast Asia: summary reports from the Philippines, Malaysia and Indonesia. MPTS Network Report No 18, Winrock International and USAID, Bangkok. Thailand. 33-52

Turvey, N.G. 1994. Afforestation and rehabilitation of lmperata grasslands in Southeast Asia: identification of priorities for research, education, training and extension. ACIAR Technical Reports No. 28, 52p.

Vitug, M.D. 2000. Forest policy and national politics. In Forest policy and politics in the Philippines: the dynamics of participatory conservation, edited by P. Utting, 11-39. Quezon City: Ateneo de Manila University Press

Weerd M. van, Snelder D., Spijkerman L. and Masipiqueña A. 2009. A Bird's eye view of Northeast Luzon. In: *Crossing Boundaries*. ISBN: 978-90-810007-6-5. Page 41-51. Cagayan Valley Programme on Environment and Development, Cabagan, Philippines

Williamson, A. 2004. Mapping public deliberation. Cambridge, MA: Harvard University Press.

Mannarini T., and Talò C. 2013. Evaluating public participation: instruments and implications for citizen involvement, Community Development. Volume: 44 No: 2. p. 239-256, DOI: 10.1080/15575330.2012.683799

APPENDIXES

Appendix 1

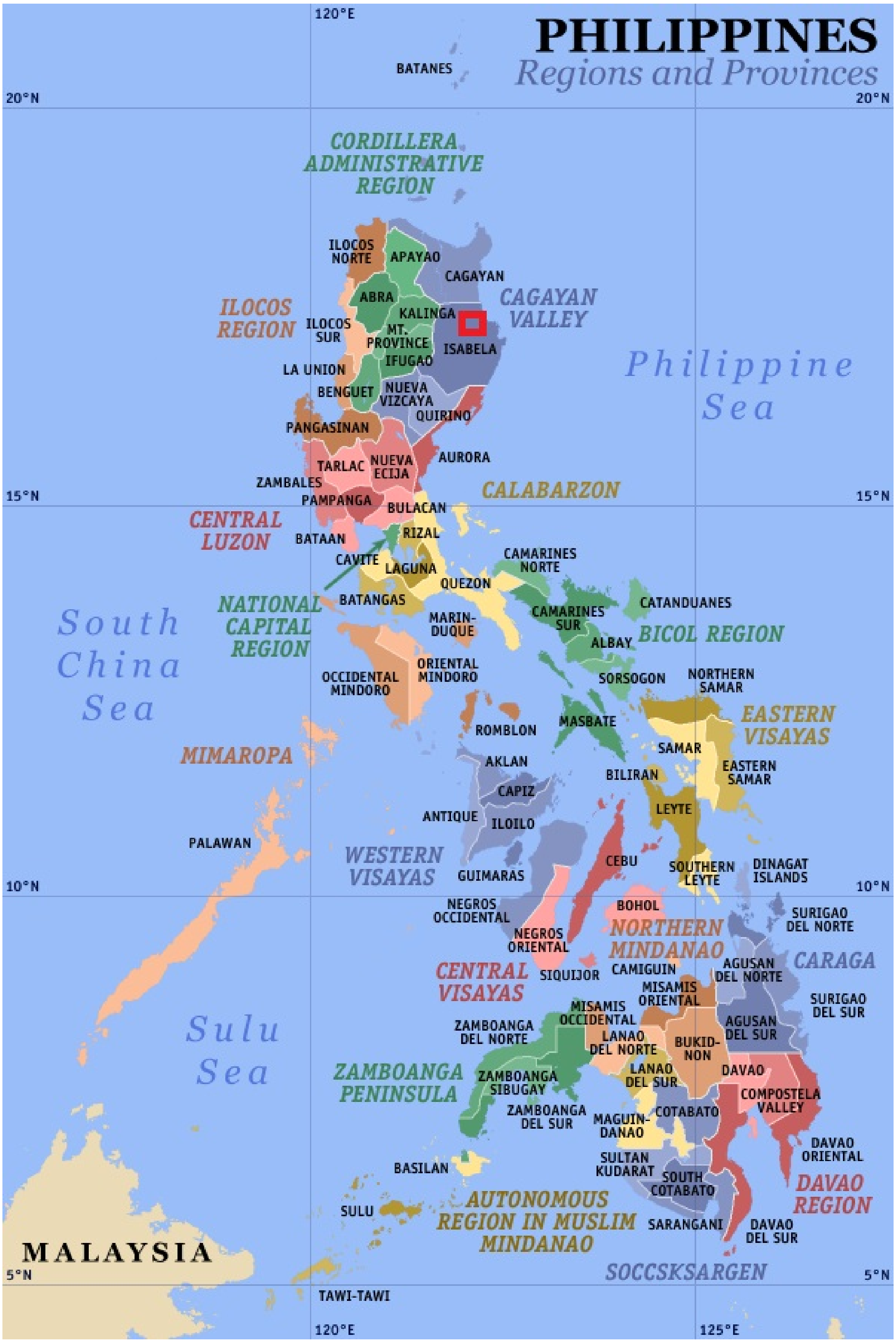

Figure 11: Map of the Philippines. The red square shows the location of the project.

Appendix 2

Figure 12: Map of the Philippines with region II (Cagayan Valley) highlighted in red

Appendix 3

Part of the project proposal

PROJECT ORGANIZATION

The organization where this thesis will be conducted is the Mabuwaya foundation. In this chapter this organization will be introduced and coaching and internal & external consultation will be discussed.

Description participants

The Mabuwaya Foundation is also engaged in the restoration of crocodile habitat and the protection of the general ecosystem in which the crocodiles survive. One of the main activities here is the reforestation of deforested watershed areas of rivers in which crocodiles live. Mabuwaya works with communities to reforest watershed areas using “rainforestation” techniques (the collection of seedlings of indigenous tree species from natural forest) and agroforestry (the planting of timber and fruit trees in combination with agricultural crops). These programs aim to re-establish forest in deforested critical watershed areas, combat erosion and provide alternative livelihoods and