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Ferns and Lycophytes as Indicators of Forest Environment of Kampo Uno, Katipunan, Davao-Arakan Valley, North Cotabato

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Abstract

Species richness of terrestrial ferns and lycophytes may indicate forest habitat quality, as analyzed for a tropical lowland of Mig Camp Resort in Katipunan. Terrestrial fern species can serve as indicators of disturbance or forest quality as many species show clear habitat differentiation with regard to light conditions and humidity. This research aims to assess forest habitat quality of Mig Camp Resort terrestrial pteridophyte species by grouping ferns and lycophytes according to their ecological requirements into 'forest species' and 'non-forest species'. Results showed that there are 21 species in this area that are categorized as forest species indicating that this primary forest is not yet totally unconserved. In places where primary forest is still present, priority should be given for the conservation of the remaining primary forest patches.

Keywords:

Biodiversity Conservation,
Systematics,
Ferns,
Lycophytes,
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1. Introduction

Ferns are the one of the oldest land plant groups in our earth's surface. Compared with other groups of plants, ferns are usually neglected by the researchers but they are becoming important for their beauty and economic uses (Bandyopadhyay and Mukherjee2014). Traditionally, pteridophytes include the so-called ferns and fern allies because of their shared life cycle as spore-producing plants. Recently, molecular data show that pteridophytes are paraphyletic. They are now recognized as the lycophytes and ferns, the latter of which includes horsetails, whisk ferns, and all eusporangiate and leptosporangiate ferns (Amoroso et al., 2016). They do not produce seeds but reproduce through spores (Wilson, 2010). They are widely distributed both in the tropic and temperate regions especially at higher elevations (Oloyede and Odu, 2011).

Understanding the effects that environmental conditionson the development of organisms is critical, given the rapid environmental changes currently occurring across the globe (Agnew, 2016). The degree to which plants are able to respond to this change depends on a combination of factors, including their evolutionary history and phenotypic plasticity. Given the trajectory of climate and habitat change, adjusting phenotypically to the new conditions may be the most immediately viable option for many plants. *A specific sub-urban community at Kampo Uno, Katipunan, Davao-Arakan Valley Road, North Cotabato is an ecological community of interesting forest structure and Dynamics as it is* *considered to belong to a sub-urban area. In order to contribute to the materialization of coming up with baseline data, this study aims provide a checklist of ferns and lycophytes together with its categorical assessment as to forest and non-forest species based on the study of Beukemia and* van Noordwijk, 2004, since there is no published checklist of ferns and lycophytes with this categorical assessment in the area.

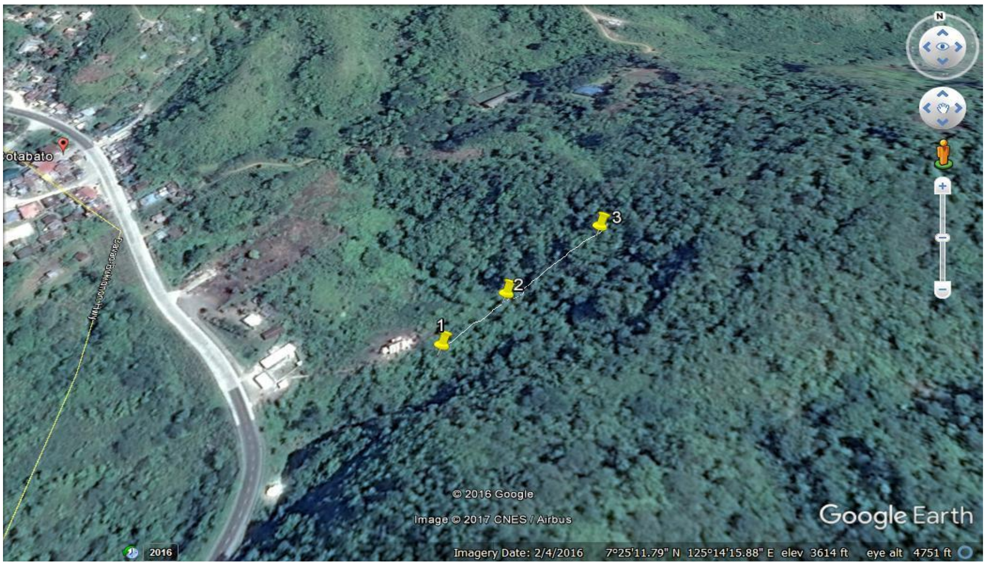

Figure 1. Transect Inventory (yellow line) in Kampo Uno, Katipunan, Arakan Valley, North Cotabato.

