

Checklist of the Flora and Fauna of the Karst Forests in Basey, Samar, Philippines

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ABSTRACT

A comprehensive list of plant and animal biodiversity is necessary as a basis for local government and concerned agencies to enact local policies on species conservation. This article provides an enumeration of the vascular flora and vertebrate fauna in the karst forests of Basey, Samar, Philippines. A review of literature concerning plants and animals of Basey, Samar Island Natural Park, from various published sources was done. A total of 67 plants, represented by 54 genera and 38 families were included in this list, with 23 threatened and 28 Philippine endemic species. For the vertebrates, a total of 70 species were enumerated, which was composed of 6 amphibian, 12 reptile, 43 bird, and 9 mammal species. Among these, 21 were threatened and 14 were endemic to the Mindanao Pleistocene Aggregate Island Complex (PAIC). This checklist can be used as a reference in crafting local conservation policies and strategies for protection and sustainable use of this ecotourism site.

Keywords: biodiversity, ecotourism, karst forests, Samar Island Natural Park, Sohoton Caves, Natural Bridge Park.

INTRODUCTION

Karst forest or limestone forest is a type of forest formation growing on karst outcrops. It is a forest formation type in the Philippines (Fernando *et al.*, 2008) which serves as a habitat to unique fauna and flora (Tolentino *et al.*, 2020).

Southeast Asia in general has its own share of majestic limestone landscapes, about 10% of its land area (Day and Ulrich 2000). Out of this, 12% are only protected. The Philippines, on the other hand, is about 10% karst in terms of land area (Restificar *et al.*, 2006), 29% of which is considered protected (Day and Ulrich 2000). Samar Island has the largest limestone formation in the Philippines.

Samar Island Natural Park (SINP) is a protected area covering approximately one-third of Samar Island. Some biodiversity studies were previously conducted within SINP, such as a faunal assessment (Patindol, 2016), floral and timber stock (Quimio, 2017), and the biodiversity assessment of the CONserve-KAIGANGAN Program in Paranas (Villanueva *et al.*, 2021) and Taft (Obeña *et al.*, 2021).

One of the municipalities within SINP is Basey, a town which is known for its caves which serve as popular tourist destination and a place of cultural significance. Sohoton

Caves and Natural Bridge Park is classified as a Class II cave by the Philippine Department of Environment and Natural Resources (DENR Memorandum Circular No. 2014-03). It has some portions which are hazardous but contain sensitive geological, archeological, cultural, historical, and biological value. This park also includes Pahulugan Cave, Sohoton Cave, and Bugasan Cave plus a limestone bridge for which Sohoton Park is named after (Restificar *et al.*, 2006). Another cave in Basey is the Saob Cave which is a place where there is native mat weaving among local groups of women in the municipality.

Alongside its tourism and cultural significance, there is also a need to highlight the biodiversity value of Basey, Samar. There are reports from some botanists that have provided records of the unique plants of Basey, Samar (Barcelona and Pelser, 2014; Berg, 2012; De Wilde, 1997; Madulid and Agoo, 2015; Madulid *et al.*, 2012; Obico and Alejandro, 2013; Pelser *et al.*, 2017; Suksthan, 2010; Wong, 2011), some of which are classified as threatened or are of endemic status.

This article was written to provide consolidated data on the flora and fauna of Basey, Samar, which can be used in crafting conservation policies and strategies supportive of the area's sustainable development. This paper created a checklist of plants and animals in the karst forests of Basey, Samar. It also provided a discussion on the current

threats to these species and describe the implication of highlighting the karst ecosystem biodiversity to the ecotourism of Basey. The scope of this article was limited to the published literature sources on the vascular plants and vertebrate animals of the karst forest ecosystem of Basey, Samar.

MATERIALS AND METHODS

Basey is a first-class municipality in Samar province, Philippines (Figure 1). It is located at the southern portion of Samar Island, which is the easternmost major landmass in the Visayas region. Samar Island is the third largest Island in the Philippines and contains the largest karst formation in the country (Restificar *et al.*, 2006). The island is also part of the Mindanao Pleistocene Aggregate Island Complex (PAIC). The municipality is well-known for tourism due to its majestic karst