increased income to farmers living near crocodile areas. The reforestation program also includes training of farmers, education and communication campaigns and a school children support program. At the moment Mabuwaya is implementing reforestation programs in the Dunoy area in the municipality of San Mariano (27 ha in total), the municipality of Ilagan (10 ha) and the municipality of Tumauini (10 ha). Mabuwaya also provides technical assistance to the National Greening Program in Isabela in several municipalities (400 ha in total). There is a need to study the success of the reforestation programs and to establish a simple and effective monitoring and evaluation program to be able to measure reforestation success and refine the program (pers. comm. M van Weerd).

Coaching

During the project coaching will be given by Erika van Duijl, GIS teacher at Van Hall-Larenstein university of applied science and supervisor from school. Merlijn van Weerd and Jan van der Ploeg will be the supervisors from the Mabuwaya foundation. Merlijn van Weerd is director of the Mabuwaya foundation and biologist at Leiden University. Jan van der Ploeg is an external advisor at the Mabuwaya foundation and anthropologist at Leiden University.

Internal & external consultations

There will be several internal and external consultations with Erika van Duijl, Merlijn van Weerd and Jan van der Ploeg. In the beginning this will be about the project proposal and gathering information. In a later stage of the project the consultations probably will go about the progress of the project.

RISK ANALYSIS AND POSSIBLE SOLUTIONS

Before conducting this thesis it is important to think about the risks and difficulties which could be encountered during the whole project. The risk/ difficulties and possible solutions are described in this chapter.

Risks

There are several risks that could be encountered:

- Communication issues; It could be difficult to communicate with the local guide who is going to help me collecting the data that is needed.
- Illness; In spite of a number of vaccines I could get sick. This will delay the collecting of data.
- Weather conditions; The months when research for this thesis will be conducted are part of the dry season, but weather is unpredictable which can lead to not expected weather conditions. This will delay the collecting of data.

