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Richness, endemism and conservation status of woody plants in the lowland forest over limestone of Northern Sierra Madre Natural Park, Northeast Luzon, Philippines

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Key words: NSMNP, Limestone forest, Species richness, Philippine endemics, Threathened species.

Abstract

The study was carried out to assess the woody species of the lowland forest over limestone in the Northern Sierra Madre Natural Park (NSMNP) in Palanan, Isabela, Northeast Luzon, Philippines in order to provide information of its floral diversity, endemism and conservation status. An updated species list was provided based on the recent field survey and analysis of herbarium records. A total of 138 woody species in 92 genera and 42 families were recorded consisting of three lianas, 34 shrubs and 101 small to large trees. The ten most speciose families were Meliaceae (13 spp.) Rubiaceae (8 spp.), Annonaceae (7 spp.), Ebenaceae (7 spp.), Fabaceae (7 spp.), Dipterocarpaceae (7 spp.), Myrtaceae (6 spp.), Primulaceae (5 spp.), Rutaceae (5 spp.), and Vitaceae (5 spp.). Genus *Diospyros* of the family Ebenaceae had the highest number of species (7) followed by genera *Ficus* (6), *Shorea* (5), *Syzygium* (5), and *Leea* (5). The most important species was *Diospyros pyrrhocarpa* Miq. Species endemism is very high, 41% (56) of the total number of species, nine (9) of which are single-island endemics known only to Luzon Island. Twenty-two (22) were threatened species, one being critically endangered, two are endangered, 15 are vulnerable and four are near threatened. The information provided is crucial in the management of the natural park, which requires serious monitoring and protection.

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Introduction

The Northern Sierra Madre Natural Park (NSMNP) is considered as the largest protected area in the Philippines and one of the least biologically explored areas in the country with an approximate area of 359,486 hectares. Reference to various vegetation maps indicates that these forests probably form the largest remaining tract of tropical rainforest in the Philippines. The NSMNP is a composite of all major habitat types found in the country, from the marine and wetland habitat to the lowland dipterocarp forests and upper montane forests. Being exposed to the Pacific Ocean and subjected to the direct and adverse impacts of frequent tropical storms, the vegetation has distinct character and structure that makes it a home to a number of endemic and rare plants. Unfortunately, its rich biodiversity is under severe threat from extreme poverty of the local population which is directly influencing its degradation. At the present rate of exploitation of the commercial forest areas the virgin forest will be logged-over within several years. Botanically, this basically means these forested areas will be destroyed before any inventory has been made of its biodiversity. Floristic assessment of the woody species of the NSMNP is extremely useful to strengthen biodiversity conservation and sustainable use of biological resources in the area. Moreover it provides a basis for the present botanical knowledge which underpins further studies of the ecology and botany of the region.

The study was conducted to assess the woody plants of NSMNP in Isabela Province as basis for its conservation. Specifically it aims to: a) describe the plant community composition of the lowland forest over limestone; b) determine the plant richness of taxa by family, genera and species; c) determine plant endemism; and d) assess the conservation status of the species.

Materials and methods

Study Area

The study is located within the Northern Sierra Madre Natural Park in Isabela Province, Luzon, Philippines (17°07' N and 122°32"E) near Palanan Point (Fig. 1). The terrain is relatively rolling to hilly. Rainfall is more or less evenly distributed throughout the year with mean annual rainfall of 3,218mm and annual totals ranging from 1,347 to 6,841mm and all months exceeding 100mm of rain. Seasonality is defined by the northeast monsoonal winds from November to June and the southeast monsoon from June to November. Typhoons frequently come from the northeast border with wind gusts up to 200kph. which have significant effects on the Palanan forest through direct crown damage.

