

Biodiversity Assessment and Conservation Status of Some Pteridophytes in the Northeastern Portion of Quezon Protected Landscape, Philippines

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ABSTRACT:- This research has been conducted to determine the pteridophytic composition of Quezon Protected Landscape (QPL), to assess fern diversity and richness and evaluate the conservation status of ferns. Field survey and species identification resulted in a total of 51 species, belonging to 25 genera, 16 families and 7 orders. The most represented families are Aspleniaceae (11.8%), Pteridaceae (19.6%), Selaginellaceae (9.8%) and Tectariaceae (11.8%). On the other hand, *Asplenium*, *Pteris*, *Selaginella* and *Tectaria* are the most represented genera. Among the eight sites “Pinagbanderahan” has the highest number of fern species while lowest number was observed in “Pinaglabanan”. Using Shannon-Wiener and Simpson’s index highest richness and dominance value of 2.27 and 0.85 was observed at the site “Eight Falls”. Sorensen’s coefficient revealed that “Eight Falls” and “Matanda” shared most common species thus gained a similarity value of 0.71. Based in this study 81% (43 species) fall under the category of critically endangered, six are categorized as endangered, one as vulnerable and two species that are of lesser concern. Identified threats causing lost in biodiversity in this protected landscape are: collection of species for other uses, land conversion, ecotourism activities and water impoundment from waterfalls.

KEYWORDS: Philippines, conservation status, ferns, diversity, richness, conservation, dominance, critically endangered, endangered, vulnerable, least concern

INTRODUCTION

The Philippines is identified as a hotspot for biodiversity and classed as a “mega diverse country”. To prevent the loss of endemic and endangered flora and fauna and to conserve the remaining biodiversity of the country, several laws and policies have been implemented by the government and these include the declaration of some areas of forest as “protected areas” under National Integrated

Protected Areas System (NIPAS) Act of 1992. To date, there are 204 identified protected areas in the Philippines, one of which is Quezon Protected Landscape in Quezon Province.

Quezon Protected Landscape is a 983.0765 hectare protected area located 164 km southeast of Manila with geographic coordinates of 13°59’22”N and 121°48’59”E (Fig. 1). It was declared as a protected landscape on June 2, 2003 under Proclamation no. 394. It

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covers the municipalities of Pagbilao, Padre Burgos and Atimonan in Quezon Province. The highest point is Mt. Mirador (Mt. Pinagbanderahan) with elevation of 366 m (1,201 ft). It is classified as lowland rainforest with karst landscape and vegetation. The virgin forest is habitat for numerous wildlife and several endemic species with several waterfalls and caves that also serve as tourist attractions.

Although the park is declared as a protected area it has been open to the public for a number of years, for activities such as hiking, trekking, bird watching and exploring waterfalls. These activities have an impact not only on the parks ecosystem but the diversity of the flora and fauna of the area as well. Among other vascular plants, ferns are often directly affected and threatened when there is intervention of their natural habitat or climate change. According to Lbars and Estrelles (2012) a significant decline in population frequently correlates with the vulnerability of habitat. The International Union for Conservation of Nature (IUCN) announced that drastic reduction in the genetic diversity of ferns is due to insufficient information on proper utilization and conservation.

This study aims to determine pteridophytes present in QPL, to assess species diversity and richness of disturbed portions / areas of the protected landscape, to determine conservation status of ferns in the area and to identify threats in biodiversity of ferns.

MATERIALS AND METHODS

Survey and Inventory

Eight sampling sites were surveyed along the northeastern portion of QPL (Fig.2). Global Positioning System (GPS) was used to record coordinates of each sampling site and their elevation. The samples were taken

at 50 meter interval in elevation and 10 meters width on both sides of the trail were marked and established, respectively (Fig. 3). Fern species inside the total of 159 quadrats were identified (Table 1). Plant cover was measured (Fig. 3) while photographs were taken for identification purposes. Areas with human intervention / activities were also noted.

Specimens were collected and prepared as herbarium vouchers following standard preparation technique. Unidentified specimens were brought to National Herbarium of the Philippines (NHP) for identification and verification. Available floras and monographs were also consulted for further comparison. Vouchers were deposited in NHP and Forest Products Research and Development Institute (FPRDI) Herbarium.