Possible solutions

At this moment there are no possible solutions for the risks that could be encountered, except to live healthy and be sure that all possible risks are identified and thought of.

PLANNING

Table 16: Timetable of activities

Date	Activity
4/1 – 9/1	Introducing and acclimatize
10/1 – 24/1	Fieldwork
25/1 – 29/1	Few days at the university to charge and make notes about fieldwork. After 4/5 days back to the field
30/1 – 13/2	Fieldwork
14/2 - 18/2	Few days at the university to charge and make notes about fieldwork. After 4/5 days back to the field
18/2 – 5/3	Fieldwork
6/3 – 10/3	Few days at the university to charge and make notes about fieldwork. After 4/5 days back to the field
11/3 – 25/3	Fieldwork
26/3 – 30/3	Few days at the university to charge and make notes about fieldwork. After 4/5 days back to the field
31/3 – 14/4	Fieldwork
15/4 – 17/4	Few days at the university to charge and make notes about fieldwork
18/4 – 27/4	Start working on final report
28/4 – 9/5	Travel around the country and return to the Netherlands

Appendix 4

Table 17: Field form which is used during the collecting of data in the Philippines

<table>
<tr><td>Plot #:</td><td colspan="2">Time:</td><td colspan="2">Conducted by:</td></tr>
<tr><td>Date:</td><td colspan="2"></td><td colspan="2">Coordinates:</td></tr>
<tr><td colspan="5"></td></tr>
<tr><th>Tree #</th><th>Species</th><th>DBH (cm)</th><th>Height (m)</th><th>Additional information</th></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td></td><td></td><td></td><td></td></tr>
<tr><td>9</td><td></td><td></td><td></td><td></td></tr>
<tr><td>10</td><td></td><td></td><td></td><td></td></tr>
<tr><td>11</td><td></td><td></td><td></td><td></td></tr>
<tr><td>12</td><td></td><td></td><td></td><td></td></tr>
<tr><td>13</td><td></td><td></td><td></td><td></td></tr>
<tr><td>14</td><td></td><td></td><td></td><td></td></tr>
<tr><td>15</td><td></td><td></td><td></td><td></td></tr>
<tr><td>16</td><td></td><td></td><td></td><td></td></tr>
<tr><td>17</td><td></td><td></td><td></td><td></td></tr>
<tr><td>18</td><td></td><td></td><td></td><td></td></tr>
<tr><td>19</td><td></td><td></td><td></td><td></td></tr>
<tr><td>20</td><td></td><td></td><td></td><td></td></tr>
<tr><td>21</td><td></td><td></td><td></td><td></td></tr>
<tr><td>22</td><td></td><td></td><td></td><td></td></tr>
<tr><td>23</td><td></td><td></td><td></td><td></td></tr>
<tr><td>24</td><td></td><td></td><td></td><td></td></tr>
<tr><td>25</td><td></td><td></td><td></td><td></td></tr>
<tr><td>26</td><td></td><td></td><td></td><td></td></tr>
<tr><td>27</td><td></td><td></td><td></td><td></td></tr>
<tr><td>28</td><td></td><td></td><td></td><td></td></tr>
<tr><td>29</td><td></td><td></td><td></td><td></td></tr>
<tr><td>30</td><td></td><td></td><td></td><td></td></tr>
<tr><td>31</td><td></td><td></td><td></td><td></td></tr>
<tr><td>32</td><td></td><td></td><td></td><td></td></tr>
<tr><td>33</td><td></td><td></td><td></td><td></td></tr>
<tr><td>34</td><td></td><td></td><td></td><td></td></tr>
<tr><td>35</td><td></td><td></td><td></td><td></td></tr>
<tr><td>36</td><td></td><td></td><td></td><td></td></tr>
<tr><td>37</td><td></td><td></td><td></td><td></td></tr>
<tr><td>38</td><td></td><td></td><td></td><td></td></tr>
<tr><td>39</td><td></td><td></td><td></td><td></td></tr>
<tr><td>40</td><td></td><td></td><td></td><td></td></tr>
<tr><td>41</td><td></td><td></td><td></td><td></td></tr>
<tr><td>42</td><td></td><td></td><td></td><td></td></tr>
<tr><td>43</td><td></td><td></td><td></td><td></td></tr>
<tr><td>44</td><td></td><td></td><td></td><td></td></tr>
<tr><td>45</td><td></td><td></td><td></td><td></td></tr>
<tr><td>..</td><td></td><td></td><td></td><td></td></tr>
</table>