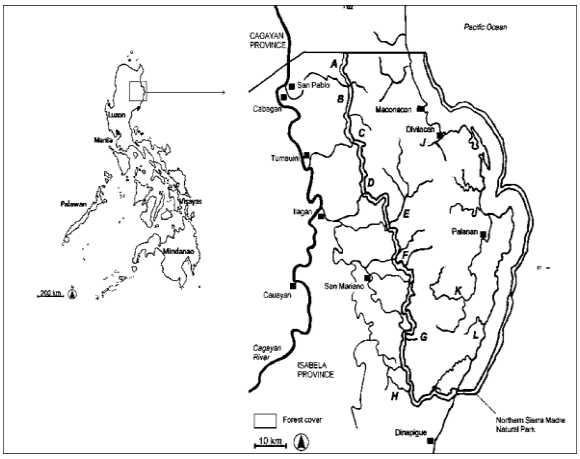

Fig. 1. Location map of the study area in NSMNP, Palanan, Isabela.

The lowland forest over limestone commonly known as *Molave Forest* occupies low limestone hills, either coastal or bordering large uplifted river valleys which are mainly composed of crystalline limestone covered by a shallow or very thin soil. This formation is generally open, characterized by few scattered large trees often short-boled, irregular in form and with wide-spreading crowns (Fernando, 1998). The intervening spaces are often filled with small trees and small erect bamboos. It occurs in regions where the dry season is very pronounced. The forest has deciduous foliage especially on rough topography.

The most extensive karst formation is found in the vicinity on the Three-Knobs-Kanaipang Area. To the north of this formation are minor patches that interdigitate with the ultrabasic south of Palanan Point. West of the Sierra Madre along the Disabungan River in San Mariano is another extensive limestone formation but with largely degraded forest cover (Co *et al.*, 2006).

Plant composition is mixed with species of *Diospyros*, *Shorea*, *Terminalia*, *Celtis*, *Syzygium*, *Mangifera*, *Ficus* and a large number of herbaceous plants.

Floristic Inventory

Floristic inventory was conducted by repeated transect walks in Palanan, Isabela near Palanan Point. Ten transect plots of 10 x 100m equivalent to 0.1ha per plot were established. All plots were surveyed giving a total sample area of one ha. All the woody plants (lianas, trees and shrubs) with girth at breast height (GBH) above 2.5cm for trees and over one cm GBH for lianas within the plots were counted, numbered, pre-identified and taken for sample. Voucher specimens were deposited at the Isabela State University Herbarium (ISUH) and duplicates were sent to the Philippine National Herbarium (PNH) and Naturalis Biodiversity Center (NBC) in the Nethrlands.

Qualitative floristic measures of data were used to determine the species composition and level of plant richness at species, genera and family levels. Importance value index for each species was calculated by determining the relative frequency, relative density and relative basal area of the species.

Collection, Processing and Identification of Specimens

Ten fertile samples and a minimum of three sterile samples per species were collected and processed using the wet method. Plants were dried at the College of Forestry and Environmental Management. Herbarium specimens were deposited at the ISUH with duplicates at the PNH.

All species were identified and verified using various floral keys. Identification of specimens was confirmed by taxonomists at the Naturalis Biodiversity Center in the Netherlands. Digitized voucher specimens are available in Global Plants on JSTOR.

Conservation status

Four categories (critically endangered, endangered, vulnerable, near threatened) were used to assess the global conservation status of the species based largely on the available data from the IUCN Red List of Threatened Species (2017). Locally threatened species were based from the National List of Threatened Philippine Plants issued by the Department of Environment and Natural Resources (DENR-DAO 2017-11).

Results and discussion

Floristic Composition and Richness

A total of 138 woody species in 92 genera and 42 families were recorded in the NSMNP's lowland forest over limestone, consisting of three (3) lianas, 34 shrubs and 101 small to large trees (Table 1). Likewise, the ground is rich with herbaceous flora suggesting that the area is rich in plant species considering the very thin soil and crystalline limestone that holds the vegetation. Studies by Co *et al.* (2006) on other limestone forest in different sites of the same area, revealed almost the same number of genera and families (95 and 41, respectively) However, it is relatively lower in terms of number of species. The location of the study site which is exposed to the direct hit of destructive typhoons may account for the lower plant diversity when compared to other forest types in the same area such as in mixed dipterocarp forest and the ultrabasic forest.