Diversity Assessment

Species abundance and evenness (equitability) were assessed using Shannon-Weiner's Index and Simpson's Index. Sorensen's coefficient was computed for determination of community similarities.

Shannon-Weiner's Diversity Index

$$H = - \sum_{i=1}^N p_i \ln p_i$$

where

p_i = total number of species

i = proportion of species

$\ln p_i$ = natural logarithm of this proportion

Simpson's Diversity Index

$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

where

N = the total number of organisms of all

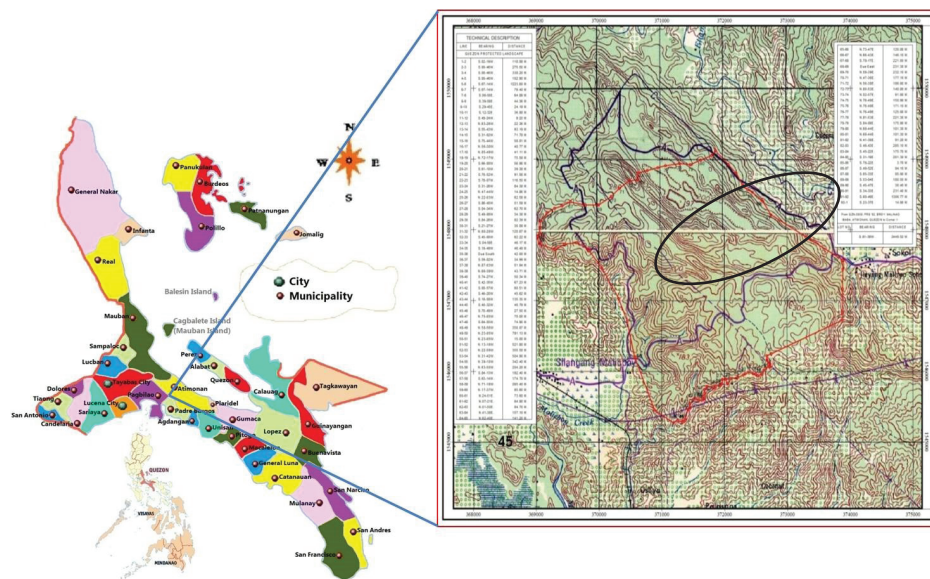


Figure 1. Topographic Map of Quezon Protected Landscape showing the boundary of the park (red mark), multiple-use zone boundary (violet) and location of study sites (black oval). Scale:1:25000.

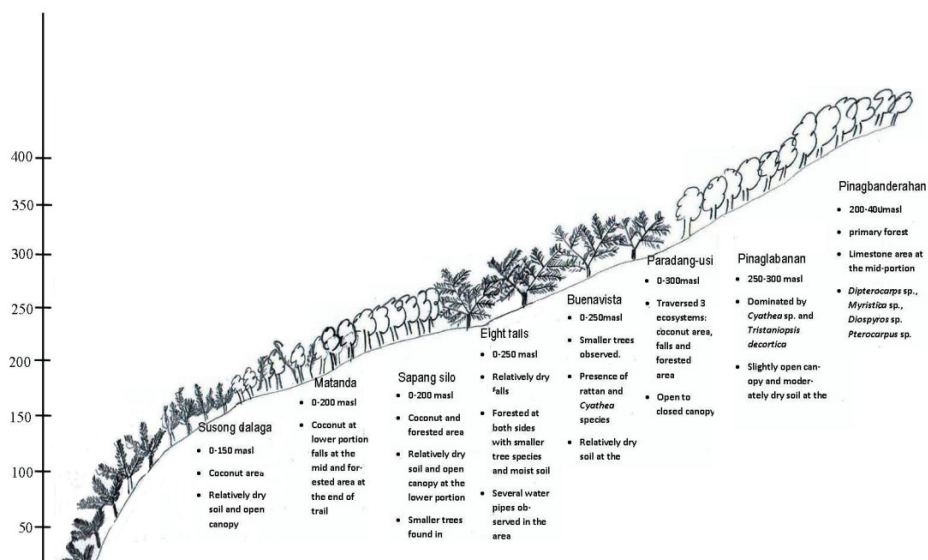


Figure 2. Transect diagram and description of sampling sites in QPL.