Appendix 5

Table 18: All species found in the NARRA-Project with number of trees, average DBH and average height per species.

Species (Ilocano)	Scientific name	# of trees	# of trees per ha	Average DBH (cm)	Average Height (m)
Malatungao	Melastoma malabarica	298	620	1.62	2.61
Agandung	Euphorbiaceae spp.	133	277	3.47	3.88
Narra	Pterocarpus indicus	108	225	4.25	3.84
Tibig	Ficus nota	36	75	3.28	3.11
Marabakit	Phyllantaceae spp.	32	66	5.18	4.32
Mandarin	Citrus reticulata	14	29	2.46	3.31
Gusilak	Tabernaemontana spp.	11	22	1.15	2.18
Buringat	-	9	18	3.73	3.47
Aruy uy	Ficus spp.	7	14	8.72	4.94
Hinlaumo	Mallotus molisimus	7	14	2.31	3.31
Salingogon	Crotoxylum furmosum	7	14	2.56	2.97
Firetree	Delonix regia	5	10	6.04	5.12
Kamagong	Madhuca burckiana	5	10	4.33	3.24
Kulipapa	-	5	10	5.76	4.94
Unknown 2	-	5	10	2.30	3.74
Unknown 7	-	5	10	2.28	2.86
Manaring	Lithocarpus solerianus	4	8	4.39	4.50
Bayabas	Psydium guajava	3	6	2.76	2.80
Langka	Artocarpus heterophyllus	3	6	5.11	4.10
Unknown 1	-	3	6	2.10	3.17
Binunga	-	2	4	1.46	240
Kalamansi	Citrusfortunella microcarpa	2	4	1.31	2.55
Mangga	Mangifera indica	2	4	4.97	2.35
Unknown 12	-	2	4	3.12	4.10
Unknown 15	Rubiaceae spp.	2	4	1.24	2.25
Unknown 3	Ficus (Moraceae)	2	4	5.83	3.80
Unknown 9	-	2	4	4.30	3.90
Alopa	Dimocarpus longan	1	2	3.18	5.60
Anabiong	Trema orientalis	1	2	3.06	3.30
Antipolo	Artocarpus spp.	1	2	8.72	5.80
Balete	Ficus balete	1	2	3.76	2.90
Hauili	Ficus septica	1	2	2.48	2.90
Kalhoi dalaga	Mussaenda okilippica	1	2	4.20	4.00
Karagumay (Iba)	Pandanus simplex	1	2	6.37	4.90
Labting	-	1	2	4.27	3.70
LNC	-	1	2	4.07	5.30
Ponkan	Citrus tangerina	1	2	2.74	3.00
Santol	Sandoricum koetjape	1	2	1.53	2.60
Tindalo	Pahudia rhomboidea	1	2	1.21	3.10

Species (Ilocano)	Scientific name	# of trees	# of trees per ha	Average DBH (cm)	Average Height (m)
Unknown 10	-	1	2	1.02	2.50
Unknown 11	Myrtaceae spp.	1	2	1.78	2.50
Unknown 13	-	1	2	1.59	2.30
Unknown 14	Apocynaceae spp.	1	2	5.92	4.00
Unknown 16	-	1	2	1.02	2.00
Unknown 4	-	1	2	4.07	3.60
Unknown 5	-	1	2	3.37	4.20
Unknown 8	-	1	2	9.04	7.00

Appendix 6

Table 19: Top 5 most occurring tree species per transect line with number of trees, average DBH and average height.

