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Characterization of the University of Bohol Ecofarm: An Urban Forestry Development Model

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Abstract - Urban forestry advocates the role of trees as a critical part of the urban infrastructure. Establishment of higher vegetation is highly called for in improving the health of the environment and the community especially in these days when the effects of global warming is obviously felt everywhere, much more in urban areas. Among the vast resources of the University of Bohol is a 2.1-hectare lot in Village San Isidto, Tagbilraran City which has commonly been referred to as the "UB Ecofarm". The site is a degraded karst land which has been left idle for quite some time with indigenous pioneer species and other dominant scrubby vegetation. A survey was then conducted to gather baseline information on the existing floral and faunal resources as well as edaphic and geo factors characterizing the area. The creation of an urban forestry development plan was the ultimate purpose and output of this research endeavor. Despite the degraded condition of the site, results showed a total of 65 species of trees and shrubs, 56 species of grasses and

broadleaved weeds; 25 bird species, 4 bat species and others like frogs and rodents. The stunted vegetation is growing in patches. Timber poaching, wildlife hunting and unauthorized pasturing of animals are the major problems in the site. The area has the potential for a bird sanctuary, a demo area of a sub-urban vegetation rehabilitation, organic farming in selected spots and a biodiversity conservation center for the city

Keywords - Urban forestry, degraded karst land, biodiversity, vegetation rehabilitation, conservation

INTRODUCTION

Urban and community forests are the trees, plants and associated ecosystems anywhere where people are - country roads in rural towns, new developments in the suburbs, or concrete neighborhoods in cities. Our landscape is a continuum from rural forest to city center. We live, work, play and learn all along this continuum. And there's more to a forest than just the trees. The other plants, soils, air, and water that are part of the community make up an ecological system that supports wildlife, a clean environment and a healthy home for humans. The health of urban and community forest ecosystem affects the quality of the water we drink, the air we breathe, the stability of our neighborhoods, and our sense of community and individual pride (http://www.mass.gov/dcr/stewardship/forestry/urban/index.htm).

Among the vast resources of the University of Bohol is a 2.1-hectare lot in Village San Isidro, Tagbilaran City which has commonly been referred to as the "UB Eco- Farm". The site has been left idle for around two decades with indigenous pioneer species and other scrubby vegetation presently dominating the site. Figures 1and 2 show the reduced vegetation cover and signs of land degradation. On the brink of becoming totally marginal, the area can still be rehabilitated and has the potential for a bird sanctuary, a demo area of a sub-urban vegetation rehabilitation, organic farming in selected spots and a biodiversity conservation center. It will also be a rich learning venue for the students

and faculty of the University of Bohol in all levels and for all other students, the community, researchers and visitors. Portions of it will be developed as demo farms showcasing to the community an approach in sustainable farming and enrichment planting or rehabilitation of a degraded ecosystem.

Equally important will be the establishment of a biodiversity monitoring system (BMS) with the long-term aim of promoting conservation of the biophysical resources of the area. The BMS require baseline data, hence this inventory. A proposed initial plan for development is also a desired output of this research.

Figure 1. The general landscape of the research site, already reduced to barren/grassy spaces interspersed with patches of pioneer vegetation like Balinghasai (an-an) and Batino

Figure 2. Barren portion littered with dead twigs possibly left by fuel wood gatherers. Stones and pebbles characterize the upper soil horizon

OBJECTIVES OF THE STUDY

The research aimed to gather baseline data on the biophysical features of the site. Specifically it sought to determine the floral and faunal species taxonomic composition, geologic and climatic features, site disturbances and threats, and formulate an initial development plan for the area.

FRAMEWORK

Urban forestry is the care and management of urban forests, i.e., tree populations in urban settings for the purpose of improving the urban environment. Urban forestry advocates the role of trees as a critical part of the urban infrastructure. It is practiced by municipal and commercial arborists, municipal and utility foresters, environmental policymakers, city planners, consultants, educators, researchers and community activists. Urban forestry is a practical discipline, which includes tree planting, care, and protection, and the overall management of trees as a collective resource (en.wikipedia.org/wiki/Urban_forestry).