Figure 3. Plot establishment (above) and fern measurement (below) in trail going to Pinag-banderahan.

species
 n = the total number of organisms of a particular species

Sorenson's Coefficient

$$CC = \frac{2C}{S1 + S2}$$

where

C = number of species in two communities have in common

$S1$ = total number of species found in community 1

$S2$ = total number of species found in community 2

Assessment of Conservation Status

Conservation status of the 51 identified species was assessed following the indicators set by Sopsop and Buot (2009) and Villanueva and Buot (2015). Relative Cover (RC) was included in the table as additional criteria for characterization. Species were classified as critically endangered (CR), endangered (EN), vulnerable (VU) and least concerned (LC). Copeland (1958-1960) list of fern and fern allies together with Price (1975) will be used as a reference to determine the geographical distribution of the threatened plants.

Table 1. Indicators of the conservation status of threatened plants used in the study.

CATEGORY	CRITERIA
Critically Endangered (CR)	• Classified as CR either by the IUCN (2012) or Fernando <i>et al.</i> (2008) • Endemic to Quezon Province • Thrives in very rare habitat type (specialist habitat) • The immediate habitats that are extremely threatened by human intervention; collection (of plants for other uses), land conversion, kaingin (slash and burn farming), hiking, trekking, bird watching, water impoundment from forest waterfalls (for uses such as car washing) • Relative cover value of 10-29%
Endangered (EN)	• Classified as EN either by the IUCN (2012) or Fernando <i>et al.</i> (2008) • Restricted local distribution within Luzon area • The immediate habitat is threatened by human settlement. • Species that are endemic to the Philippines and are threatened due to human intervention; collection (of plants for other uses), land conversion, kaingin (slash and burn farming), hiking, trekking, bird watching, water impoundment from forest waterfalls (for uses such as car washing) • Relative cover value of 30-59%
Vulnerable (VU)	• Classified as EN <i>either</i> by the IUCN (2012) or Fernando <i>et al.</i> (2008) • Restricted local distribution within the Philippines

Table 1. (continued)

CATEGORY	CRITERIA
Least Concerned (LC)	• Restricted local distribution within the Philippines • The habitat is affected negatively by human settlement • Species that are indigenous to the Philippines and are threatened due to human intervention; collection (of plants for other uses), land conversion, kaingin (slash and burn farming), hiking, trekking, bird watching, water impoundment from forest waterfalls (for uses such as car washing) • Relative cover value of 60-79% • Not included in the list either by the IUCN (2012) or Fernando <i>et al.</i> (2008) • Widely distributed within the Philippines • The habitat is not affected negatively by human settlement • Species that are not threatened by human intervention; collection (of plants for other uses), land conversion, kaingin (slash and burn farming), hiking, trekking, bird watching, water impoundment from waterfalls (for car wash uses) • Relative cover value of 80-100%

If IUCN (2012) and Fernando *et al.* (2008) have categorized ‘threatened plant species’ differently, the higher category will be considered. The Luzon area pertains not only to the Luzon Island, but to the group of islands itself, which also includes Mindoro Island, Palawan, Marinduque, Romblon, Catanduanes, as well as others.

RESULTS AND DISCUSSION

Floristic Composition and Utilization of Ferns at QPL

A total of 51 species were collected in northeastern portion of Quezon Protected Landscape (Table 1), belonging to 25 genera, 16 families and 7 orders. The most represented families are Aspleniaceae, Pteridaceae, Selaginellaceae and Tectariaceae. On the other hand, Asplenium, Pteris, Selaginella

and Tectaria are the most represented genera. Fifty nine percent of the pteridophytes are terrestrial while 41% are classified as terrestrial or epiphytic, terrestrial or epipetric, epipetric or epiphytic and epiphytic and epipetric. Ferns were identified for various uses such as food, medicine and aesthetics / decorations. Eighteen species are known for medicinal values while 8 species are identified as ornamental and decorative material. Meanwhile, 26 species have unidentified uses.

Table 2. Pteridophytes of Quezon Protected Landscape and their habit and uses.