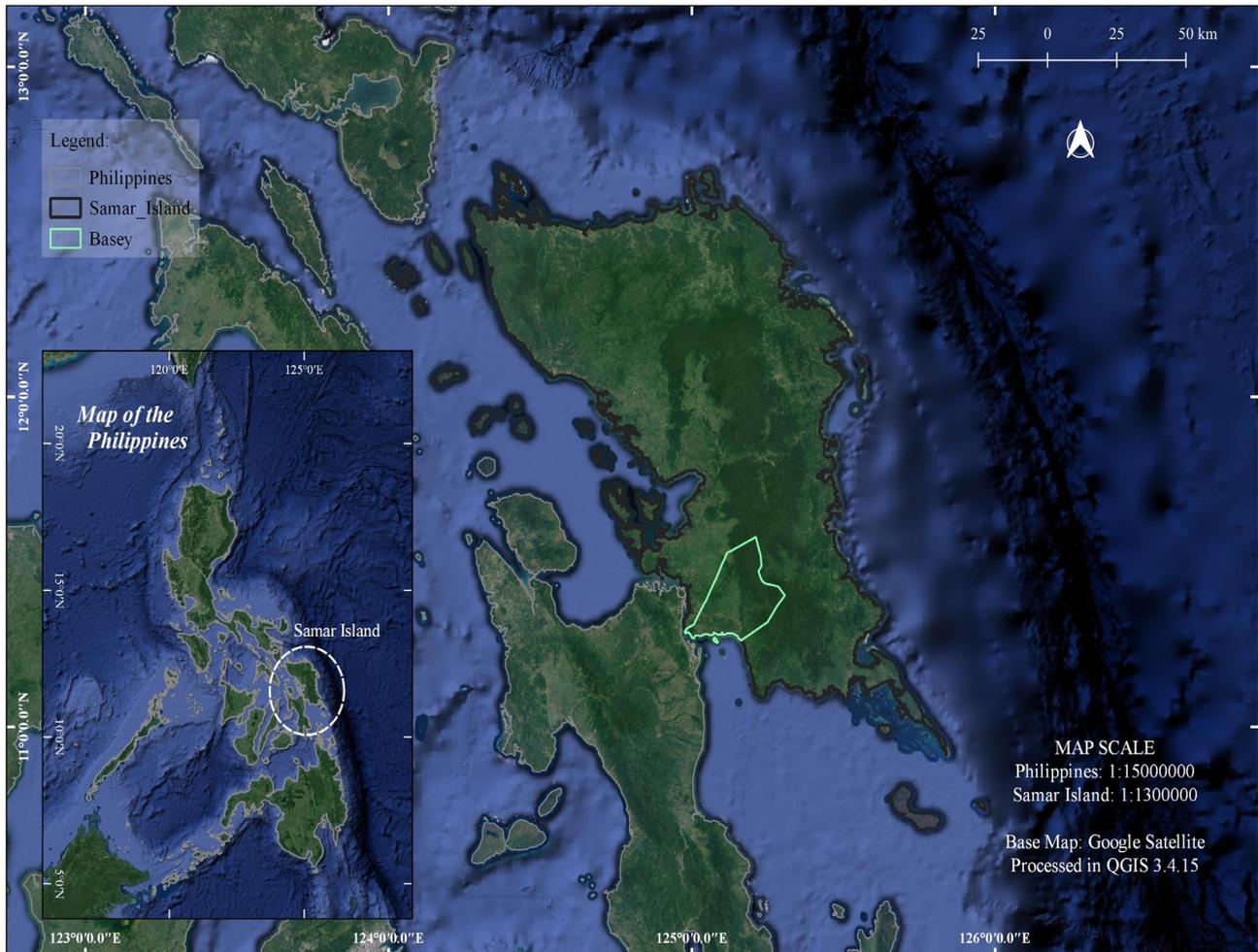


Figure 1. Map showing the location of the study area (Basey) in Samar Island, Philippines. Inset map shows Philippine map with Samar Island encircled. The map was processed using QGIS 3.4.15.

formations like the Sohoton Caves and Natural Bridge Park and the Saob Cave (Figure 2). The land cover of Basey, particularly within the boundaries of SINP, is composed mainly of open forest (National Mapping and Resource Information Authority, 2015).

Data Collection

This checklist of plants and animals was constructed by conducting an exhaustive review of publications on Basey flora and fauna. We searched for published and peer-reviewed references on the biodiversity of Basey, Samar in Google Scholar and Naturalis

Institutional Repository (<https://repository.naturalis.nl/>). We limited our list of species to vascular flora and vertebrate fauna. To narrow our search, we also used the keywords associated to the protected areas and limestone formations in Basey such as “Samar Island Natural Park” and “Sohoton Caves” and “Mt. Sohoton” in the search bar.

Biodiversity papers reviewed included that of Quimio (2017), Barcelona and Pelsler (2014), Berg (2012), De Wilde (1997), Madulid and Agoo (2015), Madulid *et al.* (2012), Obico and Alejandro (2013), Patindol (2016),