Transect line	Species (Ilocano)	Scientific name	# of trees	# of trees per ha	Average DBH (cm)	Average height (m)
TL1	Malatungao	Melastoma malabarica	48	100	1.65	2.63
TL1	Tibig	Ficus nota	16	33	2.85	3.04
TL1	Narra	Pterocarpus indicus	6	12	6.41	4.48
TL1	Unknown 7	-	5	10	2.28	2.86
TL1	Unknown 2	-	5	10	2.30	3.74
TL2	Malatungao	Melastoma malabarica	41	85	1.80	2.70
TL2	Narra	Pterocarpus indicus	6	12	3.80	3.55
TL2	Agandung	Euphorbiaceae spp.	6	12	2.90	3.95
TL2	Marabakit	Phyllantaceae spp.	3	6	5.67	4.37
TL2	Unknown 9	-	2	4	4.30	3.90
TL3	Malatungao	Melastoma malabarica	63	131	1.45	2.48
TL3	Agandung	Euphorbiaceae spp.	11	22	3.75	3.65
TL3	Marabakit	Phyllantaceae spp.	7	14	5.11	4.69
TL3	Tibig	Ficus nota	5	10	1.52	2.28
TL3	Mandarin	Citrus reticulata	3	6	2.08	2.57
TL4	Malatungao	Melastoma malabarica	59	122	1.64	2.49
TL4	Agandung	Euphorbiaceae spp.	34	70	4.43	4.95
TL4	Narra	Pterocarpus indicus	12	25	2.28	2.81
TL4	Mandarin	Citrus reticulata	6	12	2.94	4.17
TL4	Gusilak	Tabernaemontana spp.	4	8	1.18	2.25
TL5	Malatungao	Melastoma malabarica	31	64	1.39	2.52
TL5	Tibig	Ficus nota	7	14	6.44	3.59
TL5	Mandarin	Citrus reticulata	5	10	2.13	2.72
TL5	Narra	Pterocarpus indicus	4	8	6.57	5.35
TL5	Marabakit	Phyllantaceae spp.	4	8	8.23	4.88
TL6	Narra	Pterocarpus indicus	35	72	4.06	3.55
TL6	Malatungao	Melastoma malabarica	32	66	1.79	2.84
TL6	Agandung	Euphorbiaceae spp.	16	33	4.46	4.11
TL6	Gusilak	Tabernaemontana spp.	5	10	1.09	2.10
TL6	Marabakit	Phyllantaceae spp.	4	8	7.10	5.45
TL7	Agandung	Euphorbiaceae spp.	36	75	2.55	3.21
TL7	Narra	Pterocarpus indicus	25	52	3.57	3.78
TL7	Malatungao	Melastoma malabarica	14	29	1.52	2.71
TL7	Marabakit	Phyllantaceae spp.	5	10	2.33	3.04
TL7	Kulipapa	-	2	4	10.60	6.85
TL8	Agandung	Euphorbiaceae spp.	22	45	3.34	3.63
TL8	Narra	Pterocarpus indicus	20	41	5.61	4.66
TL8	Malatungao	Melastoma malabarica	10	20	2.11	2.98
TL8	Marabakit	Phyllantaceae spp.	3	6	4.12	4.70
TL8	Manaring	Lithocarpus solerianus	3	6	4.50	4.27

Appendix 7

Development Innovation Market Place
Proposal # _______
Title: Native Advocacy for Rural Reconstruction Agro-forestation (NARRA) Project
Midterm Report (1 August 2004)

Submitted to the WorldBank on behalf of the NARRA project Team Leader: Carlito Pregillana