Species Recorded	Habit	Uses
Adiantaceae		
<i>Adiantum caudatum</i> L.	terrestrial	medicinal
<i>Adiantum philippense</i> L.	terrestrial	medicinal
<i>Taenitis blechnoides</i> (Willd.) Sw.	terrestrial	medicinal
Aspleniaceae		
<i>Asplenium affine</i> Sw.	terrestrial	medicinal
<i>Asplenium nidus</i> L.	epiphytic or terrestrial	food, medicinal, ornamental
<i>Asplenium polyodon</i> G.Forst.	epiphytic or terrestrial	medicinal
<i>Asplenium ruprechtii</i> Sa. Kurata	terrestrial or epipetric	unidentified uses
<i>Asplenium subnormale</i> Copel.	terrestrial	unidentified uses
<i>Asplenium tenerum</i> G. Forst.	terrestrial	unidentified uses
Athyriaceae		
<i>Diplazium esculentum</i> (Retz.) Sw.	terrestrial	food, medicinal, insecticides
Cyatheaceae		
<i>Cyathea contaminans</i> (Wall. & Hook.) Copel.	terrestrial (tree fern)	food, medicinal, handicraft and construction material, ornamental
Davalliaceae		
<i>Davallia solida</i> (G. Forst.) Sw.	epiphytic or epipetric	medicinal; decorative material
Dryopteridaceae		
<i>Nephrolepis exaltata</i> (L.)Schott	terrestrial	medicinal
<i>Nephrolepis hirsutula</i> (G. Forst) C. Presl	terrestrial	medicinal
<i>Nephrolepis multiflora</i> (Roxb.) Jarett ex Morton	terrestrial	ornamental
Hymenophyllaceae		
<i>Cephalomanes atrovirens</i> C. Presl.	terrestrial or epipetric	unidentified uses
Lindsaeaceae		
<i>Lindsaea lucida</i> Blume	terrestrial or epipetric	unidentified uses
Lomariopsidaceae		
<i>Bolbitis sinuosa</i> Copel.	terrestrial or epipetric	unidentified uses
<i>Cyclopeltis presliana</i> (J.Sm.) Beck.	terrestrial or epipetric	unidentified uses
Lycopodiaceae		
<i>Huperzia carinata</i> (Desv. ex Poir) Trevis	Epiphytic	ornamental
<i>Huperzia phlegmaria</i> (L.) Rothm.	epiphytic	ornamental
Marattiaceae		
<i>Angiopteris palmiformis</i> (Cav.) C. Chr.	terrestrial	ornamental
<i>Christensenia aesculifolia</i> (Blume) Maxon	terrestrial	unidentified uses

Table 2. (continued)

Species Recorded	Habit	Uses
Polypodiaceae		
<i>Drynaria quercifolia</i> (L.) J. Sm.	epiphytic occasionally epipetric or terrestrial	medicinal, ornamental
<i>Microsorium diversifolium</i> Copel	terrestrial or epipetric	unidentified uses
<i>Microsorium heterocarpum</i> Ching	epiphytic or epipetric	unidentified uses
<i>Platyserum coronarium</i> (J. Koenig. ex O. F. Mull.) Desv.	epiphytic terrestrial	ornamental unidentified uses
<i>Selliguea taenita</i> (Sw.) Parris		
Pteridaceae		
<i>Antrophyum immersum</i> (Bory.) Mett.	terrestrial	unidentified uses
<i>Antrophyum reticulatum</i> (G. Forst.) Kaulf.	terrestrial	unidentified uses
<i>Antrophyum sessilifolium</i> (Cav.) Spreng.	terrestrial	unidentified uses
<i>Coniogramme macrophylla</i> (Blume) Hieron.	terrestrial	unidentified uses
<i>Pteris armata</i> C. Presl	terrestrial	unidentified uses
<i>Pteris ensiformis</i> Burm. f.	terrestrial	food, medicinal, cosmetics
<i>Pteris pellucida</i> C. Presl	terrestrial	medicinal
<i>Pteris philippinensis</i> Fee	terrestrial	unidentified uses
<i>Pteris tripartita</i> Sw.	terrestrial	medicinal
<i>Pteris vitata</i> L.	terrestrial	medicinal
Selaginellaceae		
<i>Selaginella atimonanensis</i> B.C. Tan & Jermy.	Epipetric	unidentified uses
<i>Selaginella delicatula</i> (Desv. ex. Poir.) Alston	Epipetric	medicinal
<i>Selaginella engleri</i> Hieron	terrestrial or epipetric	unidentified uses
<i>Selaginella laxa</i> Spring	epipetric	unidentified uses
<i>Selaginella plana</i> (Desv. ex. Poir.) Hieron	terrestrial	medicinal
Tectariaceae		
<i>Pteridrys microthecia</i> (Fee) C. Chr. & Ching	terrestrial	unidentified uses
<i>Tectaria athyriosora</i> M. G. Price	terrestrial	unidentified uses
<i>Tectaria aurita</i> (Sw.) S. Chandra	terrestrial	unidentified uses
<i>Tectaria crenata</i> Cav.	terrestrial	medicinal
<i>Tectaria dexevea</i> Copel.	terrestrial	unidentified uses
<i>Tectaria dissecta</i> (G. Forst.) Lellinger	terrestrial	unidentified uses
Thelypteridaceae		
<i>Pneumatopteris laevis</i> (Mett.) Holtum	terrestrial or epipetric	unidentified uses