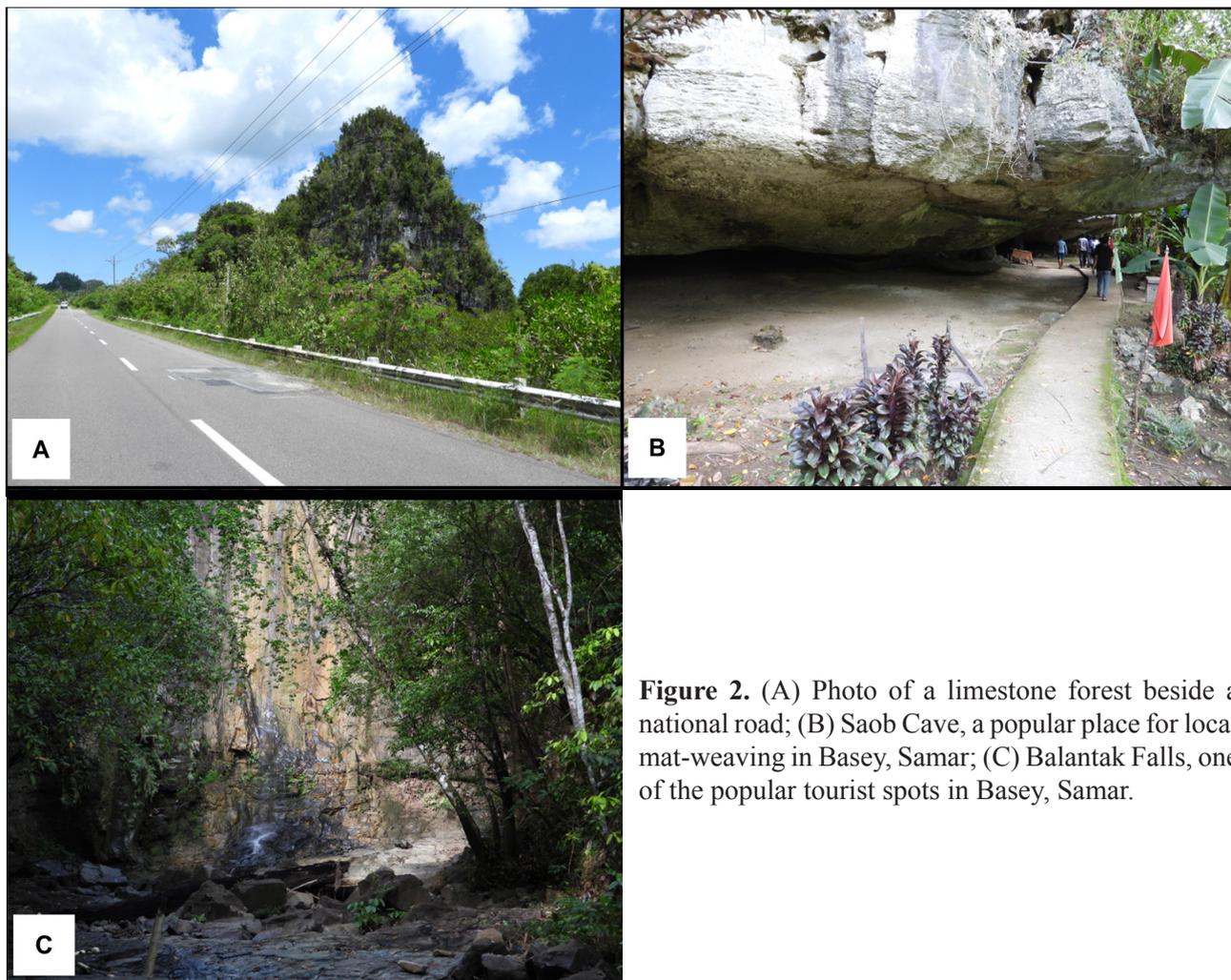


Figure 2. (A) Photo of a limestone forest beside a national road; (B) Saob Cave, a popular place for local mat-weaving in Basey, Samar; (C) Balantak Falls, one of the popular tourist spots in Basey, Samar.

Pelser *et al.* (2017), Suksthan (2010) and Wong (2011). Other notable information such as conservation status (IUCN Red List of Threatened Species; Pelser *et al.*, 2011-onwards; DENR DAO 2017-11 and 2019-09) and endemism were included in the tables.

RESULTS AND DISCUSSION

A. Floral Composition

The checklist enumerated a total of 67 vascular plant species, represented by 54 genera and 38 families (Table 1). Among these, five were pteridophytes while the other 62 were spermatophytes. In terms of species representation, Dipterocarpaceae was the family with the highest number of species recorded (8 spp.), followed by Rubiaceae (5 spp.), and Myrtaceae (4 spp.). The most represented genera in the list were *Shorea* (5 spp.), *Myristica* (3 spp.), while *Antherostele*, *Canarium*, *Diospyros*, *Elaeocarpus*, *Garcinia*, *Hopea*, and *Syzygium* were represented by two species each. Moreover, 23 species were also noted to be threatened (Table 2) and 28 species were classified as endemic to the Philippines. Compared with the other limestone forests in the Philippines, Basey shares some similarity in terms of