Research Method

Species Inventory

An inventory of ferns and lycophytes was conducted through series of transect walks from the entrance of Mig Camp Resort in Katipunan towards the tip of the primary lowland montane forest.

Collection, Processing, and Identification of Specimens

A minimum of three fronds of each species were collected with a shear and trimming cutter. Small ferns were collected by uprooting the whole plant, removing the soil, and pressing the plant intact. All specimens were processed using the wet method (Hodge 1947). Herbarium specimens were deposited at the Central Mindanao University Herbarium (CMUH). Species identifications are based on the specimens deposited at CMUH and were performed by consulting the following monographs, floras, and other publications: Copeland (1958- 1961); Holttum (1959a, b,1978, 1981, and 1991); Kramer (1971); Zamora and Co (1986) and digitized plant specimens available in Global Plants on JSTOR. The classification systems used are those of Smith et al. (2006, 2008) and Rothfels et al. (2012).

Pteridophyte grouping

Pteridophyte species were grouped based on ecological notes in literature on Malaysian species (Alston, 1937; Backer and Posthumus, 1939; Fletcher and Kirkwood, 1979; Holttum, 1932, , 1959a,b, 1963, 1966, 1981, 1991; Holttum and Hennipman, 1978; Kramer, 1971; Pemberton and Ferriter, 1998 and Spicer et al.). From the literature, it became clear that there is enough habitat differentiation among species to make pteridophytes potentially a suitable indicator group for this study. We would have liked to classify our species by their optima for both light and microclimate conditions, but the available species descriptions (mostly from taxonomical literature) included consistent information on light requirements and preferred habitat only.

Nevertheless that information was sufficient to classify the species into ecological groups for the purpose of this study. Based on the literature four levels for light conditions were distinguished: 'open' conditions, 'open/light shade', 'light shade' and 'shade/deep shade'. In combination with data on preferred habitat the species were assigned to one of two groups arbitrarily named 'forest species' and 'non-forest species'. 'Forest species' are all species that require shade or deep shade plus the species that require light shade and grow in forest. 'Non-forest species' are all species of open and open/light shade conditions plus the species that require light shade and prefer habitats other than forest (roadsides, forest edges, plantations, etc.). This grouping does not imply that 'non-forest species' never grow in the forest. Some of them do occur in forest, especially in gaps, but they are more abundant in open conditions. Species are thus grouped by (inferred) ecological optimum rather than by ecological range (Beukema and van Noordwijk, 2004)

Results and Analysis

These results implied that the presence of 21 species under forest category revealed that the primary forest in Mig Camp Resort, which is a newly developed recreational area is still partly conserved. Although other notable forest species are not present like species under family Schizaeaceae, Hymenophyllaceae, Lomariopsidaceae, Lindsaeaceae and Psilotaceae. The absence of these notable forest species can be attributed to the degree of disturbance in forest cover since anthropogenic pressures are rampant. It is also adjacent to the fact that the tropical montane forests suffer from increasing fragmentation and replacement by other types of land-use (Winkler, 2011).

Table 2. Check list of terrestrial pteridophyte species found in Mig Camp Resort in Katipuan for classification criteria and Ecological Status based on Fernando et al. In 2008.

	Spepcies Name	**Group**
Aspleniaceae	*Asplenium apoense* Copel.	Non-forest
	A. baileyanum (Domin.) Watts	Non-forest
	A. longgissimum Blume	Non-forest
	A. nidus Linn.	Non-forest
	A. phyllitidis Don.	Non-forest
	A. tenerum Forster	Non-forest
Cyatheaceae	*Alsophila fuliginosa* Christ lurida (Blume) Hook.	Non-forest
	Sphaeropteris glauca (Blume) R.M.Tryon	Non-forest
	S. lepifera (J.Sm. ex Hook.) R.M.Tryon	Non-forest
	S. polypoda R.M.Tryon	Non-forest
Davalliaceae	*Davallia denticulata* (Burm.) Mettenius	Non-forest
	D. solida (Forst.) Sw	Non-forest
	D. trichomanoides Blume	Non-forest
Dennstaedtiaceae	*Microlepia biformes*	Non-forest
	Microlepia speluncae (Linn.) Moore	Non-forest
Dryopteridaceae	*Arachnoides aristata* Forster	Forest