Table 2. (continued)

Species Recorded	Habit	Uses
<i>Pneumatopteris nitidula</i> (C. Presl) Holttum	terrestrial	unidentified uses

References: Petard, 1972; Grepin and Grepin, 1984; Camble and Ash, 1994; Bourdy *et al.*, 1996; Vasudeva, 1999; Singh, 2001; Gogoi, 2002; Anderson, 2003; You-Sing, 2005; Kumar *et al.*, 2006; Srivastana, 2007; Rout, 2009; Setyawan, 2009; Perumal, 2010; Sen and Ghosh, 2011; Kauschik, 2011; Bharti, 2011; Singh and Upadhyay, 2014.

Species diversity

The result showed that “Eight Falls” has the highest value for Shannon-Weiner and Simpson index of 2.27 and 0.85, respectively. Twenty three species belonging to 15 genera and 11 families were observed in the sampling site (Table 4). Plant diversity is attributed by some factors such as: the presence of rocks which provides suitable substrate for ferns to

attach to, the enclosed canopy of nearby forest and herbacious plants which traps and allows a small amount of light to penetrate forest floor as well as the humid and moist areas provided by highly valuable tree species such as *Dipterocarpus*, *Diospyros*, *Pterocarpus* and *Myristica*. It also showed that waterfalls and forested areas found at the middle of the site offer a better environment for the reproduction and survival of ferns.

Table 3. Species richness and dominance using Shannon and Simpson’s Diversity indexes. Pb = Pinagbanderahan; Pl = Pinaglabanan; B = Buenavista; F = 8 Falls; PU = Paradang-Usi; SD = Susong-dalaga; M = Matanda; SS = Sapang silo.

	Pb	Pl	B	F	PU	SD	M	SS
Shannon-Weiner Index	1.92	1.17	1.99	2.27	0.18	1.81	1.65	1.62
Simpson Index	0.69	0.60	0.79	0.85	0.61	0.78	0.75	0.67

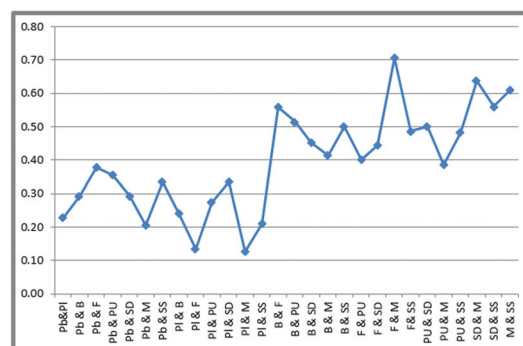


Figure 4. Similarity index of sampling sites. Pinagbanderahan (Pb); Pinaglabanan (Pl); Buenavista (B); Eight falls (F); Paradang-Usi (PU); Susong-dalaga (SD); Matanda (M); Sapang silo (SS).

Figure 4 shows similarity index of sampling sites. The results revealed that “Eight Falls” and “Matanda” has similarity values of 0.71. The 6 species commonly found in the 2 sites were: *Pteris ensiformis* Burm. f., *Pteris philippinensis* Fee, *Selaginella engleri* Hieron, *Tectaria dissecta* (G. Forst.) Lellinger, *Pneumatopteris laevis* (Mett.) Holttum and *Pneumatopteris nitidula* (C. Presl) Holttum.

