

Vegetation Analysis in the Riparian Zones of Angono Rizal, Philippines

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Abstract

Saving the life of the Angono River system is the ultimate vision of this research. Specifically, it analyses the vegetation along the riparian zones of the river's headwater as important benchmark information for future environmental actions of government agencies. Transect walk and satellite imagery revealed that the land cover, based on Standard Land Cover Classification System of the Department of Environment and Natural Resources (DENR) of the Philippines, is a non-forest other land cultivated annual. It was also found out that the tree vegetation is already weak and in critical condition and the very few remaining tree species are threatened by the fact that the study site is privately owned by a realty developer and a mining company and occupied by informal settlers. Thus, rehabilitation, conservation, protection and other important research endeavors, within the whole length of the river system are deeply calling for an immediate and active priority and concern from its various private and public stakeholders.

zones are already occupied by the informal settlers; very few tree species are to be found and the number is apparently small; soil erosion is very common; very little concern of the community residents towards their natural environment is observable; and overharvesting of the remaining few second growth plant resources is common. All these are threatening the death of the headwater of the river system.

Vegetation as the primary component that will sustain the life of the headwater certainly needs evaluation and rehabilitation. Hence, this research offered significant benefits including but not limited to scientific basis for future rehabilitation, significant information for the community and the Local Government Unit of the current status of the vegetation at the riparian zones, and attracting more active participation of the community and LGU towards its rehabilitation. Likewise, the result of the study provided scientific evidence to convince funding agencies to offer support toward the riverbank and headwater rehabilitation.

Index Terms- headwater, inventory, riparian, vegetation

INTRODUCTION

Sitio Labahan is a small portion of the large Barangay of San Isidro which can be found at the upper section of the river and mountainous north-eastern side of Barangay Angono, Rizal.

In 2007, the University of Rizal System Angono Campus identified the Barangay San Isidro, Angono Rizal as its adopted place in support to the mission of the institution of extending service to the community. And in 2008, the adopted community continues their cooperation with the projects given to them. Small as it is, the area, where the community lives, is very significant for it forms part of the headwater of the river system.

The natural characteristics of the area is already profoundly affected by the unprecedented human activities such as mining, land conversion and overharvesting of the remaining few natural resources available. In addition, the area had been seriously damaged by the tropical cyclone Ondoy in September 2009 which destroyed the large area along the riparian zone.

The area needs high priority due to several reasons namely, the amount of water flowing on the river portion traversing the barangay is very little; the residential wastes can be found anywhere in the river; some portion of the riparian

OBJECTIVES

This research was conducted to analyze the vegetation in the riparian zones of Angono River. Specifically, it sought to:

- determine the type of vegetation or land cover along the riverbanks of Sitio Labahan;
- assess the vegetation by identifying the remaining tree species and families in the area including its average height and diameter, know the diversity index of the remaining tree species in the area.
- analyze the result and identify other important research endeavors to be done in the area which shall lead to the development or crafting of a comprehensive rehabilitation plan.

REVIEW OF LITERATURE

The Reality

In the Philippines, there are 421 principal river basins in 119 proclaimed watersheds, 19 of which are identified as major river basins. There are a total of 99 lakes, 16 of which have areas more than 400 hectares. Laguna de Bay in Luzon, with an area of

922 sq. km, and Lake Lanao in Mindanao are the largest lakes. (Kho et al., no. date).

The micro-watershed system traversing along the political boundaries of Antipolo City, Municipality of Taytay and Angono Rizal is one of the twenty two (22) supporting channels to the Laguna Lake. Likewise, the system is a critical watershed and a major water supply support system for the agricultural and residential areas located along the river system.

At present, there were no recorded formal researches similar to the present work that have been done in the area which aims at evaluating and rehabilitating the headwater, the riverbank and the Angono River system as a whole.

The Service that is threatened to its Extinction

Japan International Cooperation Agency (JICA) mentioned that water demand in the Philippines was 29,944 mm/yr. in 1996 and is expected to dramatically increase up to 86,500 mm/yr. in 2025 (Kho et al., no date).

Water supply support system has always been the compelling force to put these watersheds under appropriate management. The river system under study, as it contributes primarily in the sustenance of the micro-watershed system demands high priority on protection, conservation and rehabilitation considering its current observable conditions.

Watershed management requires various forms of resources or capital to support the activities and the task is made more challenging by the fact that most of the watersheds have already been turned into settlement areas (which is also observed along the Angono micro-watershed system- both the upstream and downstream areas). The support should come from the political units closest to the watershed. These usually consist of the municipalities and Barangays that are found within the watershed, and those people living in the upstream and the downstream areas (Francisco and Rola, 2004).