taxonomic representation. In an assessment conducted in Mt. Lantoy, Cebu Island (Lillo *et al.*, 2019), the represented families were Sapotaceae, Moraceae, Anacardiaceae, Meliaceae, Elaeocarpaceae, and Rubiaceae. The most recorded genera were *Elaeocarpus*, *Palaquium*, *Syzygium*, and *Cinnamomum*. In another study by Cadiz and Buot (2019) in Mt. Tabunan, Cebu, the most represented families included Moraceae, Meliaceae, and Araceae. Most represented genera were *Ficus*, *Aglaia*, and *Garcinia*. Meanwhile in the limestone forests of Dinagat Island (Lillo *et al.*, 2019a), the most represented families include Moraceae, Rubiaceae, Euphorbiaceae, Clusiaceae, Anacardiaceae, Lauraceae, Apocynaceae, Phyllanthaceae, Rutaceae, and Araliaceae, while the most dominant genera were *Ficus*, *Psychotria*, *Timonius*, *Osmoxylon*, *Phyllanthus*, and *Buchanania*. In another study by Caringal *et al.* (2019) at the coastal limestone forests of Batangas, Philippines, the vegetation zones were dominated by a combination of native, endemic, and cultivated trees such as *Tectona philippinensis*, *Terminalia polyantha*, *Garuga floribunda*, *Celtis latifolia*, *Tamarindus indica*, and *Xylocarpus rumphii*.

Table 1. List of plants in the karst forest ecosystems of Basey, Samar.

PLANT GROUP/ Order	FAMILY	SPECIES	COMMON NAME	ENDEMICITY	REFERENCE
Peridophyta					
Polypodiales	Lomatopsidaceae	<i>Cyclopetis</i> sp.			Barcelona and Pelsler (2014)
	Polypodiaceae	<i>Pyrrhosia splendens</i> (C. Presl) Cling		Endemic	Barcelona and Pelsler (2014)
		<i>Pyrrhosia nummularifolia</i> (Swartz) Cling		Non-endemic	Barcelona and Pelsler (2014)
Gleicheniales	Pteridaceae	<i>Pteris vittata</i> L.		Non-endemic	Barcelona and Pelsler (2014)
		<i>Phanerogonum major</i> Diels		Non-endemic	Barcelona and Pelsler (2014)
Spermatophyta: Gymnospermae					
Gnetales	Gnetaceae	<i>Gnetum gnemon</i> L.	Bago	Non-endemic	Quinio (2016)
		<i>Agathis philippinensis</i> Warb.	Almacyga	Non-endemic	Quinio (2016)
Pinales	Araucariaceae				
Spermatophyta: Angiospermae					
Magnoliales	Myristicaceae	<i>Myristica laevis</i> subsp. <i>laevis</i> de Wilde		Endemic	de Wilde (1997)
		<i>Myristica philippinensis</i> Gand.	Daguan	Endemic	Quinio (2016)
Laurales	Lauraceae	<i>Myristica laxiflora</i> Merr.	Duguan-nalabai	Endemic	Quinio (2016)
		<i>Cinnamomum mercedoi</i> S. Vidal	Kalingag	Endemic	Quinio (2016)
Zingiberales	Marantaceae	<i>Phrynium bracteosum</i> (Warb. ex K. Schum.) Suksathan & Borchs.		Non-endemic	Suksathan et al. (2010)
		<i>Phrynium fasciculatum</i> (Presl.) Horan.		Non-endemic	Suksathan et al. (2010)
Zingiberales	Marantaceae	<i>Dillenia philippinensis</i> Rolfe	Katnon	Endemic	Quinio (2016)
		<i>Albizia saponaria</i> (Lour.) Miq.	Salangkugi	Non-endemic	Quinio (2016)
Fabales	Fabaceae	<i>Ormosia calauensis</i> Blanco	Bahai	Non-endemic	Quinio (2016)
		<i>Artocarpus nitidus</i> Trécul	Kubi	Endemic	Quinio (2016)
Rosales	Moraceae	<i>Ficus samarana</i> C. C. Berg		Endemic	Berg (2012)
Fagales	Fagaceae	<i>Lithocarpus celebicus</i> (Miq.) Rehder [= <i>Lithocarpus llanosii</i> (A.DC.) Rehder]	Ulaian	Non-endemic	Quinio (2016)
		<i>Morella javanica</i> (Blume) I.M. Turner [= <i>Myrica javanica</i> Blume]	Hindang	Non-endemic	Quinio (2016)
Oxalidales	Elaeocarpaceae	<i>Elaeocarpus leytenis</i> Merr.	Bamsiak	Non-endemic	Quinio (2016)
		<i>Elaeocarpus octopetalus</i> Merr.	Salak	Non-endemic	Quinio (2016)

Table 1. List of plants in the karst forest ecosystem of Basey, Samar (continued).

