A Rapid Floral Diversity-Elevation Survey Along the Maddiangat Trail of Mt. Palali, Nueva Vizcaya

Ryan P. Manuel[1] and Romnick L. Pascua[1]

[1] Department of Environmental Science, Nueva Vizcaya State University, Bayombong 3700, Nueva Vizcaya

Keywords:

soil interpolation method, soil mapping, IDW, kriging, spline

ABSTRACT

Mt. Palali is one of the standout and economically-critical land forms in the province of Nueva Vizcaya. It is feared that without proper understanding of biodiversity therein, resources may be exploited for short-term economic returns. To generate viable information for decision-makers, the researchers conducted a rapid survey of Palali's floristic composition and diversity with respect to the ecological elevation and terrain of the mountain. Incidence data was recorded from 37 stations established along the major trail loacated at Barangay Maddiangat, Quezon. Alpha diversity indices (Shannon H', Simpson's D, Pielou's J') were computed and cluster analysis done to describe species, vegetation types and community diversity.

Ninety seven (97) species including nine morphotypes in 208 encounters were counted. The most frequently observed were Shoreapolysperma (14 observation points) Lithocarpusllanosii (12), Shoreacontorta (11) Saurarialatibractea (10) Sarcandraglabra (9) and Caralliabrachniata, Cinnamomummercadoi, (8), Pityrogrammacalomelanos, Shoreapalosapis, Tristaniopsisdecorticata, all with 8 encounters. Species diversity is very high (H'=4.229). as well as variety of dominant species (1-D = 63.400) and distribution is highly even (J' = 0.924).

Six (6) observation points were without forest trees, which were either converted farm lots or open areas dominated by grasses. At (~300-500 masl) Palalis's plant community were influenced by farming and timber harvesting, while at (~1350 to ~1,717 masl) is dominated by Vaccinium, Rhododendron, Symplocos and Homolanthus. At ~1450 masl, Astronia, Melastoma, Nephenthes, Dacrycarpus become more visibly abundant. Numerous rattan species are found as well in the upper montane and sub-alpine mossy forest of Mt. Palali.

Visual observation was supported by ordination of observation points, yielding four communities. Community 1 dominated by Cinnamomummercadoi ,*Shorea palosapis*, *Shorea polysperma*, *Lithocarpus lanosii* and *Sarcandra glabra*, has the most contiguous span, ranging from 655 to 857 masl. Estimated crown cover is 60%-80% along the trail allowing smaller plants to receive sunlight without much interference and attenuation while Community 2 forms the lower elevations of Palali (360 to 567 masl). Ficus species are found scattered and where shade is present, ferns like Kilob (Dicranopterislinearis) and Pneumatopterissp can be found. Community 3 are scattered somewhere between 644 to 1,601 masl. The composition is mixed, but visibly abundant are rattans, Syzygium, Astronia and Saurarialatibractea. Lastly, Community 4 is comprised of the subalpine from 1519 to the summit.

Here, the vegetation and structure is very different from the rest as it is dominated by Vaccinium, Rhododendron, Melastoma. Leptospermum and numerous mosses. These observations denote that Mt. Palaliis very diverse not only in terms of species, but also in the variety of ecosystems / plant communities found along its terrain.

INTRODUCTION

With the exception of Mount Pulag in the Cordilleras, Mount Palali is the highest peak in Nueva Vizcaya (~1717 masl). It is part of the Palali-Mamparang range located in the southern portion of the Sierra Madre ecological corridor. The land is shared by Quezon, Kasibu and Bayombong towns. Of these three municipalities, Quezon, particularly Barangay Maddiangat, enjoys the best access to resources of the area, wherein residents derive livelihood thru timber harvesting, farming and ecotourism.

Efforts have been made in recent years to declare Palali as a protected area. Even the local residents recognize the importance of conserving biophysical resources in the area, as they see the watershed as very important aspect of their community. However, it has been observed in regular visits to the area that there is a gradual influx of migrants. They allegedly (thru personal communication with key informants) incur more damage than the original residents. For this it is feared that substantial degradation to the area may be imminently.

As people rely heavily on Palali's wealth, protection by stopping harvesting and other livelihood activities is not an option. Without proper policy at hand, over- or unsupervised extraction of resources may happen, and arrest certain ecological services most important to people in surrounding communities. In applying of biodiversity conservation's Principle of Persistence (Fernando, 2012),stakeholders of Palali need to know and understand the biodiversity of the area so as to formulate science-based policies and decisions. In biodiversity studies, looking into the composition of plant communities should not be limited to mere species listing, but should be focused on expounding species niches and the ecological health of the area so that people would know how and where they would approach environment-linked problems. With biodiversity as a perspective, people would have a more complete view where conservation, rehabilitation and proper land utilization can take off.