Elevation and types of ecosystem present in the sites are very relevant in computation of percent similarity. Highest similarity values was observed in “Eight Falls” and “Matanda” since both sites were located at 0-250 MSL. Moreover, both sites have the presence of waterfalls and forested area along the trail going to the two sites dictates the presence of similar species stated above.

Meanwhile, lowest Sorensen's Coefficient of 0.13 was observed in “Pinaglabanan” and “Eight Falls” and “Pinaglabanan” and “Matanda”. Only one species was observed common in the sites, *Cyathea contaminans* (Wall. & Hook.) Copel. in the former while *Angiopteris palmiformis* (Cav.) C. Chr. in the latter. Pinaglabanan trail was located at 250-300 MSL while “Eight Falls and Matanda” at 29-250 MSL. Differences in elevation explained the very small overlap in species composition. It also justified the work of Banaticla and Buot (2005) with altitudinal zone of pteridophytes in Mt. Banahaw that some fern species are habitat specialists and preferential to certain environment.

Conservation Status

Conservation status of pteridophytes in QPL was determined based on IUCN, DENR and classification set by this study. Using IUCN classification, no species coincides in any of the categories. The reason for this is due to the evaluation being on a global scale, this lessens the probability of categorizing species

as critically endangered (CR), endangered (EN), vulnerable (VU) and least concerned (LC).

At a national scale, using DENR categorization there is one critically endangered species [*Platyserum coronatum* (J. Koenig. ex O. F. Mull.) Desv.], two endangered species (*Huperzia phlegmaria* (L.) Rothm. and *Selaginella atimonanensis* B.C. Tan & Jerry) and three vulnerable species (*Cyathea contaminans* (Wall. & Hook.) Copel., *Huperzia carinata* (Desv. ex Poir) Trevis and *Drynaria quercifolia* (L.) J. Sm.). Among the VU species *S. atimonanensis* is endemic to Quezon. During the survey the species was sighted only at “Pinagbanderan” at 350-400 m alt. during the month of November. This species easily get dry during summer and cannot tolerate high light intensity. As far as this species is concerned, it would be ideal to conduct a survey during rainy season.

The classification systems of Sopsop and Buot (2009) and Villanueva and Buot (2015) have been adapted for this study. This modified classification system identifies the threats in biodiversity and computes the relative cover of species. Relative cover is the area covered by individual species over the total area covered by all species. The smaller the species cover, the higher risk of extinction. It is important to develop conservation measures and strategies, at local scale, to address the declining population and genetic diversity of ferns in Quezon Protected Landscape.

Using the modified classification, majority of the species have relative cover of 10-29%. The park indeed has many diverse species. However, individual species cover represents only small portion of the total area surveyed so almost 81% of the species (43 species) fall under the critically endangered category. The six species identified as endangered were

Bolbitis sinuosa Copel., *Pteris ensiformis* Burm. f., *Pteris philippinensis* Fee, *Tectaria athyriosora* M. G. Price, *Pneumatopteris laevis* (Mett.) Holttum and *Pneumatopteris nitidula* (C. Presl) Holttum. Only *Cyathea contaminans* (Wall. & Hook.) Copel. with relative cover of 68.7% was categorized as vulnerable species. Two species classified as least concern were *Nephrolepis multiflora* (Roxb.) Jarett ex Morton and *Selaginella engleri* Hieron. The former being dominant and reproductively active in coconut area while the latter being highly adaptive to different habitat, environmental factors and altitudinal gradient gained a relative cover of 85.8% and 88.71%, respectively.

Threat to Biodiversity

To identify the level of threat to the biodiversity of QPL we must first understand what the possible factors are. Invasive human activities that have been noted taking place on the protect national park are: collection of species where specimens are being taken for other uses, land conversion for camping or farming, ecotourism activities such as trekking and hiking. Over exploitation increases the risk of extinction for some species such as *Platyserum coronatum* (J. Koenig. ex O. F. Mull.) Desv., *Huperzia carinata* (Desv. ex Poir) Trevis, *Huperzia phlegmaria* (L.) Rothm. *Drynaria quercifolia* (L.) J. Sm., *Angiopteris palmiformis* (Cav.) C. Chr., *Asplenium nidus* L. and *Cyathea contaminans* (Wall. & Hook.) Copel. Construction of trails, establishments of campsites, tapping of water for car washing, all of which have been observed taking place within the protected area. These could very well be causing ecological imbalance thus promoting forest destruction, climate change and changes in floristic composition.