Table 1. Species composition in the lowland forest over limestone of the Northern Sierra Madre Natural Park. Legend: t=tree, st=small tree, lt=large tree, s=shrub, l=liana).

Name of Species	Family Name	Common Name
1. *Aglaia argentea* Blume	Meliaceae	Ilo-ilo (t)
2. *Aglaia cumingiana* Turcz.	Meliaceae	Alauihau (t)
3. *Aglaia edulis* (Roxb.) Wall.	Meliaceae	Malasaging (t)
4. *Aglaia tomentosa* Teijsm. & Binn.	Meliaceae	Karamiras (t)
5. *Alangium villosum* subsp. *pilosum* (Merr.) Bloemb.	Cornaceae	Malabulau (t)
6. *Albizia butarek* sp. nov. nom.	Fabaceae	Butarek (t)
7. *Allophylus cobbe* (L.) Raeusch.	Sapindaceae	Mala-lagundi (t)
8. *Antidesma ghaesembilla* Gaernt.	Phyllanthaceae	Binayuyo (t)
9. *Antidesma tomentosum* var. *tomentosum* Blume	Phyllanthaceae	Bignai-kalaw (t)
10. *Archidendron scutiferum* (Blanco) I.C.Nielsen	Fabaceae	Anagap (t)
11. *Ardisia darlingii* Merr.	Primulaceae	Barasingag (s)
12. *Ardisia elliptica* Thunb.	Primulaceae	Tagpo (s)
13. *Ardisia polysticta* Miq.	Primulaceae	Ramos tagpo (s)
14. *Astronia lagunensis* Merr.	Melastomataceae	Dungau-bundok (t)
15. *Astronia viridifolia* Elmer	Melastomataceae	Dalipos (s)
16. *Atalantia racemosa* Wight ex Hook.	Rutaceae	Malarayap (t)
17. *Bridelia stipularis* (L.) Blume	Phyllanthaceae	Lubalob (s)
18. *Buxus rolfei* S.Vidal	Buxaceae	Malagaapi (s)
19. *Calophyllum blancoi* Planch. & Triana	Calophyllaceae	Bitanghol (t)
20. *Calophyllum whitfordii* Merr.	Calophyllaceae	Pamitaogen (t)