I. Background Information

Period Covered by this Report (15 January 2004 to 31 July 2004)
Report Authors: Dominic G. Rodriguez & Jan van der Ploeg
NARRA Project Team Leader: Carlito Pregillana
Total Grant Award: PhP 1,000,000.00

The mid-term evaluation of the NARRA Project was done on in two phases. The first field visit was made on 2-5 May 2004. The evaluation team of the Cagayan Valley Program on Environment and Development (CVPED) visited the reforestation area together with the members and officers of the San Isidro Agro-forestry Developers Multi-purpose Cooperative (SIAFDMPC), the primary partner organization in the NARRA project. Additional visits were made on 3 May 2004 to the site management office of WWF-Philippines' Northern Sierra Madre Natural Park Conservation and Development Project (NSMNP-CDP), and on 12 May 2004 to the Local Government Unit (LGU) of San Mariano. The second field visit was conducted on 30-31 July 2004 together with *Sangguniang Bayan* member Mr. Jerome Miranda, the contact person for the NARRA project of the municipal government of San Mariano, and staff members of the NSMNP-CDP, which provides technical assistance to the NARRA project.

This mid-term evaluation report was supposed to be send to the on 21 May 2004. However, based on our observations in the field in May 2004 we concluded that the NARRA project had not yet satisfactory met 25 % of the project goals, which is a requirement for the disbursement of the 2nd tranche of the WorldBank grant. The failure to meet the targets of the proposal was largely due to the May 2004 elections, which disrupted municipal government activities in San Mariano, and to the harvest time, which made it difficult for PO members to invest much time in the NARRA project. Therefore, we decided to delay the mid-term report. In July we revisited the project. **Based on our recent observations, we conclude that the NARRA project has reached all (100%) milestones for the covered period. Therefore, we recommend that the WorldBank will release the 2nd tranche of the proposed budget.** In this mid-term evaluation report, we highlight the objectives and outputs of the NARRA project. We will follow the format as provided by the WorldBank.

Photo 1: Jackfruit seedling planted in July 2004 at the NARRA project reforestation site

II. Accomplishment to Date

1. *What were the project objectives/expected outputs/expected outcomes for the period?*

   Objectives:

   a. Reforestation of Philippine crocodile habitat.
   b. Providing security of tenure.
   c. Development of alternative livelihood options for short-term cash needs.

   Expected outputs/outcomes

   a. 26 hectares reforestation (40% agro-forestry farms, 59% indigenous tree plantations and 1% banana plantations for fire lines).
   b. Issuance of appropriate tenurial security.
   c. Improvement of the well-being of the upland farmers.
   d. Conservation of Philippine Crocodile
   e. Strengthening the capacities of the San Isidro Agro-forestry Developers Multi-purpose Cooperative (SIADFMPC).

2. *What were the actual objectives/outputs/outcomes achieved?*

Several meetings were conducted with the different stakeholders and actors in the project. WWF-Philippines NSMNP-CDP and the LGU are supporting the SIAFDMPC to develop and strengthen local capacities, especially in financial book keeping and nursery maintenance. The project site was relocated after several meetings and consultations with stakeholders. A suitable planting site was selected and a permanent nursery was established here. A technical development/reforestation plan was made by the SIAFDMPC with technical support of WWF-Philippines NSMNP-CDP. Meetings between SIAFDMPC and NSMNP-CDP are regularly conducted and minutes are well kept. The Local Government Unit of San Mariano rehabilitated/established the road network. Wildlings of indigenous timber trees were collected and fruit trees seedlings were acquired. The collection of indigenous wildlings was a valuable source of income for local farmers during the agricultural off-season. Planting of the fruit trees is taking place since August. The Department of Environment and Natural Resources (DENR) conducted the required perimeter/land survey for the issuance of an appropriate tenure instrument. SIAFDMPC has opted to apply for a community SIFMA. Summarizing: the SIAFDMPC and its partners are implementing the NARRA project. All proposed activities are being executed, so far with considerable success. The project is succeeding in achieving its goal: the development of agro-forestry farms and the panting of indigenous timber tree species will contribute to poverty alleviation and biodiversity conservation in the Philippine crocodile habitat management zone of the Northern Sierra Madre Natural Park (NSMNP).