In view of the above premise, this study attempts to shed light on the ecology and diversity of Palali's flora. This study could serve as basis for sound management practices in the future.

Objectives

In this paper, the researchers intended to describe the floral diversity of Mt. Palali in relation with elevation, and associations of plants with one another. To carry out such objective, the researchers performed the following:

1. Sampling and identification of plant species
2. Biodiversity analyses (richness, dominance, evenness)
3. Vegetation typing
4. Basic elevation-based ecological ordination

MATERIALS AND METHODS

Sampling

To observe extent of distribution or home range of species in the area, the researchers carried out sampling of the plants using trail method. Apart from safety and efficiency reasons, the trail was considered

ideal baseline for species observation because it approximates the vegetation profile (foot-summit) of the mountain. A sampling station was established each time the researchers noted distinct change in vegetation. For this, GPS was used to record coordinates as well as elevation of the observation point. This data is needed to describe extent of the home range of a species, and which species co-habit in a particular level, and which species make up the core of a particular community. Coordinates of sampling stations were superimposed onto satellite imagery provided by Google Earth so as to provide remote observation of the area which may be available to other Google Earth users. It must be understood that elevation does not give defined boundaries of plant habitat, but rather an idea of range wherein a species can thrive and where communities might develop an ecotone along the gradient. Thirty-seven (37) stations were established along the 8-km trail.

All identifiable species (trees, shrubs, ferns and other plants of interest) within the close vicinity of the station were recorded. Notable species along the trail were noted as well but not included in the tabulation. The data generated was encounter or incidence data. As such, this study assumes that some species would be present to some extent only, dictated primarily by elevation. Said data also was used to reveal co-incidences, thereby describing species associations. Presence-absence data is also equated to standardized data to eliminate biases by the frequency of rare and dominant species. In some measurements, further standardization of data was done.

Data Analysis

Analysis of data involved the measures listed in Table 1.

To describe the phytodiversity of the study site, researchers used alpha diversity measures for species and multivariate analysis (clustering/ordination) for community diversity. Aided by MS Excel, the researchers used BioDiversityProfessional software (McAleece, *et al.*, 1997) to process the data.

Vegetation typing (Stoddart, *et al.*, 1975) was also conducted in liberal terms, to serve as basis on how plant community changes with elevation. Literatures were then consulted to verify the types enumerated during the sampling activity.

RESULTS AND DISCUSSION

Species Diversity

The researchers identified 97 species in 208 total encounters (Table 2). The most frequently observed were *Shorea polysperma* (14 observation points) *Lithocarpus lanosii* (12),

Table 1: Various analysis tools used in this study

Measure / Index		Data used	Information generated
Alpha Diversity	1. Shannon (H') 2. Simpson (D, 1-D, 1/D) 3. Evenness (J)	Occurrences per species divided by total occurrences of all species	1. General diversity 2. Community Dominance 3. Proportion of a species, occurrence to that of all species
Multivariate	Cluster Analysis	Occurrence data per observation point	Which observation plots are similar; Which species are associated with one another