Name of Species	Family Name	Common Name
21. *Camellia lanceolata* (Blume) Seem.	Theaceae	Haikan (s)
22. *Canarium asperum* Benth.	Burseraceae	Pagsahingin (t)
23. *Canarium gracile* Engl.	Burseraceae	Pagsahingin-langgam (t)
24. *Canarium hirsutum* Willd.	Burseraceae	Milipili (t)
25. *Capparis micracantha* DC.	Capparaceae	Salimbagat (s)
26. *Casearia grewiifolia* Vent.	Salicaceae	Kaluag (t)
27. *Casearia trivalvis* (Blanco) Merr.	Salicaceae	Boog-boog (t)
28. *Celtis luzonica* Warb.	Cannabaceae	Magabuyo (t)
29. *Champereia manillana* (Blume) Merr.	Opiliaceae	Malalukban (t)
30. *Chisocheton cumingianus* (C.DC.) Harms	Meliaceae	Balukanag (t)
31. *Chisocheton patens* Blume	Meliaceae	Agogoy (t)
32. *Chisocheton pentandrus* (Blanco) Merr.	Meliaceae	Katong-matsing (t)
33. *Cinnamomum mercadoi* S.Vidal	Lauraceae	Kalingag (t)
34. *Citrus hystrix* DC.	Rutaceae	Kabuyau-kitid (s)
35. *Cleistanthus pedicellatus* Hook.f.	Phyllanthaceae	Anupag (s)
36. *Croton luzoniensis* Müll.Arg.	Euphorbiaceae	Pagaibayong (s)
37. *Cryptocarya euphlebia* Merr.	Lauraceae	Impaparen (t)
38. *Cynometra malaccensis* Meeuwen	Fabaceae	Dila-dila (t)
39. *Cyrtandra disparifolia* Quisumb.	Gesneriaceae	Cyrtandra (s)
40. *Cyrtandra oblongata* Merr.	Gesneriaceae	Cyrtandra (s)
41. *Decaspermum fruticosum* J.R.Forst. & G.Forst.	Myrtaceae	Patalsik (s)
42. *Dehaasia cairocan* (S.Vidal) C.K.Allen	Lauraceae	Malakadios (t)
43. *Dimocarpus longan* subsp. *malesianus* Leenh.	Sapindaceae	Alupag (t)
44. *Dimorphocalyx ixoroides* (C.B.Rob.) Airy Shaw	Euphorbiaceae	Agindulong (s)
45. *Diospyros buxifolia* (Blume) Hiern	Ebenaceae	Gumunan (t)
46. *Diospyros cauliflora* Blume	Ebenaceae	Tamil (t)
47. *Diospyros discolor* Willd.	Ebenaceae	Kamagong (t)
48. *Diospyros hebecarpa* A.Cunn. ex Benth.	Ebenaceae	Lagikdi (t)
49. *Diospyros pilosanthera* Blanco	Ebenaceae	Bolong-eta (t)
50. *Diospyros pyrrhocarpa* Miq.	Ebenaceae	Anang (t)
51. *Diospyros racemosa* Buch.-Ham	Ebenaceae	Bulatlat (t)
52. *Diplodiscus paniculatus* Turcz.	Malvaceae	Balobo (t)
53. *Diplospora fasciculiflora* (Elmer) Elmer	Rubiaceae	Kaping-bundok (s)
54. *Diplycosia luzonica* (A.Gray) Merr.	Ericaceae	Atepen/Ginula (s)
55. *Discocalyx cybianthoides* (A.DC.) Mez	Primulaceae	Paginga (t)
56. *Discocalyx insignis* Merr.	Primulaceae	Sitaas (s)
57. *Dracontomelon dao* (Blanco) Merr. & Rolfe	Anacardiaceae	Dao (t)
58. *Drypetes grandifolia* (C.B.Rob.) Pax & K.Hoffm.	Putranjivaceae	Banaui (t)
59. *Drypetes littoralis* (C.B.Rob.) Merr.	Putranjivaceae	Bato-bato (t)
60. *Drypetes microphylla* (Merr.) Pax & K.Hoffm.	Putranjivaceae	Butong-manok (t)
61. *Dysoxylum acutangulum* Miq.	Meliaceae	Milau-tilos (t)
62. *Dysoxylum arborescens* (Blume) Miq.	Meliaceae	Kalimutain (t)
63. *Dysoxylum cyrtobotryum* Miq.	Meliaceae	Katong-lakihan (t)
64. *Dysoxylum excelsum* Blume	Meliceae	Kulig-baboi (t)
65. *Endiandra coriacea* Merr.	Lauraceae	Magarilau (t)
66. *Endospermum peltatum* Merr.	Euphorbiaceae	Gubas (t)
67. *Enicosanthum grandifolium* (Elmer) Airy Shaw	Annonaceae	Lanutan-laparan (t)
68. *Erythropalum scandens* Blume	Olacaceae	Bokai (l)
69. *Ficus ampelas* Burm.f.	Moraceae	Upling-gubat (t)