PLANT GROUP/ Order	FAMILY	SPECIES	COMMON NAME	EDEMICTY	REFERENCE	
Malpighiales	Achariaceae	<i>Hydnocarpus subfalcata</i> Merr.	Damo	Non-endemic	Quinio (2016)	
	Calophyllaceae	<i>Calophyllum blancoi</i> Planch. & Triana	Bitanghol	Non-endemic	Quinio (2016)	
	Clusiaceae	<i>Garcinia oligophlebia</i> Merr.	Diis	Endemic	Quinio (2016)	
	Euphorbiaceae	<i>Garcinia venulosa</i> (Blanco) Choisy	Gatasan	Endemic	Quinio (2016)	
		<i>Blumeodendron karzii</i> (Hook.f.) J.J.Sm. Ex Koord. & Valetton [= <i>Blumeodendron philippinense</i> Merr. & Rolfe.]	Salnagan	Non-endemic	Quinio (2016)	
Euphorbiaceae	<i>Hancea cordatifolia</i> (Slik) S.E.C.Sierra, Kulju & Welzen [= <i>Mallotus cordatifolius</i> Slik]		Endemic	Slik 1988; Slik and van Welzen (2001)		
Myrtales	Rafflesiaceae	<i>Croton consanguineus</i> Müll. Arg.	Malatuba	Endemic	Quinio (2016)	
		<i>Mallotus cunningii</i> Müll.Arg. [= <i>Neotrewia cunningii</i> (Müll.Arg.) Pax & K.Hofim.]	Apanang	Non-endemic	Quinio (2016)	
	Melastomataceae	<i>Rafflesia manillana</i> Teschem.	Babalian	Endemic	Madulid et al (2012)	
		<i>Memecylon sessilifolium</i> Merr.	Tulanan	Endemic	Quinio (2016)	
	Myrtaceae	<i>Engenia tulanan</i> Merr. [= <i>Jossinia tulanan</i> (Merr.) Merr.]		Endemic	Quinio (2016)	
		<i>Syzygium hutchinsonii</i> (C.B. Robinson) Merr.	Malatambis	Endemic	Quinio (2016)	
		<i>Syzygium striatulum</i> (C.B.Rob.) Merr.	Malaruhat sapa	Endemic	Quinio (2016)	
	Sapindales	Anacardiaceae	<i>Tristania micrantha</i> Merr.	Tiga	Endemic	Quinio (2016)
			<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe	Dao	Non-endemic	Quinio (2016)
		Bursaceae	<i>Canarium hirsutum</i> Willd.	Milipili	Non-endemic	Quinio (2016)
<i>Canarium ovatum</i> Engl.			Pili	Non-endemic	Quinio (2016)	
Meliaceae		<i>Chisocheton cumingianus</i> Harms	Baltakang	Non-endemic	Quinio (2016)	
		<i>Reinwardtiodendron celebicum</i> Koord.	Malakamanga	Non-endemic	Quinio (2016)	
Rutaceae		<i>Sandoricum vidalii</i> Merr.	Malasantol	Non-endemic	Quinio (2016)	
		<i>Zanthoxylum diabolicum</i> Elmer	Madbad	Non-endemic	Quinio (2016)	
		<i>Dipterocarpus gracilis</i> Blume	Panau	Non-endemic	Quinio (2016)	
		<i>Hopea foxworthyi</i> Elmer	Dalingdangan	Endemic	Quinio (2016)	
Malvales	Dipterocarpaceae	<i>Hopea malibato</i> Foxw.	Yakal-kaliot	Endemic	Quinio (2016)	
		<i>Storea almon</i> Foxw.	Almon	Non-endemic	Quinio (2016)	

Table 1. List of plants in the karst forest ecosystem of Baisey, Samar (continued).