	Bolbitis heroclita (C.Presl) Ching	Forest
	Bolbitis sp.	Forest
	Dryopteris sparsa (Bon) O. Kuntze	Forest
	Elaphloglossum angulatum (Blume) Moore	Forest
	E. callifolium (Blume) Moore	Forest
	E. petiolatum (Swartz) Urban	Forest
	Pleocnemia irregularis (C.Presl) Holttum	Forest
	P. macrodonta (Fée) Holttum	Forest
Gleicheniaceae	*Dicranopteris linearis (Burm) Underwood*	Non-forest
	Gleichenia laevigata (Wild.) Presl	Non-forest
Lindsaeaceae	*Lindsaea cultrata Willd* (Phylogr.)	Forest
	Tapeinidium luzonicum (Hook.) K.U.Kramer	Forest
Lomariopsidaceae	*Nephrolepis bisserata (Sw.) Schott*	Non-forest
	N. cordifolia (L.) C.Presl	Non-forest
	N. hirsutula	Non-forest
Marattiaceae	*Angiopteris evecta* (G.Forst.) Hoffm.	Non-forest
Polypodiaceae	Cyclosorus ensifer	Non-forest
	Drynaria quercifolia (L.) J.Sm.	Non-forest
	Drynaria sp.	Non-forest
	*Drynariopsis heracleai (Runze)*Ching	Non-forest
	Goniophlebium subauriculatum (Blume) Presl.	Non-forest
	Goniophlebium sp.	Non-forest
	Microsorum alternifolium Wild.	Non-forest
	M. punctatum (L.) Copel.	Non-forest
	M. scoloprendria (Burm. f.) Copel	Non-forest
	Pyrossia adnacens	Non-forest
	P. sphaerosticha (Mett.) Ching	Non-forest
	P. pelosilloides (Linn.) Price	Non-forest
Pteridaceae	*Pteris glaucovirens* Goldman	Non-forest
	P. longipinnula Wallich	Non-forest
	P.oppositpinata	Non-forest
	Taenitis blechnoides (Willd.) Sw	Forest
Selaginellaceae	*Selaginella longipina*	Forest
	S. *usterii*	Forest
	S. engleri Hieron	Forest
	S. cupressina (Willd.) Spring	Forest
Tectariaceae	*Tectaria meyanthidis*	Forest
Thelypteridaceae	*Christella parasitica (Linn.) Lev*	Non-forest
	Phronephrium aspersum Sheiland Tsai	Forest
	Sphaerostephanos unitus	Forest
	Sphaerostephanos sp.	Forest
Vittariaceae	*Vittaria ensiformes* Swartz.	Non-forest
Woodsiaceae	*Diplaziumesculentum* (Retz.) Sw.	Forest
	Diplaziopsis javanica (Blume) Christ.	Forest

The terrestrial environment that provide 98 % of food and accounts up to 95 % of the world's natural resources is affected by human activities including agriculture (Paoletti et al., 1992). The intensity of the disturbance may have a direct effect on specific diversity, because environmental variation in these ecosystems decreases habitat stability. In addition, irradiance patterns caused by vegetation structure and atmospheric conditions are responsible for changes in vegetation dynamics. Ferns and lycophytes are seedless plants, whose reproduction success depends on high humidity levels. Fern richness is influenced by temperature, precipitation and relative humidity, so anthropogenic changes in the physical environment have a negative effect on their diversity**.** Because of this fact, they usually serve as indicators of climate conditions (Lozano et al. 2017).

It should not be forgotten that species richness of terrestrial pteridophytes alone, without knowing the species or their ecological requirements, is not a useful indicator of habitat quality, as it discriminates poorly between the disturbed land use types and primary forest. A prior ecological information on the species involved is needed before terrestrial pteridophyte species can be used to indicate disturbance level or habitat quality of the forest understorey. In addition, we need to know the ecological position including habitat requirements and guilds of the species, as diversity alone does not give enough information for most taxonomic groups. Even so, such data collected within 'homogeneous' land use types cannot directly answer questions about the change in overall biodiversity value that can be expected if some types of land use will decrease while others decrease.

Pteridophytes proved in this study to be a relatively well-described group suitable to indicate local environmental conditions. Because the spores are wind dispersed their occurrence is not limited by presence of other organisms required for most seed dispersal or pollination. However, this characteristic of pteridophytes makes the group less suitable to represent biodiversity of other taxa. Hunting pressure and habitat fragmentation will affect some taxa more than others (Beukema and van Noordwijk, 2004).

Conclusion

There are 21 forest species of ferns and lycophytes indicating that this primary forest is not yet totally unconserved. In places where primary forest is still present, priority should be given for the conservation of the remaining primary forest patches.

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