CONCLUSION

The biodiversity of the Quezon Protected Landscape needs to be a high priority for protection and conservation in the Philippines. The park showed high species diversity, however, the identified threats if not properly addressed, may lead to forest ecological imbalance thus resulting in forest destruction and species extinction.

Assessment of conservation status of ferns at local level suggests for adaption of management strategies and conservation techniques practiced abroad to preserve and save their remaining fern population. Ex-situ conservation like cryopreservation, in-vitro, (Lbars and Estrelles, 2012) and transplanting (Eleuterio and Salicrup, 2009) is highly recommended to limit decline in genetic diversity and to preserve fern germplasm in this area.

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Table 4. List of threatened fern species in Quezon Protected Landscape, Quezon Province, Philippines.

Family	Species	Location	Relative Cover (%)	Conservation Status		
				IUCN	DENR Fernando et al. 2008	This study
Adiantaceae	<i>Adiantum caudatum</i> L.	Pb	0.9	NA	NA	CR
Adiantaceae	<i>Adiantum philippense</i> L.	B	2.87	NA	NA	CR
Adiantaceae	<i>Taeniitis blechnoides</i> (Willd.) Sw.	Pl, PU	23.2	NA	NA	CR
Aspleniaceae	<i>Asplenium affine</i> Sw.	Pb	0.15	NA	NA	CR
Aspleniaceae	<i>Asplenium nidus</i> L.	Pb, B, F, PU, SS	18.06	NA	VU	CR
Aspleniaceae	<i>Asplenium polyodon</i> G. Forst.	Pb, PU	1.19	NA	NA	CR
Aspleniaceae	<i>Asplenium ruprechtii</i> Sa. Kurata	F	3.01	NA	NA	CR
Aspleniaceae	<i>Asplenium subnormal</i> Copel.	Pb, B	0.19	NA	NA	CR
Aspleniaceae	<i>Asplenium tenerum</i> G. Forst.	Pb	7.53	NA	NA	CR
Athyriaceae	<i>Diplazium esculentum</i> (Retz.) Sw.	B, PU, SD	14.84	NA	NA	CR
Cyatheaceae	<i>Cyathea contaminans</i> (Wall. & Hook.) Copel.	Pl, B, F, PU	68.7	NA	VU	VU
Davalliaceae	<i>Davallia solida</i> (G. Forst.) Sw.	Pb, SS	2.24	NA	NA	CR
Dryopteridaceae	<i>Nephrolepis exaltata</i> (L.) Schott	Pb, PU	1.18	NA	NA	CR
Dryopteridaceae	<i>Nephrolepis hirsutula</i> (G. Forst) C. Presl	Pb	1.65	NA	NA	CR
Dryopteridaceae	<i>Nephrolepis multiflora</i> (Roxb.) Jarett ex Morton	F, PU, SD, M	85.8	NA	NA	LC
Hymenophyllaceae	<i>Cephalomanes atrovirens</i> C. Presl.	Pb, B, F, M	4.36	NA	NA	CR
Lindsaeaceae	<i>Lindsaea lucida</i> Blume	Pl	0.46	NA	NA	CR
Lomariopsidaceae	<i>Bolbitis sinuosa</i> Copel.	F, SS, M	48.26	NA	NA	EN
Lomariopsidaceae	<i>Cyclopeltis presliana</i> (J. Sm.) Beck.	Pb, F, M	5.61	NA	NA	CR
Lycopodiaceae	<i>Huperzia cariata</i> (Desv. ex Poir) Trevis	F, M	0.03	NA	VU	CR

Table 4. (continued)