70. *Ficus elmeri* Merr.	Moraceae	Dugnai (t)
71. *Ficus nervosa* subsp. *pubinervis* (Blume) C.C.Berg	Moraceae	Dungo (t)
72. *Ficus pseudopalma* Blanco	Moraceae	Niog-niogan (t)
73. *Ficus rivularis* Merr.	Moraceae	Baleteng-bato (t)
74. *Ficus variegata* Blume	Moraceae	Tangisang-bayawak (t)
75. *Fissistigma latifolium* (Dunal) Merr.	Annonaceae	Alakai (t)
76. *Flacourtia indica* (Burm.f.) Merr.	Salicaceae	Bitongol (t)
77. *Garcinia oligophlebia* Merr.	Clusiaceae	Dilis (s)
78. *Glycosmis parviflora* (Sims) Little	Rutaceae	Patulan (s)
79. *Gomphandra luzoniensis* (Merr.) Merr.	Stemonuraceae	Mabunot (t)
80. *Gymnacranthera farquhariana* var. *paniculata* (A.DC.) R.T.A.Schouten	Myristicaceae	Anuping (t)
81. *Hopea malibato* Foxw.	Dipterocarpaceae	Yakal-kaliot (t)
82. *Ixora macrophylla* Bartl. ex DC.	Rubiaceae	Asas/Aboong (s)
83. *Knema glomerata* Merr.	Myristicaceae	Tambalau (t)
84. *Lasianthus clementis* Merr.	Rubiaceae	Bukit-liit (s)
85. *Leea congesta* Elmer	Vitaceae	Kahig-inulo (s)
86. *Leea guineensis* G.Don	Vitaceae	Mali-mali (s)
87. *Leea indica* (Burm.f.) Merr.	Vitaceae	Nutub (s)
88. *Leea magnifolia* Merr.	Vitaceae	Kahig (s)
89. *Leea philippinensis* Merr.	Vitaceae	Kaliantan (s)
90. *Leptonychia banahaensis* Merr.	Malvaceae	Musar (s)
91. *Lithocarpus robinsonii* Rehder	Fagaceae	Babaisakan (t)
92. *Lunasia amara* Blanco	Rutaceae	Lunas (s)
93. *Mallotus cumingii* Müll.Arg.	Euphorbiaceae	Apanang (t)
94. *Mangifera altissima* Blanco	Anacardiaceae	Pahutan (t)
95. *Memecylon ramosii* Merr.	Melastomataceae	Ramos agam (s)
96. *Mesua philippinensis* (Planch.) Kosterm.	Clusiaceae	Bitanghol (t)
97. *Micromelum compressum* (Blanco) Merr.	Rutaceae	Tulibas-tilos (t)
98. *Mucuna samarensis* Merr.	Fabaceae	Mala-nipai (l)
99. *Mussaenda magallanensis* Elmer	Rubiaceae	Agboy (t)
100. *Neonauclea calycina* (Bartl. Ex DC.) Merr.	Rubiaceae	Kalamansanai (t)
101. *Neo-uvaria acuminatissima* (Miq.) Airy Shaw	Annonaceae	Batag-ukai (t)
102. *Nephelium ramboutan-ake* (Labill.) Leenh.	Sapindaceae	Rambutan (t)
103. *Orophea cumingiana* S.Vidal	Annonaceae	Amunat (t)
104. *Papualthia reticulata* (Elmer) Merr.	Annonaceae	Bogsog (t)
105. *Polyalthia flava* Merr.	Annonaceae	Lanutan-dilau (t)
106. *Polyalthia lanceolata* S.Vidal	Annonaceae	Anolang (t)
107. *Psychotria banahaensis* Elmer	Rubiaceae	Katagpong-banahaw (s)
108. *Psychotria membranifolia* Bartl. ex DC.	Rubiaceae	Kadpayaan (t)
109. *Pterocarpus indicus* Willd.	Fabaceae	Narra (t)
110. *Pterocymbium tinctorium* (Blanco) Merr.	Malvaceae	Taluto (t)
111. *Pygeum ramiflorum* Merr.	Rosaceae	Papain (t)
112. *Rinorea bengalensis* (Wall.) Gagnep.	Violaceae	Tuak (t)
113. *Semecarpus cuneiformis* Blanco	Anacardiaceae	Kamiring (t)
114. *Shorea assamica* Dyer	Dipterocarpaceae	Manggasinoro (t)
115. *Shorea contorta* S.Vidal	Dipterocarpaceae	White lauan (t)
116. *Shorea falciferoides* Foxw.	Dipterocarpaceae	Yakal-yamban (t)
117. *Shorea guiso* (Blanco) Blume	Dipterocarpaceae	Guijo (t)
118. *Shorea palosapis* (Blanco) Merr.	Dipterocarpaceae	Mayapis (t)
119. *Sterculia rubiginosa* Vent.	Malvaceae	Sinaligan (t)
120. *Strongylodon macrobotrys* A.Gray	Fabaceae	Bayou (l)