PLANT GROUP/ Order	FAMILY	SPECIES	COMMON NAME	ENDEMICITY	REFERENCE
		<i>Shorea astylosa</i> Foxw.	Yakal	Endemic	Quinio (2016)
		<i>Shorea falciferoides</i> Foxw. [= <i>Shorea gisok</i> Foxw.]	Yakal-gisok	Non-endemic	Quinio (2016)
		<i>Shorea polysperma</i> Merr.	Tangle	Endemic	Quinio (2016)
		<i>Shorea squamata</i> (Turcz.) Dyer ex S. Vidal	Mayapis	Endemic	Quinio (2016)
	Malvaceae	<i>Campsiostemon philippinense</i> (S. Vidal) Becc.	Gapas-gapas	Non-endemic	Quinio (2016)
	Olacaceae	<i>Strombosia philippinensis</i> S. Vidal	Tamayuan	Non-endemic	Quinio (2016)
	Ebenaceae	<i>Diospyros bulsanensis</i> Elmer	Baganio		Quinio (2016)
		<i>Diospyros montana</i> Roxb.	Kamagong-bundok	Non-endemic	Quinio (2016)
	Sapotaceae	<i>Minusops parvifolia</i> R.Br.	Bansalagin	Non-endemic	Quinio (2016)
		<i>Palauquinn luzonense</i> S. Vidal	Nato	Non-endemic	Quinio (2016)
		<i>Planchonella velutina</i> (Elmer) H.J.Lam [= <i>Pouteria velutina</i> (Elmer) Baehmi]	Uakatan	Endemic	Quinio (2016)
Gentianales	Gentianaceae	<i>Fagraea racemosa</i> Jack	Balatbuana	Non-endemic	Quinio (2016)
	Rubiaceae	<i>Antherostele samarensis</i> Obico & Alejandro		Endemic	Obico and Alejandro (2013)
		<i>Antherostele grandistipula</i>		Endemic	Obico and Alejandro (2013)
		<i>Antirhea livida</i> Elmer	Lunangog	Endemic	Quinio (2016)
		<i>Gardenia mutabilis</i> Reinw. ex. Blume		Non-endemic	Wong & Low (2011)
		<i>Neonauclaea formicaria</i> (Elmer) Merr.	Hambabulad	Endemic	Quinio (2016)
		<i>Timonius appendiculatus</i> Merr.	Upong-upong	Endemic	Quinio (2016)
Lamiales	Bignoniaceae	<i>Rademacheria pinnata</i> (Blanco) Seem.	Banaybanay	Non-endemic	Quinio (2016)
	Gesneriaceae	<i>Teijsmanniodendron pteropodium</i> (Miq.) Bakh.	Tikoko	Non-endemic	Quinio (2016)
	Lamiaceae	<i>Vitex quinata</i> (Lour.) F.N. Williams	Kalipapa	Non-endemic	Quinio (2016)

Table 2. Conservation status of plants in Basey, Samar.

PLANT GROUP/ Order	FAMILY	SPECIES	CONSERVATION STATUS	
			IUCN	DENR DAO 2017-11
Pteridophyta				
Polypodiales	Polypodiaceae	<i>Pyrrhosia splendens</i> (C. Presl) Ching		VU
Gleicheniales	Matoniaceae	<i>Phanerosorus major</i> Diels		CR
Spermatophyta: Gymnospermae				
Pinales	Araucariaceae	<i>Agathis philippinensis</i> Warb.		VU
Spermatophyta: Angiospermae				
Laurales	Lauraceae	<i>Cinnamomum mercadoi</i> S.Vidal	LC	OTS
Dilleniales	Dilleniaceae	<i>Dillenia philippinensis</i> Rolfe	NT	
		<i>Hancea cordatifolia</i> (Slik) S.E.C.Sierra, Kulju & Welzen [= <i>Mallotus cordatifolius</i> Slik] [= <i>Mallotus cumingii</i> Müll.Arg. [= <i>Neotrewia cumingii</i> (Müll.Arg.) Pax & K.Hoffm.]	CR	
Myrtales	Rafflesiaceae Myrtaceae	<i>Rafflesia manillana</i> Teschem. <i>Syzygium hutchinsonii</i> (C.B. Robinson) Merr.	CR	EN
Sapindales	Anacardiaceae	<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe		VU
		<i>Canarium ovatum</i> Engl.	LC	OTS
		<i>Sandoricum vidalii</i> Merr.	VU	
Malvales	Dipterocarpaceae	<i>Dipterocarpus gracilis</i> Blume	VU	VU
		<i>Hopea foxworthyi</i> Elmer	EN	CR
		<i>Hopea malibato</i> Foxw.	VU	CR
		<i>Shorea almon</i> Foxw.	NT	VU
		<i>Shorea astylosa</i> Foxw.	EN	CR
		<i>Shorea falciferoides</i> Foxw. [= <i>Shorea gisok</i> Foxw.]		VU
		<i>Shorea polysperma</i> Merr.	LC	VU
	Malvaceae	<i>Camptostemon philippinense</i> (S.Vidal) Becc.	EN	
Ericales	Sapotaceae	<i>Palaquium luzoniense</i> S.Vidal	VU	VU
Gentianales	Rubiaceae	<i>Antherostele samarensis</i> Obico & Alejandro <i>Timonius appendiculatus</i> Merr.	VU	CR

*CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, OTS – Other Threatened Species, LC – Least Concern

Furthermore, if we compared the plant species number in Basey to other municipalities of Samar Island, it shared some similarities with Paranas in terms of high species representation of dipterocarps (Villanueva *et al.*, 2021). Basey had higher number of plant species (67 spp.) than in Taft (30 spp.) (Obeña *et al.*, 2021) and Guiuan (41 spp.) (Fernandez *et al.*, 2020), although relatively lower than that of Paranas (Villanueva *et al.*, 2021). However, since the data gathered in this study was derived from published and not field assessment data, the comparison of flora indicated here was not conclusive. Future studies based on field data will support and complement what

had been gathered in this research.