The urban environment presents the arboricultural challenges of limited root and canopy space, poor soil quality, deficiency or excess of water and light, heat, pollution, mechanical and chemical damage to trees, and mitigation of tree-related hazards. Management challenges include maintaining a tree and planting site inventory, quantifying and maximizing the benefits of trees, minimizing costs, obtaining and maintaining public support and funding, and establishing laws and policies for trees on public and on private land (forestry.lib.umn.edu/bib/urban.html).

Aside from avenue, planting of trees in heavy industrialized urban areas like Manila, garbage dumps like the infamous Smokey Mountain in the heart of Tondo is now planted with trees. This area had been the capital's main dump site for four decades until its closure in 1994 (http://philforestforum.com/pressreleases/pr018.htm).

The Green Philippines Project was launched by the Philippine government in June 2006. Model projects for the program include urban greening, watershed rehabilitation and eco-tourism, community

forestry and commercial/industrial large scale tree plantation. It also hopes to promote public awareness, particularly for city dwellers on the value and importance of trees and forests in urban landscape. The community forest aspect of Green Philippines will demonstrate ways of recovering, rehabilitating and putting added value to communal forests, now in open and denuded conditions through tree and or agroforestry farming (http://philforestforum.com/pressreleases/pr020.htm).

Baseline wilderness data are of considerable importance for several reasons. One of the primary values of wilderness is as a reference that contrasts with those lands where humans dominate the landscape. Leopold (1941) called wilderness "a base-datum of normality, a picture of how healthy land maintains itself." To realize this value, baseline data on wilderness conditions are needed, for comparison at some future time and for comparison to other lands. Baseline data also contribute knowledge needed to effectively steward wilderness. Baseline recreation data are particularly important to managing recreation in wilderness (http://www.treesearch.fs.fed.us/pubs/27709). Moreover, baseline data provides information on the status of the resources for development planning and determine appropriate management actions (http://biology.usgs.gov/cro/98fws-7.htm).

METHODOLOGY

Area Reconnaissance

Prior to the field data collection, the area was reconnoitered for a preliminary investigation of the resources to determine the amount of work to be done and equipment needed.

Floral Inventory

A 100% floral inventory was made. The whole area was divided into 13 blocks. The plants were listed by individuals and by species. These were categorized into the following growing habits: trees, shrubs, vines, herbs and grasses. Trees and shrubs were further classified into those having a DBH (diameter at breast height) of 5 cm or less and those with a DBH of above 5 cm. Heights were also taken of those having a DBH of 5 cm or more. Tree form was also noted like if a tree was forking, straight or leaning.

Faunal Inventory

The birds were identified through observation and through birdcalls. Those observed were either seen or captured. Mist nets were set-up along flyways late in the afternoon. The trapped birds and bats were retrieved at the earliest time in the morning to minimize stress for the animals. These were carefully disentangled from the net and released right away after identification, taking of measurements and photo-documentation. The entire area was covered during the faunal inventory as this was simultaneously done with the floral inventory. Round and tree frogs were both listed. For the rodents (non-volant or non-flying mammals) traps were set-up for their capture. These were also released right after identification and documentation.

Geological and Other Physical Features

Elevation and climatic data were taken from secondary sources. Edaphic conditions, topography, past disturbances and present threats were by observation.

Data Treatment and Analysis

Taxonomy. The plants were identified and classified according to official common names, scientific names and family names.

Simple counts and frequency of occurrence were used for descriptive analysis of species dominance.

Vegetation map was made from floral distribution as noted by block.

The proposed initial development map was generated after analyzing the biophysical conditions of the site.

RESULTS AND DISCUSSION

Floral Composition, Distribution and Growth Performance

A total of 1,976 trees and shrubs (table 1) belonging to 65 species under 23 families were inventoried. In addition, some 56 species grasses and broadleaved weeds were recorded which include carabao grass, hagonoy, cogon, kawayan tinik and makahiya. In table 1, only 12 of the 65 tree species had a diameter of 5cm and above with only 25 cm as the highest and an average DBH of only 10.4 cm. The average height was only 6.9 meters. This implies a fairly young stand dominated by

individuals in the sapling to barely the pole stage. Only a few molave and bangkal got a DBH of 20 – 25 cm and a height of 10 -13 meters.