3. *What were the deviations (if any) from the stated objectives/outputs/outcomes, and what were the reasons for these?*

In general, all activities were delayed for several months due to adverse peace and order situation during the May 2004 elections. Harvest season also slightly delayed project activities. But in July 2004, most activities got underway. Internal conflicts and misunderstandings within the SIAFDMPC have been solved. The LGU of San Mariano and the WWF-Philippines' NSMNP-CDP have played an important role in strengthening the capacity of the SIAFDMPC to execute the NARRA project.

The reforestation site was relocated to an area locally known as *taraw*, after the palm species that are common in the area. This grassland area was logged during the logging boom in San Mariano in the 1970s by the De La Pena sawmill. The original site was located within the jurisdiction of *sitio* Dilumi of *barangay* Dibuluan. The inhabitants of this *sitio* objected to the NARRA project, apparently because they want to plant the area with cassava. To avoid any potential conflicts, the SIAFDMPC and the LGU selected another site. This relocation also delayed the NARRA project activities, but was essential for the start-off of the project.

4. *What were the deviations (if any) from the stated project budget and what were the reasons for these?*

The financial management system of the SIAFDMPC is sound, and is regularly checked by the community-organizers of WWF-Philippines' NSMNP-CDP. The administrative and financial systems are in line with the requirements of the World Banks as specified in the Grant Agreement. The financial counterpart budgets of LGU (road rehabilitation and maintenance) and WWF-Philippines' NSMNP-CDP (technical support) are allocated to the NARRA project (and have exceeded projected budgets).

5. *What are the factors that helped or hindered achievement of project objectives/outputs/outcomes?*

Four factors have seriously hindered the implementation of the project. First, **national and local politics** have played an important role in delaying the project. San Mariano was one of the flashpoints in the province of Isabela during the May 2004 election. Second, **leadership problems and internal conflicts** in the PO have delayed the project. The NARRA project was initiated by its Chairman, Mr. Vicente Anog, who died in December 2003. The transition period caused some internal difficulties in the SIAFDMPC. In addition the SIAFDMPC went through the registration process of the CDA, which had caused some confusion and misunderstandings among the members. It is important to note that these issues have now been solved. Fourth, **communication** between the partners in the NARRA project is of crucial importance for the success of the project. Although communication between stakeholders has significantly approved, much more should be done to assure that all partners are informed about their responsibilities in the project.

Several factors have also significantly contributed to the success of the project. First, the SIAFDMPC sees the NARRA project as their success. There is a strong feeling of **ownership** among the community, and pride. Second, the **involvement of the LGU**, especially through *Sangguniang Bayan* member Jerome Miranda, was essential to create support of government line agencies and solve internal conflicts by a trusted a respected outsider of the local community. Third, the **technical support** of the WWF-Philippines' NSMNP-CDP, especially in the organizing of the community and the establishment of a nursery, has significantly contributed to the results that are achieved so far.

6. *What are planned future actions?*

Most fruit trees have been planted. The cooperative is now planning to establish the banana fire lines and start with the planting of the indigenous timber wildlings. These timber trees will be planted along existing forest patches (assisted natural regeneration). After the planting, people will be assigned to regularly monitor the reforestation area. After the rainy season the farm-to-market road has to be maintained by the LGU; an essential component of the project. To minimize fire risks the SIAFDMPC has divided the area in to private plots that will be cultivated by individual farmers as long as the trees are growing. A graduate student of the Isabela State University, supported by CVPED, will document the experiences of the NARRA project as part of her graduate thesis.

The SIAFDMPC prepared a resolution requesting the Provincial Government to donate a tractor. This will facilitate the agricultural development of the site, and will make the cooperative less dependent on other actors.