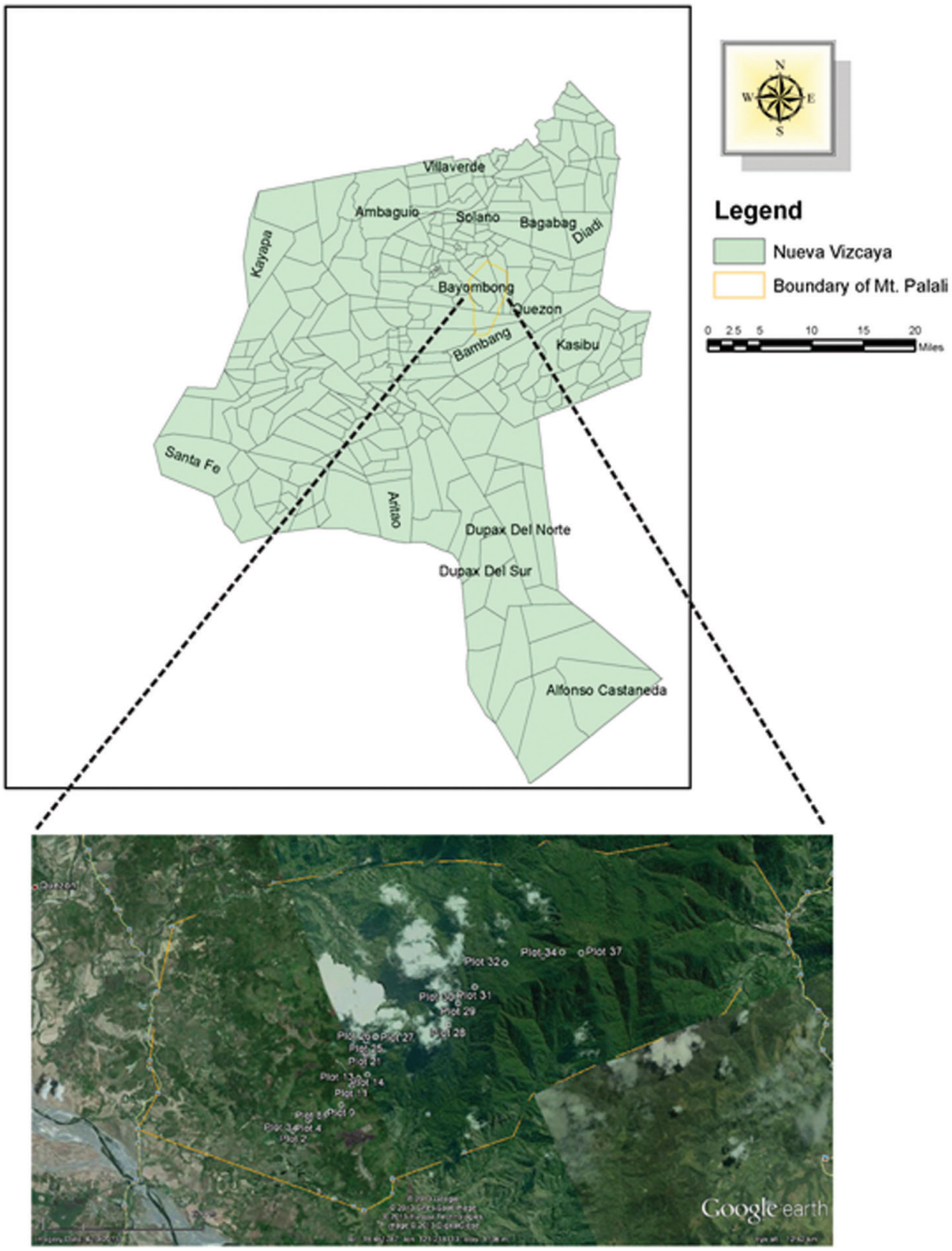

Figure 1: location of study area showing the observation points. Imagery by RL Pascua

Table 2: Alpha (Community) Diversity Metrics and Measurements

No. of observation Points	No of Species	Morphotypes	Shannon (H')	Simpson's			Pielou's Evenness (J')
				D	1-D	1/D	
37	97	9	4.229	0.016	0.984	63.400	0.924

Shorea contorta (11) *Sauraria latibractea* (10) *Sarcandra glabra* (9) and *Carallia brachniata*, *Cinnamomum mercadoi*, (8), *Pityrogramma calomelanos*, *Shorea palosapis*, *Tristaniopsis decorticata*, all with 8 encounters. There were 9 morphotypes, *i. e.*, species distinguished and identified to its genus/family). Four (4) of these belong to family Arecaceae (2 rattans, 1 *Dypsis* species and another palm) others were *Eugenia* species, *Lithocarpus* sp., *Rhododendron* sp., and *Vaccinium* sp.

The tallest species in the trail are dipterocarps and few gum species (Myrtaceae), especially in higher elevations (greater than 1400 masl). Other plants like *Cyathea elegans*, *Pandanus exaltatus*, *Garcinia* and *Nepenthes* (Pitcher plant) are scattered in the vegetation. The researchers also encountered few but large *Dacrycarpus cumingii* somewhere at ~1500 masl. For shrubs, the most frequent is *Sarcanda glabra*, known to locales as a tea plant. Edible ferns are frequent as well.

Species diversity is very high (H'=4.229). Magurran (1988) iterates that Shannon values rarely surpass 4.5, and normal values fall within 1.50 – 3.50. Considering that the researchers surveyed a vast area but still a "sample" of whole Palali is undiscovered, the computed H' here may be considered a conservative estimate of diversity. Variety of dominant species (1-D = 63.400) is high and distribution (J' = 0.924) is highly even, and rare species are infrequent. By "rare" in this study means species that were encountered in only few observation points. There were six (6) observation points without forest trees, which were either converted farmlots or open areas dominated by grasses.