Table 1. List of tree species (5 cm. in diameter and above) UB Eco-Farm, San Isidro District, Tagbilaran City

No.	Common Name	Scientific Name	Family Name	DBH (Cm)	Height (M)
1	Balinghasai	Buchanania arborescens	Anacardiaceae	7.3	9.7
2	Bangkal	Nauclea orientalis	Rubiaceae	17.05	11.26
3	Batino	Alstonia macrophylla	Apocynaceae	7.52	6.3
4	Bignai	Antidesma bunius	Euphorbiaceae	7.43	4.86
5	Binunga	Macaranga tanarius	Euphorbiaceae	10.0	7.5
6	Hauili	Ficus septica	Moraceae	6.5	4.0
7	Ilang-ilang	Cananga odorata	Annonaceae	5	5
8	Malapapaya	Polyscias nodosa	Aralliaceae	10	9
9	Mamalis	Pittosporum pentandrum	Pittosporaceae	6.5	6.5
10	Molave	Vitex parviflora	Verbenaceae	17.44	7.78
11	Tamaho	Gloecarpus patentivalvis	Sapindaceae	11.4	6.2
12	Unknown 2			15	7
		AVERAGE VALUES		**10.4 cm**	**6.9 m**

Most of the trees /shrubs had heights below 10 meters. Balinghasai (an-an), bangkal and batino dominated the upper canopy of the area. This was followed by molave and bignai (injam). Except for molave, the rest of the tree species have low timber value. Most were just good for firewood and minor construction. Trees with a DBH of below 5 cm were dominated by balinghasai, batino and bakawan-gubat.

The trees and shrubs were growing in patches and in small clumps covering about a third of the area. There are some spaces which are either bare or are grown to grasses / weeds and other scrubby vegetation. There is a need for rehabilitation with higher vegetation in these patches.

The vegetation, in general, were stunted in growth as manifested by heavy forking near the base, profusion of small branches and small leaves. This was not surprising with the degraded condition of the area: shallow soils, stony surfaces and soil erosion.

Faunal Composition

Despite the degraded conditions of the site, it still hosted a diversified faunal species, some of which may be just permeate in the area. Birds and bats are most important in seed dispersal or natural regeneration.

Table 2. List of birds found at the UB Eco- Farm, San Isidro, Tagbilaran City

NO.	COMMON NAME	LOCAL NAME	SCIENTIFIC NAME	FAMILY NAME	REMARKS
1	Barred Rail	Tikling-banlan	Gallirallus torquatus	Rallidae	Heard
2	Brown Shrike	Tibas	Lanius cristatus	Laniidae	Observed
3	Chestnut Munia	Maya	Lonchura malacca	Estrildidae	Observed
4	Common House Swift	Buta-buta	-	Apodidae	Observed
5	Cryptic Fly-catcher	-	Fecidula crypta	Muscicapidae	Observed
6	Emerald Dove	Manatad	Chalcophaps indica	Columbidae	Captured
7	Glossy Starling	Lansiyang	Aplonis panayensis	Sturnidae	Observed
8	Long-tailed Shrike	Tibas	Lanius schach	Laniidae	Observed
9	Olive-backed Sunbird	Tamsi	Nectarinia jugularis	Nectariniidae	Observed
10	Oriental Magpie Robin	Siloy	Copsychus saularis	Turdidae	Observed
11	Philippine Bulbul	Tagmaya	Hypsipetes philippinus	Pycnonotidae	Observed
12	Philippine Coucal	Kokok	Centropus viridis	Cuculidae	Observed
13	Philippine Nightjar	Tihiw	Caprimulgus manillensis	Caprimulgidae	Captured
14	Pied Fantail	Kitoy / Kamantigon	Rhipidura javanica	Muscicapidae	Captured
15	Pied Triller	Bogaongon	Lalage nigra	Campephagidae	Captured

16	Pink-necked Green Pigeon	Punay	Treron vernans	Columbidae	Observed
17	Purple-throated Bee-eater	Pirok-pirok	Merops sp.	Meropidae	Observed
18	Red-keeled Flowerpecker	Tamsi	Dicaeum australe	Dicaeidae	Observed
19	Small Button-quail	Bontog	Turnix sylvatica	Turnicidae	Captured
20	Spotted Dove	Tukmo	Streptopelia chinensis	Columbidae	Observed
21	Striated Grass-bird	Tibsok	Megalurus palustris	Sylviidae	Observed
22	White-breasted Waterhen	Kijaw	Amaurornis phoenicurus	Rallidae	Heard
23	White-eared Brown Fruit Dove	Limocon	Phapitreron leucotis	Columbidae	Observed
24	Yellow-vented Bulbul	Tagol-ol	Pycnonotus goiavier	Pycnonotidae	Captured
25	Zebra Dove	Korokoko	Geopelia striata	Columbidae	Captured