7. *Are there any additional comments or observations you wish to make with regards to the implementation of the project?*

The reforestation site is located in a fire-prone area. There is an urgent need to establish effective fire-breaks. For extra security, **fire lines should be established** using the bulldozer of the LGU. The dry season from March-June 2005 will be critical, and decisive for the success of the NARRA project. Many reforestation projects in Region 02 have failed because of fire-damage to the reforestation site.

The focus of the project is mainly on the planting of fruit trees/the establishment of agro-forestry farms. **The planting of indigenous timber species is an essential component of the proposal**. This will generate significant economic revenues for the community, although not on the short term. Obviously the SIAFDMPC prioritizes short term benefits, and focuses on the planting of fruit trees. However, considering the objectives of the proposal it is essential that due importance is given to the forest trees. The cultivation of corn until the trees are grown is an appropriate strategy to prevent fire and create short term benefits for the local community. However, **we warn that too much emphasis is given to the development side, while disregarding the conservation aspects of the project**. It is necessary to readdress this balance in the community meetings and the implementation of the project, especially as the reforestation area is located in the buffer zone of the Northern Sierra Madre Natural Park.

Along the same line: the relocation of the project site has solved some serious problems for the implementation. The current site is an excellent choice. However, there is no direct link with the protection of the Philippine crocodile, as the area is no crocodile habitat. **The partners should rethink how to materialize this link with crocodile conservation.** Obviously, the implementation of the NARRA project has mobilized significant public support for reforestation and biodiversity conservation in the area, and will certainly contribute to the protection of the critically endangered Philippine crocodile. But it is essential to make this link clearly visible for the partners in the NARRA project.

A point of concern is the continuity of the technical support of the WWF-Philippines' NSMNP-CDP, which has proved to be essential for the implementation of the project (see above). There is a chance that the funding of the NSMNP-CDP will be phased out in December 2004, and this could have significant impact on the NARRA project, too. The other partners of the project will closely monitor the situation and make appropriate arrangements in the event of the phase out of NSMNP-CDP.

Photo 2: The Local Government Unit of San Mariano rehabilitated the farm-to-market road to *sitio* San Isidro.

Conclusion

The evaluation has shown that, despite some initial delays, the SIAFDMPC has successfully implemented the first phase of the NARRA project. More than the required twenty-five percent for the release of the second payment has been achieved. The management and financial bookkeeping has proved to be sound and able to achieve results. We're recommending releasing the remaining budget for the SIAFDMPC, as this will facilitate further project implementation.

Photo 3: SIAFDMPC Vice-Chairman Mr. Carlito Pregillana discussing the NARRA project during a consultative meeting

Recommendations

1. To improve information sharing within the cooperative, we recommend that the SIAFDMPC should have a monthly meeting to discuss the future activities and to assess the accomplishments in terms of activities and financial statements. To address communication problems between all stakeholders in the project (LGU, CVPED, WWF-Philippines' NSMNP-CDP, and DENR) a quarterly meeting should be organized in *sitio* San Isidro to evaluate/assess the status of the project.
2. Illegal hard wood was used in the construction of the nursery. This was done because there was no legal source of good construction wood. The NARRA project aims to solve exactly this problem, and as such this problem is the best justification of the project. But, for further constructions of the SIAFDMPC only legal wood and other indigenous materials should be used.
3. More attention should be given to the biodiversity conservation aspect of the NARRA project: more importance should be given to planting indigenous timber trees and the link with crocodile conservation should be clarified. This should be addressed in the regular meetings. The SIAFDMPC should clearly explain to the members the importance of these components and forward suggestions how to incorporate them more effectively in the NARRA project activities.
4. Membership of the SIAFDMPC is limited. More effort should be made by the SIAFDMPC to include other community members. This will strengthen the cooperative and have an important effect on poverty alleviation and biodiversity conservation in the area.

Photo 4: the temporary nursery for the indigenous timber trees in barangay Minanga, San Mariano. A permanent nursery was established in the reforestation site.