Community Structure and Similarity

By visual observation, plant communities of Palali's lower elevations (~300-500 masl) are influenced by farming and timber harvesting. Periphery of the trail is converted into ricefield patches. A considerable portion of the land is open and occupied by Napier, Elephant Grass, Runo and *Themeda triandra*. Numerous *Gmelina arborea* stands and individuals are scattered within this elevation range. From the composition of abundant and dominant species, the researchers initially determined that there are 2-3 types of natural forest formations observable above ~650 masl: tropical lower montane rainforest (Fernando, et.al, 2004) and mossy forest (Whitford, 1911; Fernando, *et al.*, 2004). Tropical lower montane rainforest, earlier described as mid-montane forest (Brown, 1919) is identified because of the presence of Lithocarpus (*L. sulitii, L. llanosii*) and Shorea (*S. polysperma, S. contorta*). This community is found between 700 to 1200 masl and there a considerable population of oak-laurel-tanguile species are found, closely corresponding to description of Fernando, et.al (2004).

Meanwhile, the old "mossy forest" classification by Whitford (1911) is also seen in Palali, gradually becoming visible starting from the "Haring Bato" point of the trail to the summit (~1350 to ~1,717 masl). However, in the recent literature by Fernando, *et al*., this forest type is subdivided into two formations – upper montane and sub-alpine. These two also equate to "cloud forests" of Palali as dense water vapor can be observed suspended on the canopy of trees.

After the Haring Bato, the trees were

noticeably more clumped and stunted than members of vegetation in lower slopes. Moss cover most surfaces of trees and rocks starting ~1,550 masl. Moisture and temperature were obviously different from lower slopes. The researchers also noticed a small headwater stream supplied with water by numerous natural gullies and channels. This part of the trail leading to the summit is dominated by *Vaccinium*, *Rhododendron*, *Symplocos* (albeit encountered outside observation points) and *Homolanthus*. At ~1450 masl, Astronia, Melastoma, Nephenthes, Dacrycarpus become more visibly abundant. Numerous rattan species are found as well. From the inaccessible parts of the mountain's higher slopes, researchers suspect that there may be other species of *Taxus*, *Syzygium*, *Ardisia* and *Medenillia*. As of writing of this paper, the researchers are in the process of gathering and analyzing data of higher slopes (1,600-1,700) of the mountain so as to explain more of the community structure thereat.

Similarity of communities (observation points) was measured and illustrated here using Bray-Curtis method of cluster analysis (group average link; see Fig.2). From the resulting similarity analysis, there are three (3) contiguous community formations and 1 community dispersed along the trail. Note that the clustering is based on the frequent species, and certain dominant members of a community may be found in other communities.

Community 1 has the most contiguous span, ranging from 655 to 857 masl. This elevation range is dominated by *Shorea Palosapis*, *Shorea Polysperma*, *Lithocarpus lanosii* and *Sarcandra glabra*. *Cinnamomum mercadoi* are numerous. Estimated crown cover is 60%-80% along the trail allowing smaller plants to receive sunlight without much interference and attenuation. Community 2 forms the lower elevations of Palali (360 to 567 masl). This area is more often, as described earlier in this paper. Ficus species are to be found scattered and where shade is present, ferns like Kilob (*Dicranopteris linearis*) and *Pneumatopteris sp* can be found. Community