Birds. Some 25 species of birds (table 2) belonging to 17 families were recorded. Most of these were seen or observed in the area. A few were caught in the mist net and still a few were identified only through birdcalls. Those caught in the net were carefully released right away after identification and photo documentation Among the birds were the emerald dove (manatad), small button-quail (bontog), olive-backed sunbird (tamsi), pied fantail (kamantigon), olive-backed sunbird (tamsi), yellow-vented bulbul (tagol-ol), brown shrike (tibas), Philippine nightjar (tihiw), pied triller (bogaongon) and zebra dove (korokoko).

The obvious absence of big birds indicated a degraded habitat for them. Hunting may have happened too.

Figure 3. Brown Shrike (Tibas)

Figure 4. Emerald Dove (Manatad)

Fruit Bats. Four species of bats (Table 5) and a total of 64 individuals were identified. These were the common short-nosed fruit bat, common rousette, the musky fruit bat and an unidentified large fruit bat. Half of the bats were the common short-nosed fruit bats. Most of the captured bats were males. The unidentified large fruit bat was observed roosting in a bangkal tree. It was the biggest of all the bats found in the area but also noted to be smaller than the known P. vampyrus, also a large fruit bat. The sex or gender of the unidentified large fruit bat could not be determined because it wasn't captured. Mist nets were used in capturing the bats. At retrieval time early in the morning, the caught bats were carefully disentangled from the net. After taking measurements, identification and photo documentation, these were carefully released.

Frogs. A total of 24 individuals of frogs belonging to 3 species were identified. These were the four-lined tree frog, white-lipped tree frog and slender-digit chorus frog.

Rodents. Five individuals of rodents belonging to three species were identified. Four of the 5 were males. The rodent species were the rice field rat, oriental house rat and the Mindanao mossy forest rat.

Butterflies. Only a few were encountered. This was attributed to the absence of host plants like citrus (especially pomelo) and tulibas-tilos,

Geological, topographic and climatic features

The area is typical of Bohol with its limestone geo-base of carbonate and sedimentary rocks. The resultant karst environment produces a system that is fragile in terms of erosion with its readily

soluble limestone bedrock. The study site had two sinkholes about 4 meters deep and bottom diameters ranging from 6 – 8 meters. Small depressions were found in several spots which might develop to sizeable sinkholes like the two bigger ones.

Very shallow soils with rock fragments / pebbles on the surface dominated the area. Only the sinkholes and a small portion on the northern point had better soil depth. The area had a rolling topography with the slopes leading to the two sinkholes a little steep. The elevation is less than 20 meters above sea level. Like the rest of the island, the climate is generally dry, with maximum rainfall between the months of June and October.

Past disturbances and present threats to the area

The condition of the remnant vegetation, i.e., devoid of the valuable timber species and occurring in patches, strongly suggested relentless harvesting or cutting. The presence of many old molave stumps was also evident of the disturbance. Firewood collection may have happened too. There were also indications of stones or pebble gathering. Removal of stones especially in slopes or undulating terrain destabilizes the soil profile and contributes to the vulnerability of the area to soil erosion. Encroachment also occurred with the unauthorized cultivation in some spots which were opened and planted to corn, sweet potato and kangkong. The area on the northeastern at the main lot which was cultivated to corn was about 10 x 20 meters in size. The illegal cultivation may have also contributed to the floral biodiversity loss when the area was opened or cleared for farming. Other old cultivations were noticed along the slopes near the sinkholes. Small grassy portions suffered from compaction from pastured animals like cows and carabaos.

The northern portion suffered compaction from pastured animals like cows, carabaos and goats.

Present threats include continued cutting, encroachment, wildlife hunting and compaction from grazing. A trap for monitor lizards which is called halo/haw in the dialect was also found during the survey.