Name of Species	Family Name	Common Name
121. *Sympetalandra unijuga* (Airy Shaw) Steenis	Fabaceae	Malakamatog (t)
122. *Syzygium bordenii* (Merr.) Merr.	Myrtaceae	Malaruhat-puti (t)
123. *Syzygium crassipes* (C.B.Rob.) Merr.	Myrtaceae	Barukbak (t)
124. *Syzygium lineatum* (DC.) Merr. & L.M.Perry	Myrtaceae	Lubeg (t)
125. *Syzygium phanerophlebium* (C.B.Rob.) Merr.	Myrtaceae	Malayambu (t)
126. *Syzygium xanthophyllum* (C.B.Rob.) Merr.	Myrtaceae	Malatampui-haba (t)
127. *Tabernaemontana pandacaqui* Lam.	Apocynaceae	Pandakaki (s)
128. *Trigonostemon longipes* (Merr.) Merr.	Euphorbiaceae	Katap/kamaus a (t)
129. *Vatica mangachapoi* Blanco	Dipterocarpaceae	Narig (t)
130. *Vavaea amicorum* Benth.	Meliaceae	Nangka-nangka(t)
131. *Villaria glomerata* (Bartl. ex DC.) Mulyan. & Ridsdale	Rubiaceae	Karagli (t)
132. *Vitex parviflora* Juss.	Lamiaceae	Molave (t)
133. *Voacanga foetida* (Blume) Rolfe	Apocynaceae	Bayag-kambing (t)
134. *Voacanga globosa* (Blanco) Merr.	Apocynaceae	Bayag-usa (t)
135. *Walsura pinnata* Hassk.	Meliaceae	Bayit (t)
136. *Wikstroemia indica* (L.) C.A.Mey.	Thymelaeaceae	Salagong-liitan (s)
137. *Xanthophyllum bracteatum* Chodat	Polygalaceae	Durog (s)
138. *Ziziphus angustifolius* (Miq.) Hatus. & Steen	Rhamnaceae	Ligaa (t)