B. Faunal Composition

For the vertebrate faunal checklist, a total of 70 species were recorded by Patindol (2016). The list was composed of 6 amphibian species, 12 reptile species, 43 bird species, and 9 mammal species (Table 3). Among these, 34 species (48.57%) were endemic to the Philippines and 21 (30%) were threatened species (Table 4) according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species and the Updated National List of Threatened Philippine Fauna (DENR

DAO 2019-19).

This checklist of vertebrate species is similar in composition to that of other karst forest areas in Samar Island such as Guiuan (Fernandez *et al.*, 2021), Paranas (Villanueva *et al.*, 2021), and Taft (Obeña *et al.*, 2021). However, it is important to note that the paper of Patindol (2016) was the only published study on vertebrates in Basey that was available. Thus, more studies in the area need to be conducted in order to have a better understanding of its faunal composition.

C. Notable Species

The results from Tables 1-4 show that Basey has unique biodiversity that is worthy of protection and conservation. Some species are noted to be of limited distribution due their endemism. There were also species that were included in the IUCN and the national list of threatened species (DENR DAO 2017-11 and 2019-19). Some notable plant species include the threatened dipterocarp species such as *Dipterocarpus gracilis*, *Hopea foxworthyi*, *Hopea malibato*, *Shorea almon*, *Shorea astylosa*, *Shorea falciferoides*, *Shorea polysperma* (Table 2). Dipterocarps are common dominating trees in Southeast Asian forests (Ghazoul, 2016) and can naturally grow on karst landscapes like in Bohol Island, Philippines (Fernando *et al.*, 2009). These are well known to be excellent sources of timber (Ghazoul, 2016). Dipterocarps also play a critical ecological role as they serve as a habitat for birds like the Philippine eagle (Bueser *et al.*, 1998), a food source to herbivores, and exhibit symbiotic associations with ectomycorrhizal fungi (Ghazoul, 2016). Recent studies also recorded rare and Critically Endangered (DAO 2017-11) plant species in Basey. *Antherostele samarensis*, a Rubiaceae species previously found in Mindoro Island, received its second species record in Mt. Sohoton (Obico and Alejandro 2013). *Phanerosorus major*, a fern species which is widespread in New Guinea and Moluccas, was first recorded in the country particularly in Sohoton Natural Bridge National Park (Barcelona and Pelsler, 2014).

There were also many notable vertebrate fauna species recorded in Basey by Patindol (2016). Of the aforementioned 34 species endemic to the Philippines, there are even narrower endemics such as the 14 species that can only be found in the Mindanao PAIC (Table 3). This biogeographic region includes Mindanao, Samar, Leyte, Bohol and adjacent islands which were all theoretically interconnected by land bridges during the last ice age (Heaney, 1986). Furthermore, the wildlife of Basey include some highly threatened species such as the critically endangered Philippine

eagle (*Pithecophaga jefferyi*) Philippine hanging parrot (*Loriculus philippensis*), the endangered Southeast Asian box turtle (*Cuora amboinensis*), southern rufous hornbill (*Buceros hydrocorax semigaleatus*), Philippine eagle-owl (*Bubo philippensis*), Philippine brown deer (*Cervus mariannus*), and large flying fox (*Pteropus vampyrus*). Unfortunately, many of the species listed here are known to face threats such as habitat loss and exploitation in the wildlife trade (BCSP, 2020).

D. Conservation Concerns

Like most natural ecosystems, human activities can be seen as a threat to the biodiversity in Basey. Forest conversion has been considered as a threat to biodiversity in Southeast Asia (Sodhi *et al.*, 2004). The Philippines has lost great areas its forest cover during the last century, and Basey is not excluded in this situation. In a study on the forest loss among the terrestrial protected areas in the Philippines (Apan *et al.*, 2017), Samar Island Natural Park has the second highest area of forest lost recorded (12,340 ha). The cumulative forest cover loss rate in SINP is 2.79% from 2001 to 2012. The study also noted a relatively high forest loss in Sohoton Caves and Natural Bridge Park (419 ha, 7.44%) during the same period. Illegal activities such as poaching of timber (Quimio 2016) and hunting of wildlife, like in the case of the Philippine eagle (Ibañez *et al.*, 2016) could also threaten the existence of these valuable species. Moreover, the Maydolong-Basey road is being constructed to boost ecotourism activities in Samar. The road construction has been quite controversial as it will pass through an old-growth forest (Bugayong *et al.*, 2016).

To protect and conserve this biodiversity, the management of these resources should start within the local communities in Basey. Protected areas in the Philippines like SINP and Sohoton Caves and Natural Bridge Park are not entirely free from human habitation (Catibog-Sinha, 2010). Thus, environmental protection in this area must be designed in such a way that people are actively involved, while strictly implementing the existing local and national policies on environment and conservation. The existing ecotourism activities managed by the DENR and the Sohoton Service Cooperative, a people's organization, are a good start to promote biodiversity conservation in Basey. When enforced with other conservation mechanisms and strategies such as protected area approach, payment for ecosystem services, and monitoring, ecotourism can protect forest ecosystems (Brandt and Buckley, 2018). Ecotourism also supports wildlife and protected areas while providing diversified livelihood and strengthened institutions among locals (Stronza *et al.*, 2019).