CONCLUSIONS

The area is generally degraded despite the remaining floral and faunal diversity. An averaged-condition natural forest would have a floral diversity 10 times or more given the same area. The loss of a good vegetation cover also rendered the loss of good top soil. Faunal population is also of inferior quantity / quality compared to areas sufficiently covered with diverse higher vegetation. Although nearly becoming marginal, the site can still be rehabilitated and a good functioning ecosystem restored therein. The continued disturbances endanger the site to further degradation. Protection and rehabilitation needs are immediate.

RECOMMENDATIONS

1. Enrichment planting to a diversified valuable indigenous timber and fruit trees should be done as early as possible. Prior to this should be a complete perimeter fencing to secure the area and protect the improvements to be made. A 6-strand barbed wire fence with concrete posts will meet the purpose. A live fence of a double-hedgerow kakauate (madre de cacao) will be planted right after the installation of the barbed wire to superimpose the outer fence and serve as the eventual permanent fence in the future.

Recommended trees for enrichment planting are indigenous fruit and timber species like molave, kalumpit, kalingag, bitanghol, narig, dao, citrus, maksa, white lauan, Quisumbing guisok, bagtikan, mangasinoro, other dipterocarps and more. As a conservation area, no exotic trees should be introduced.

Host plants for birds include the following: antipolo / tipo (suited to be planted near the sinkholes), kamagong, gumihan, mansanitas, kalingag, tagibokbok, anabiong, marang, bitaog (for bats), balete or ficus and sablot and others. Only a few balete plants should be planted in selected spots preferably along corners of the property.

Host plants for butterflies include tulibas-tilos, some vines, sto. Nino, citrus (especially the pomelo or buongon as called in the local dialect) and others.

Carefully chosen flowering trees may also be planted along the perimeter fence mainly for aesthetic purposes.

2. Other Proposed Development and Structures

Aside from the enrichment planting or vegetation restoration in all EP (enrichment planting) areas, it is also recommended to gradually develop the area into a nature conservation park and learning center with the following proposed developments as reflected on the map

Trail. The trail is designed to pass through the different micro-ecosystems of the area. The location of the trail should be identified and marked prior to enrichment planting so that the spaces be left vacant, thus saving efforts and planting materials. The trail can also be used for the Biodiversity Monitoring System (BMS) of the Park.

Visitors' Center. Information materials like posters, brochures, CDs and other learning materials will be in this place. A space shall also be provided for a brief orientation or lecture to about 20 students or visitors. A snack and souvenir corner would also be practical as a component.

Water System. Water systems have to be installed at the Organic AF Gardens and at the Orchard area.

Organic Vegetable Production Garden. This is proposed to be established at the separated (by road) eastern portion of the property. Contour hedgerows shall be constructed and planted to vegetables and other economic plants. A nursery and organic / vermicomposting will be incorporated in the set-up.

Caretaker's Cottage. This will be located adjacent or within the vegetable production area.

Viewing Deck. This will be a high-rise structure to provide a panoramic view of the area. This will be constructed at the highest point of the area.

Mini Tree Park. This is proposed to be established at the extensive grassy portion where the soil is deeper than the rest. Various indigenous valuable timber trees, especially the dipterocarps, will be mix-planted. Only robust and healthy planting stocks should be used for these trees to become potential sources of planting stocks or mother trees in the future.

Orchard. Proposed to be established at the northern edge, the area will be mix-planted to indigenous fruit trees. To give the plants a good

start in the degraded site, the planting holes should be big enough (ex. 1 m x 1 m x 1 m) and be filled with good top soil mixed with compost and manure.

Bat houses, Birds' Nests and Pond. As the site is still devoid of vegetation sufficiently tall and safe for roosting, about 2-3 bat houses would temporarily serve as roosting structures for bats. Once the vegetation is sufficiently improved, the tall vegetation will become the natural roosting hosts. The bat houses and birds' nests will be made of perforated bamboos mounted higher high enough. As the site has no natural source of surface water like streams, lakes or rivers, the creation of a small artificial pond will be a big help to the water need of the birds and other animals in the area.

Other developments in the future: bird sanctuary, bee farming, bird watching. Wooden signage shall be installed in all areas as needed. Wooden benches may also be provided in strategic areas of the trail as a resting area.

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