Family	Species	Location	Relative Cover (%)	Conservation Status		
				IUCN	DENR Fernando et al. 2008	This study
Lycopodiaceae	<i>Huperzia phlegmaria</i> (L.) Rothm.	PU	0.03	NA	EN	CR
Marattiaceae	<i>Angiopteris palmiformis</i> (Cav.) C. Chr.	Pb, Pl, B, PU, M	20.18	NA	NA	CR
Marattiaceae	<i>Christensenia aesculifolia</i> (Blume) Maxon	M, SS	6.07	NA	NA	CR
Polypodiaceae	<i>Drynaria quercifolia</i> (L.) J. Sm.	Pb, B, F, PU, SS	18.82	NA	VU	CR
Polypodiaceae	<i>Microsorium diversifolium</i> Copel	B, F, M	15.27	NA	NA	CR
Polypodiaceae	<i>Microsorium heterocarpum</i> Ching	Pb, SD	6.18	NA	NA	CR
Polypodiaceae	<i>Platyserum coronarium</i> (J. Koenig. ex O. F. Mull.) Desv.	PU	0.01	NA	CR	CR
Polypodiaceae	<i>Selliguea taenita</i> (Sw.) Parris	Pb, F, M	9.69	NA	NA	CR
Pteridaceae	<i>Antrophyum immersum</i> (Bory.) Mett.	Pb	3.25	NA	NA	CR
Pteridaceae	<i>Antrophyum reticulatum</i> (G. Forst.) Kaulf.	F, M	1.07	NA	NA	CR
Pteridaceae	<i>Antrophyum sessilifolium</i> (Cav.) Spreng.	Pb	0.08	NA	NA	CR
Pteridaceae	<i>Coniogramme macrophylla</i> (Blume) Hieron.	B	18.56	NA	NA	CR
Pteridaceae	<i>Pteris armata</i> C. Presl	Pb	0.22	NA	NA	CR
Pteridaceae	<i>Pteris ensiformis</i> Burm. f.	B, F, PU, SD, M, SS	34.46	NA	NA	EN
Pteridaceae	<i>Pteris pellucida</i> C. Presl	Pb, SD	2.26	NA	NA	CR
Pteridaceae	<i>Pteris philippinensis</i> Fee	B, SD, M, SS	56.8	NA	NA	EN
Pteridaceae	<i>Pteris tripartita</i> Sw.	F, M	0.09	NA	NA	CR

Table 4. (continued)

Family	Species	Location	Relative Cover (%)	Conservation Status		
				IUCN	DENR Fernando et al. 2008	This study
Pteridaceae	<i>Pteris vittata</i> L.	B	0.72	NA	NA	CR
Selaginellaceae	<i>Selaginella atimonanensis</i> B.C. tan & Jerry	Pb	6.14	NA	EN	CR
Selaginellaceae	<i>Selaginella delicatula</i> (Desv. ex. Poir.)	Pb, F	5.99	NA	NA	CR
Selaginellaceae	<i>Selaginella engleri</i> Hieron	Pb, B, F, PU, SD, M, SS	2.87	NA	NA	LC
Selaginellaceae	<i>Selaginella laxa</i> Spring	Pb, Pl, SS	88.71	NA	NA	CR
Selaginellaceae	<i>Selaginella plana</i> (Desv. ex. Poir.) Hieron	Pb, F, SD, M	17.16	NA	NA	CR
Tectariaceae	<i>Pteridrys microthecia</i> (Fee) C. Chr. & Ching	Pb	4.63	NA	NA	CR
Tectariaceae	<i>Tectaria athyriosora</i> M. G. Price	Pb, Pl, B, F, PU, SD, M, SS	36.07	NA	NA	EN
Tectariaceae	<i>Tectaria aurita</i> (Sw.) S. Chandra	Pb, M	2.53	NA	NA	CR
Tectariaceae	<i>Tectaria crenata</i> Cav.	B, F	5.56	NA	NA	CR
Tectariaceae	<i>Tectaria dexevea</i> Copel.	Pb, F, M	3.34	NA	NA	CR
Tectariaceae	<i>Tectaria dissecta</i> (G. Forst.) Lellinger	B, F, SD, M, SS	7.88	NA	NA	CR
Thelypteridaceae	<i>Pneumatopteris slaevia</i> (Mett.) Holttum	Pb, B, F, PU, SD, M, SS	53.98	NA	NA	EN
Thelypteridaceae	<i>Pneumatopteris nitidula</i> (C. Presl) Holttum	PU, SD, M, SS	34.66	NA	NA	EN

Notes: Pinagbanderahan (Pb); Pinaglabanan (Pl); Buenavista (B); Eight falls (F); Paradang-Usi (PU); Susong-dalaga (SD); Matanda (M); Sapang silo (SS); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Least Concern (LC)