Families Rubiaceae and Fabaceae were the most abundant in terms of genus richness with seven (7) genera each. Among the families with the most number of genera were families Annonaceae (6 genera) and Euphorbiaceae, Rutaceae and Meliaceae with five (5) genera each. Twenty-three (23) or 54 percent of the plant families were represented by a single genus.

The ten most speciose families were Meliaceae (13 spp.) Rubiaceae (8 spp.), Annonaceae (7spp.), Ebenaceae (7 spp.), Fabaceae (7 spp.), Dipterocarpaeae (7 spp.), Myrtaceae (6 spp.), Primulaceae (5 spp.), Rutaceae (5 spp.), and Vitaceae (5 spp.). Genus *Diospyros* of the family Ebenaceae had the highest number of species (7) followed by genera *Ficus* (6), *Shorea* (5), *Syzygium* (5), and *Leea* (5).

This finding is similar to the floristic study conducted by Gillespie *et al.* (2011) in tropical dry forests in the Pacific where the most speciose families were Rubiaceae, Euphorbiaceae, Fabaceae, Sapindaceae and Myrtaceae. Also Genry (1995) previously conducted the largest analysis of tropical dry forest sites in the world and concluded that Fabaceae was consistently the dominant family of trees in neotropical sites while Bignoniaceae was the dominant family of lianas in dry forest. Myrtaceae, Rubiaceae, Sapindaceae, Euphorbiaceae, and Flacourtiaceae were the other most speciose woody families in the neotropical dry forests. Similar studies were conducted in other tropical rainforest of China and India with results showing similar species compostion. These indicate that the families with greatest importance value in tropical forests were the same especially Euphorbiaceae.

Zhu *et al.* (2015) undertook a complete floristic and vegetation surveys in a new nature reserve on a tropical mountain in southern Yuman and recorded a total of 1,657 species of seed plants in 758 genera and 146 families, tropical families and genera comprise the majority of the flora. The lower mountain forest was dominated by Fagaceae and Lauraceae at 1100-1500m. The families with highest species richness were Fabaceae, Euphorbiaceae, Rubiaceae, Lauraceae, Orchidaeae, and Lamiaceae. Similar studies were conducted in other tropical rainforest of China with results showing similar species compostion. Lu *et al.* (2010) recorded Euphorbiaceae, Meliaceae, Sapindaceae, Lauraceae and Lecythidaceae as families with greatest importance value. In the tropical forest of India, Combretaceae, Euphorbiaceae and Anacardiaceae showed the greatest importance value among 44 families, Euphorbiaceae having the most number of species (Naidu *et al.*, 2016).

The most common species was Anang (*Diospyros pyrrhocarpa* Miq./Ebenaceae) a Southeast Asian native, with 1021 individuals followed by Amunat (*Orophea cumingiana* S.Vidal/Annonaceae) and Balobo (*Diplodiscus paniculatus* Turcz./Malvaceae) with density of 390 and 352, repectively.

Three genera of dipterocarps were recorded, *Shorea*, *Hopea* and *Vatica*. Genus *Shorea* being the most represented in terms of tree density with a total of 5 species. Their occurrence can be attributed to the relative distance of the lowland dipterocarp forest from the area. *Shorea palosapis* (Blanco) Merr. was the most represented species with 39 individuals and *Shorea assamica* Dyer with 30 individuals.

Plant Endemism and Conservation Assessment

The limestone forest supports many local endemics (Table 2). Fifty-six (56) species or 40.58 percent of its total species compositon are endemic to the Philippines, nine (9) of which are single-island endemics known only to Luzon Island. These include *Croton luzoniensis* Müll. Arg., *Dimorphocalyx ixoroides* (C.B.Rob.) Airy Shaw, *Trigonostemon longipes* (Merr.) Merr., *Ficus rivularis* Merr., *Garcinia oligophlebia* Merr., *Cyrtandra disparifolia* Quisumb., *Cyrtandra oblongata* Merr., *Memecylon ramosii* Merr. and *Pygeum ramiflorum* Merr.

Table 2. Endemic taxa in the lowland forest over limestone of the Northern Sierra Madre Natural Park.