Riverbanks perform an important role in the lives of the people and the communities around it. A well-protected and stable riverbank protects the nearby agricultural land and crops from damage during flood. Due to the wanton destruction of forests and improper land use practices, most riverbanks become unstable and are now in critical condition. Hence, there is a need to rehabilitate these riverbanks to address the problem of stream bank erosion and instability (PCARRD, 2006).

What could possibly be done?

Fajanil et al. (DENR 6) conducted a study from 2002 to 2005 to find out the suitability of bamboo (*Gigantochloa levis-Botong & Bambusa blumeana* var. Luzonensis -Bayog) and vetiver grass in rehabilitating critical riverbanks in Cuartero, Capiz Philippines. These two species have great potential to control soil erosion and can be used to stabilize riverbanks as mentioned in other reports. Fajanil et al. found that *Bayog* + vetiver grass performed best in terms of growth performance, number of vetiver tillers, and soil build-up.

In addition, in 2004, *Botong* had an average of 8.5 poles/clump with an average of 5.3 shoots/clump while *Bayog* had an average of 7.85 poles and 4.42 shoots, and it had an average of 30.3 poles and 6.2 shoots in 2005. These indicated

that inter-planting of bamboos with vetiver enhances bamboo pole and shoot production. Hence, *Bayog* in combination with vetiver should be planted along riverbanks to control soil erosion. (PCARRD, 2007)

During the field reconnaissance in the study area, many bamboos were also observed. With the study of Fajanil et al. and the observation in Sitio Labahan, bamboo seems to be a species of interest in rehabilitating the riverbank while maintaining the existing tree species found in the study area.

CONCEPTUAL FRAMEWORK

The current study is a salient factor, together with the remaining research endeavors, required prior to the crafting of the rehabilitation plan for the riverbanks. It is also important that participation of prime stakeholders (LGUs, Landowners, Neighborhood Associations and residents, national and local laws, policies and regulations on watershed and environment) are present towards the success of the development of the riverbank rehabilitation plan.

The current research results and the future research endeavors to be conducted plus the whole rehabilitation plan will directly support the riverbank recovery. It will also indirectly benefit the residents, the whole river system, and the agriculture and industries and ultimately the Laguna Lake water support system.

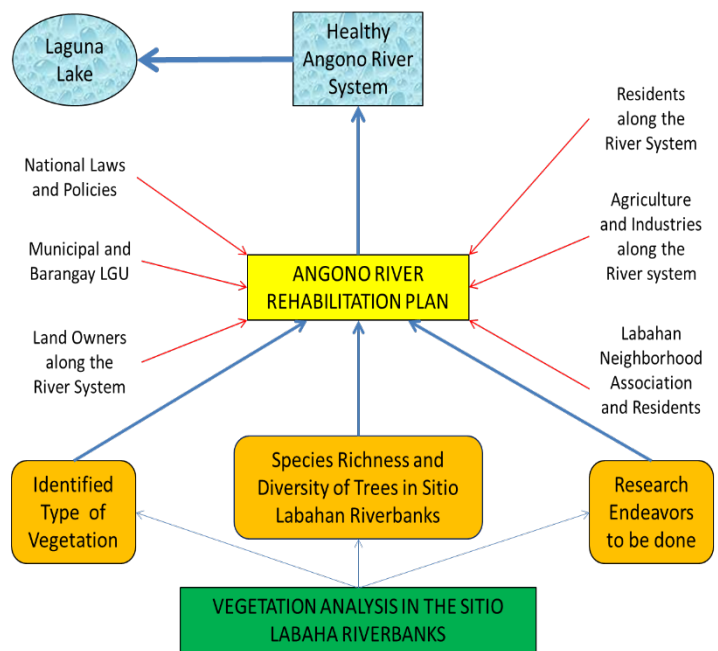


Figure 1. Framework of the study

METHODOLOGY

The following implementing strategies were used in the study.

Request of unwarranted permits

The Local Government Unit and the Neighborhood Association were formally informed to suit the requirements of the Executive Order 247 (*Bioprospecting*) and the Republic Act 9147 (*Wildlife Resources Conservation and Protection Act of the Philippines*).

Determination of the type of vegetation or land cover

Transect walk and field reconnaissance were conducted. The land cover classification made by Philippine's National Mapping and Resource Information Authority (NAMRIA) and the DENR's Standard Land Cover Classification System and the existing site state were considered in the land cover identification.

Assessing the vegetation

Field reconnaissance and establishment of sampling plots were done with the assistance of the officers of the *Sitio Labahan Neighborhood Association*. GPS unit was used during the survey. A total of eight 10x10m sampling plots were established where the species were identified. Average height and diameter, classification as to diameter and height at maturity and population density were also measured. Shannon-Weiner Diversity Index (1n) was used to compute the diversity values.