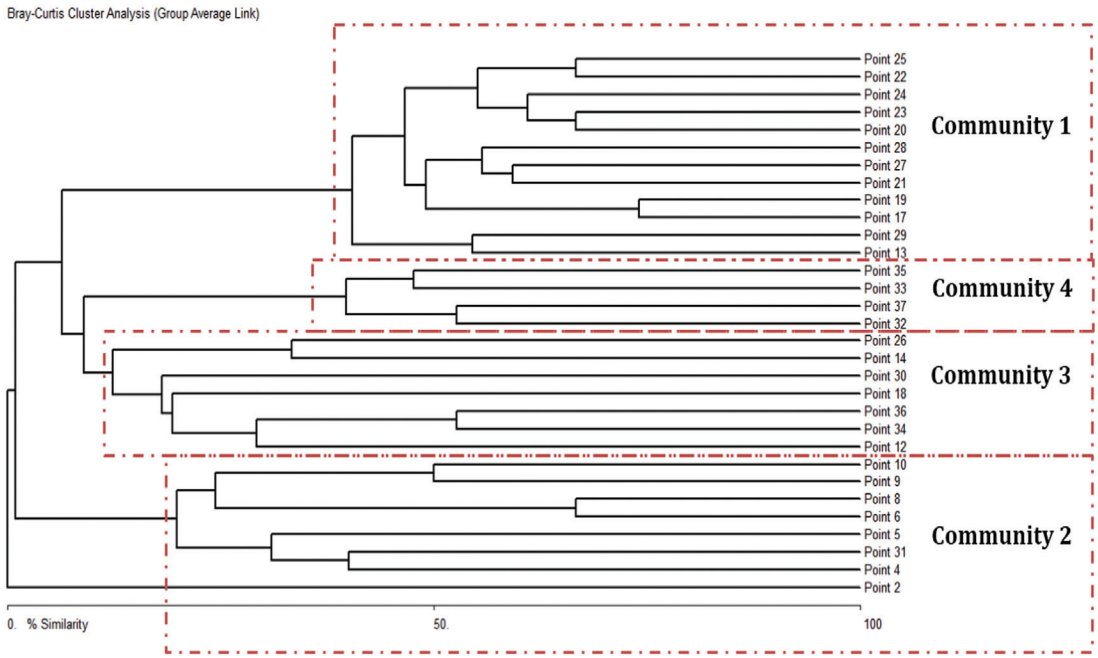

Figure 2: Cluster analysis of observation points to show community similarity

3 are scattered between 644 to 1,601 masl. The composition is mixed, but visibly abundant are rattans (in close resemblance to *Calamus*), *Syzygium*, Astronia and *Sauraria latibractea*. Lastly, Community 4 is subalpine from 1519 to the summit where the vegetation and structure is very different from the rest as it is dominated by *Vaccinium*, *Rhododendron*, *Melastoma*, *Leptospermum* (encountered outside the points) and numerous mosses. The canopy is dense; about 90 percent of area is covered with vegetation which may contribute to the cold and moist microclimate, hence the proliferation of bryophytes and moisture-loving organisms.

CONCLUSION

Mt. Palali is found to be very diverse not only in terms of species, but also in the variety of ecosystems/plant communities. It is commonly known that different vegetation support different fauna, and so the researchers posit that faunal diversity is great as well. In the perspective of both man and science, Palali has the capacity to provide many ecological functions and services that can be enjoyed by all. From the initial assessment of plants thereat, Palali can be considered as a very important and a delicate natural sanctuary. The plant community near the summit, for example, is very critical of elevation and microclimate and so migration and dispersion of populations may not succeed in lower slopes. And with anthropogenic pressures like land clearing, farming and timber harvesting, the risk of losing such wild populations may be more imminent than expected. In turn, ecosystem benefits like rainfall "security" may fail, leading to problems in the human realm.

This study is only a precursor to more in-depth studies of ecosystem functions and dynamics at Mt. Palali. Nonetheless, the researchers believe that the plant diversity glimpsed thereat is already a strong indication that the area is ought to be protected and conserved. As there may be other areas similar to Palali, the same appreciation and similar studies may be conducted.

LITERATURE CITED

FERNANDO, E. S., M. H. SUH, J. LEE, and D. K. LEE. 2008.Forest Formations of the Philippines.ASEAN-Korea Environmental Cooperation Unit (AKECOP). Seoul, Korea.

FERNANDO, E. S., B. Y. SUN, M. H. SUN, H. Y. KONG, and K. S. KOH. 2004.Flowering Plants and Ferns of Mt. Makiling. ASEAN-Korea Environmental Cooperation Unit (AKECOP), Seoul National University, South Korea

FERNANDO, E. S. 2012.Biodiversity Assessment of Conservation Planning and Protected Area Management. Training-Workshop on Biodiversity Resource Assessment and Management Protocols. PCAARRD, Los Baños, Laguna. 25-28 September 2012.

STODDART, L. A., A. D. SMITH and THADIS W. BOX.1974.Range Management. McGraw-Hill, Inc. 178 pp.

MAGURRAN, A. E. 1988. Ecological Diversity and its Measurement.Princeton University Press.New Jersey. 34 pp

MCALEECE, N., J. D. G. GAGE, P. J. D. LAMBSHEAD, G. L. J. PATERSON.1997. BioDiversity Professional statistics analysis software.

WHITFORD, H.N. 1911. The Forests of the Philippines. Part I, Forest Types and Products. Philippine Bureau of Forestry Bulletin No. 10. Manila. Bureau of Printing.