	Species
Luzon Endemics	*Croton luzoniensis* Müll.Arg
	Cyrtandra disparifolia Quisumb.
	Cyrtandra oblongata Merr.
	Dimorphocalyx ixoroides (C.B.Rob.) Airy Shaw
	Ficus rivularis Merr.
	Garcinia oligophlebia Merr.
	Memecylon ramosii Merr.
	Pygeum ramiflorum Merr.
	Trigonostemon longipes (Merr.) Merr.
Other Philippine Endemics	*Alangium villosum* subsp. *pilosum* (Merr.) Bloemb.
	Archidendron scutiferum (Blanco) I.C.Nielsen
	Ardisia darlingii Merr.
	Ardisia polysticta Miq.
	Astronia lagunensis Merr.
	Astronia viridifolia Elmer
	Buxus rolfei S.Vidal
	Calophyllum whitfordii Merr.
	Canarium gracile Engl.
	Casearia trivalvis (Blanco) Merr.
	Cinnamomum mercadoi S.Vidal
	Cryptocarya euphlebia Merr.
	Dehaasia cairocan (S.Vidal) C.K.Allen
	Diplodiscus paniculatus Turcz.
	Diplospora fasciculiflora (Elmer) Elmer
	Diplycosia luzonica (A.Gray) Merr.
	Discocalyx insignis Merr.
	Endiandra coriacea Merr.
	Ficus pseudopalma Blanco
	Fissistigma latifolium (Dunal) Merr.
	Gomphandra luzoniensis (Merr.) Merr.
	Gymnacranthera farquhariana var. *paniculata* (A.DC.) R.T.A.Schouten
	Hopea malibato Foxw.
	Ixora macrophylla Bartl. ex DC.
	Knema glomerata Merr.
	Leea congesta Elmer
	Leea magnifolia Merr.
	Leea philippinensis Merr.
	Leptonychia banahaensis Merr.
	Lithocarpus robinsonii Rehder
	Mucuna samarensis Merr.
	Mussaenda magallanensis Elmer
	Orophea cumingiana S.Vidal
	Papualthia reticulata (Elmer) Merr
	Psychotria banahaensis Elmer
	Psychotria membranifolia Bartl. ex DC.
	Shorea contorta S.Vidal
	Shorea falciferoides Foxw
	Shorea palosapis (Blanco) Merr.
	Strongylodon macrobotrys A.Gray
	Syzygium bordenii (Merr.) Merr.
	Syzygium crassipes (C.B.Rob.) Merr.
	Syzygium phanerophlebium (C.B.Rob.) Merr.
	Syzygium xanthophylum (C.B.Rob.) Merr.
	Villaria glomerata (Bartl. ex DC.) Mulyan. & Ridsdale
	Voacanga globosa (Blanco) Merr.
	Xanthophyllum bracteatum Chodat

Family Rubiaceae had the highest number of endemic species (6), followed by Lauraceae (4), Myrtaceae (4), Dipterocarpaceae (4), Annonaceae (3), Euphorbiaceae (3), Melastomataceae (3), Primulaceae (3), Fabaceae (3) and Vitaceae (3).

Apparently, endemism was principally at the species level. The families and most genera in the study area were all widespread in the Malesian region or broadly found in the tropics. Thus, no family was endemic to the Philippines. The only endemic genus was *Villaria* of the family Rubiaceae.

On the other hand, 22 were threatened species, one being critically endangered (*Hopea malibato* Foxw.) two are endangered (*Strongylodon macrobotrys* A.Gray and *Vitex parviflora* Juss.),15 are vulnerable and four are near threatened (Table 3).

Table 3. Conservation status of woody plants in NSMNP's lowland forest over limestone.

Species	Conservation tatus
Celtis luzonica Warb.	Vulnerable
Cinnamomum mercadoi S.Vidal	Vulnerable
Cynometra malaccensis Meeuwen	Vulnerable
Dimocarpus longan subsp. *malesianus* Leenh.	Near Threathened
Diospyros cauliflora Blume	Vulnerable
Diospyros discolor Willd.	Vulnerable
Diospyros pilosanthera Blanco	Vulnerable
Diospyros pyrrhocarpa Miq.	Vulnerable
Dracontomelon dao (Blanco) Merr. & Rolfe	Vulnerable

Species	Conservation tatus
Hopea malibato Foxw.	Critically Endangered
Mangifera altissima Blanco	Vulnerable
Mussaenda magallanensis Elmer	Vulnerable
Nephelium ramboutan-ake (Labill.) Leenh.	Vulnerable
Psychotria banahaensis Elmer	Near Threathened
Pterocarpus indicus Willd.	Vulnerable
Shorea contorta S.Vidal	Vulnerable
Strongylodon macrobotrys A.Gray	Endangered
Vatica mangachapoi Blanco	Vulnerable
Vitex parviflora Juss.	Endangered

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