Classification and identification of collected specimens

Collected specimens were identified using taxonomic keys, books from Forest Products Research and Development Institute (FPRDI) and verified by dendrologists from College of Forestry, University of the Philippines in Los Banos, Laguna.

To determine the necessary research endeavors to be conducted in the area

The work of Contreras (2004) on the "*Realities of a Watershed Management Approach in the Philippines*" published in the Philippine Institute for Development Studies, Discussion Paper Series No. 2004-19 was analyzed and salient information were considered. PCARRD's "*Vegetation Analysis Manual*" was also utilized. Kho and Agsaoay-Saño's work on "*Customary water laws and practices in the Philippines*" were also utilized.

RESULTS

The type of vegetation or land cover

The transect walk and field reconnaissance conducted along the riparian areas revealed that the vegetation or the land cover occurring in the site is a non-forest other land cultivated annual based on the Standard Land Cover Classification System of DENR (DAO 2008-24 –Annex F1).

Assessment of vegetation or land cover

On Species Richness

Inventory of the vegetation in the sampling plot revealed a total of 150 combined trees and seedlings counted from the different sections of riparian zones of the study area. Of this total, 96 are seedlings and 54 are trees. Further, the combined data revealed a total of 20 families, 29 genera and 43 species (Table I). This number of species is comparatively lower than those observed in Mt. Hamiguitan (Amoroso et al., 2006) and Mt. Malindang (Arances & Amoroso et al., 2004).

Table I. Number of families, genera, species and counts

Plant Group	Families	Genera	Species	Count
Seedlings	10	12	23	96
Trees	10	17	20	54
Total	20	29	43	150

Of the two plant groups, the count of the seedling species is a bit higher than the trees which are maybe due to excessive or overharvesting by the informal settlers in the area. Likewise, the low species count of plants in the area can be attributed to the sandy and gravelly soil type plus its susceptibility to erosion, landslide and continual quarrying. The area covered in the study is so small with 7.7 hectares as compared to about 6,834 hectares of Mt. Hamiguitan (Amoroso et al., 2006).

Diameter and Height of Trees

The sampling inventory revealed that the average diameter of trees is 8.84 cm, while the average height is 5.96 meters. It was also noted that the highest diameter and height average can be found in Plot 1 because it is located at the highest point in the transect and the farthest from the bulk of the informal settlers. However, when Plot 1 was compared to other plots, still these averages are quite alarming because this only implies that the trees in the area are no longer reaching ideal diameters before being harvested.

Table II. Mean Diameter (a*) and Mean Height (b*) of Trees

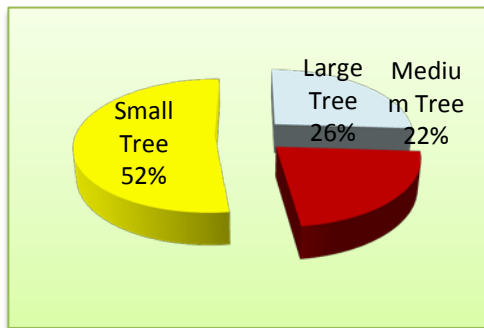
Average Diameter	Average Height
8.84 cm	5.96 m



(a*) Mean Diameter per Plot (cm) (b*) Mean Height per plot (m)

Classification as to diameter and height at maturity (Tree Size)

In the analysis of the inventory data, it can be noted that more than half (52%) of the total plants identified are classified as small trees, 22% are medium and 26% are large with regards to their diameter and height at maturity as classified in the *Lexicon of Philippine Trees* (Salvosa, 1963). This higher percentage of small trees can be attributed to the fact that large trees are usually the preferred subject of harvesting, thereby reducing its chance to multiply as times pass by.



*Large (>40cm dm/>15m ht), Medium (30-40cm dm/5-15m ht), Small (3-30cm dm/2-5m ht)

Figure 2. Percentage distribution of identified plant species as to Tree size, diameter and height at maturity

Population density

The average population density of the species identified is 0.007 (Table 4).

Table III. Population Density of Tree and Seedlings

Common Name	Relative Density	Common Name	Relative Density
<i>Acacia auriculiformis</i>	0.005	<i>Pithecellobium dulce</i> Roxb.	0.001
<i>Persea gratissima</i> Mill.	0.001	<i>Semecarpus cuneiformis</i> Blanco	0.004
<i>Voacanga globosa</i> Blanco	0.001	<i>Mangifera indica</i> L.	0.006
<i>Pterospermum diversifolium</i> Blume	0.001	<i>Artocarpus heterophyllus</i> Lam.	0.006
<i>Antidesma ghaesembilla</i> Gaertn.	0.003	<i>Ficus pseudopalma</i> Blanco	0.005
<i>Muntingia calabura</i> L.	0.011	<i>Ficus odorata</i> Blanco	0.001
<i>Gmelina arborea</i> Roxb.	0.001	<i>Tebernaemontana pandacaqui</i> Poir.	0.003
<i>Anona muricata</i> L.	0.003	<i>Sandoricum koetjape</i> Burm.	0.004
<i>Endospermum peltatum</i> Merr.	0.001	<i>Spondias purpurea</i> L.	0.001
<i>Macaranga bicolor</i> Muell.-Arg.	0.001	<i>Macaranga grandifolia</i> Blanco	0.004
<i>Ficus septica</i> Burm.	0.005	<i>Terminalia catappa</i> L.	0.001
<i>Leucaena leucocephala</i> Lam.	0.095	<i>Sterculia crassiramea</i> Merr.	0.001
<i>Ficus ulmifolia</i> Lam.	0.014	<i>Ficus nota</i> Blanco	0.001
<i>Gliricidia sepium</i> Jacq.	0.009		

The table indicates that the number of individuals of a population per unit of living space in the study area is very small. The data also reveals that the vegetation is composed of twenty (20) fruit bearing species and out of twenty, nine (9) of which are edible. Out of the nine edibles, six (6) can give marketable produce when given proper care and management. Further, this fact suggests that planting strategies have to be devised to increase the population of the remaining species in the area and to increase the economic use or profitability of the possible produce of the edible and fruit bearing species.

Species diversity

Species are distinct units of diversity and each playing a specific role in the ecosystem. Species diversity refers to the variety of species within a region. In nature, the number and kind of species, as well as the number of individuals per species vary, leading to greater diversity (Tutorvista, 2010).

Table IV. Shannon-Weiner Diversity Index per Plot

Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Trees	0.759	0.872	n/a	n/a	0.759	0.639	0.276	0.26
	Very low	Low			Very Low	Very Low	Very Low	Very Low
Seedlings	0.265	0.759	0.171	0.276	0.439	0.171	0.615	0.301
	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Trees & Seedlings	0.532	1.004	0.171	0.276	0.71	0.469	0.677	0.499
	Very Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

The inventory data showed a very low diversity index as revealed by the Shannon-Weiner Index. The diversity indices in all sampling plots are comparatively lower than the diversity indices in the analysis made in the different vegetation types in Mt Hamiguitan (Amoroso et al., 2006).

Other important research endeavours to be done in the area before crafting the comprehensive rehabilitation plan

To meet the basic requirements in the rehabilitation of the riparian zones in Sitio Labahan, the following steps have to be undertaken prior to the crafting of comprehensive riparian zone rehabilitation plan.

1. Basic Scoping
2. Mapping
3. Floral diversity assessment
4. Soil and Climate Characterization
5. Species-Site Compatibility Assessment
6. Identification of suitable land cover development strategy or technique (Assisted Natural Regeneration, Reforestation or Enrichment Planting)
7. Assessment of institutional and social capital (Contreras, 2004)
8. Assessment of political capital (Contreras, 2004)

CONCLUSIONS

Therefore, the current land cover (trees in particular) in the riparian zone of Sitio Labahan showed low species richness and diversity on a per unit area basis. And the physical features revealed an area that is highly disturbed and eroded by natural and man-made forces such as tropical cyclones, mining and quarrying activities. Hence, both biological and physical components of Sitio Labahan riparian zones need high priority for protection, conservation and rehabilitation.

IMPLICATIONS AND RECOMMENDATIONS

The national policies and guidelines regarding the mining, quarrying and settlement along the buffer zones of bodies of water are not implemented well in the study area. The floral component is basically limited and needs attention. The headwater of the river is in the brink of its extinction and the riverbanks are unhealthy and physically dangerous to the residents occupying the area. Hence, the Local Government Unit should implement policies religiously. Likewise, a local ordinance or Memorandum of Agreement regarding the management, rehabilitation, protection and conservation of the riparian zones and its biological components should be established to ascertain the protection of the headwater and river system as a whole.

Local Government Units adjacent to the river system should also make their priority because the headwater of this micro-watershed is within their political boundaries and their constituents also benefit from it.

Realty developer and resort owner along the headwater should take part in maintaining the buffer zones to sustain the life of the current micro-watershed system as a whole.

Lastly, all the necessary research activities be conducted the soonest possible time to be able to craft the rehabilitation plan.

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