Table 3. List of vertebrate fauna species in Basey, Samar (Source: Patindol, 2016).

ORDER	FAMILY	SPECIES	COMMON NAME	DISTRIBUTION
Amphibians				
Anura	Ranidae	<i>Sanguirana albotuberculata</i>	Everett's frog	Mindanao PAIC Endemic
		<i>Staurois natator</i>	Mindanao splash frog	Mindanao PAIC Endemic
	Microhylidae	<i>Kalophrynus sinensis</i>	Spotted narrow-mouthed frog	Resident
	Megophryidae	<i>Megophrys stejnegeri</i>	Horned litter toad	Mindanao PAIC Endemic
	Rhacophoridae	<i>Philautus leitensis</i>	Leyte forest tree frog	Mindanao PAIC Endemic
<i>Polypedates leucomystax</i>		Common tree frog	Resident	
Reptiles				
Squamata	Agamidae	<i>Draco mindanensis</i>	Mindanao flying lizard	Mindanao PAIC Endemic
		<i>Hydrosaurus pustulatus</i>	Philippine sailfin lizard	Philippine Endemic
	Scincidae	<i>Brachymeles gracilis</i>	Common burrowing skink	Philippine Endemic
		<i>Otosaurus cumingi</i>	Cuming's sphenomorphus	Philippine Endemic
		<i>Sphenomorphus acutus</i>	Point-headed sphenomorphus	Philippine Endemic
	Gekkonidae	<i>Gekko gecko</i>	Tokay gecko	Resident
	Colubridae	<i>Tropidonophis dendrophlops</i>	Spotted water snake	Philippine Endemic
		<i>Calamaria lumbricoidea</i>	Dark-bellied worm snake	Resident
	Boidae	<i>Malayopython reticulatus</i>	Reticulated python	Resident
	Elapidae	<i>Naja samarensis</i>	Samar cobra	Mindanao PAIC Endemic
<i>Ophiophagus hannah</i>		King cobra	Resident	
Testudinata	Emydidae	<i>Cuora amboinensis</i>	Southeast Asian box turtle	Resident
Birds				
Accipitriformes	Accipitridae	<i>Pithecophaga jefferyi</i>	Philippine eagle	Philippine Endemic
		<i>Haliastur indus</i>	Brahminy kite	Resident
Anseriformes	Anatidae	<i>Anas luzonica</i>	Philippine mallard	Philippine Endemic
Bucerotiformes	Bucerotidae	<i>Buceros hydrocorax semigaleatus</i>	Southern rufous hornbill	Mindanao PAIC Endemic
Caprimulgiformes	Apodidae	<i>Collocalia esculenta</i>	Philippine glossy swiftlet	Philippine Endemic
Columbiformes	Columbidae	<i>Gallicolumba crinigera</i>	Mindanao bleeding-heart	Mindanao PAIC Endemic
		<i>Ducula aenea</i>	Green imperial pigeon	Resident

Table 3. List of vertebrate fauna species in Basey, Samar (Source: Patindol, 2016) (continued).

ORDER	FAMILY	SPECIES	COMMON NAME	DISTRIBUTION
		<i>Streptopelia chinensis</i>	Spotted dove	Resident
		<i>Chalcophaps indica</i>	Asian emerald dove	Resident
Coraciiformes	Alcedinidae	<i>Ceyx melanurus</i>	Philippine dwarf-kingfisher	Philippine Endemic
	Coraciidae	<i>Eurystomus orientalis</i>	Oriental dollarbird	Resident
Cuculiformes	Cuculidae	<i>Centropus melanops</i>	Black-faced coucal	Mindanao PAIC Endemic
		<i>Centropus viridis</i>	Philippine coucal	Philippine Endemic
	Megapodiidae	<i>Megapodius cumingii</i>	Tabon scrubfowl	Resident
Gruiformes	Rallidae	<i>Amanornis phoenicurus</i>	White-breasted waterhen	Resident
		<i>Gallinula chloropus</i>	Common moorhen	Resident
		<i>Gallirallus torquatus</i>	Barred rail	Resident
		<i>Rallina eurizonoides</i>	Slaty-legged rake	Resident
Passeriformes	Artamidae	<i>Artamus leucorhynchus</i> <i>leucorhynchus</i>	White-breasted woodswallow	Resident
		<i>Lalage nigra</i>	Pied triller	Resident
	Cisticolidae	<i>Orthotomus frontalis</i>	Rufous-fronted tailorbird	Mindanao PAIC Endemic
		<i>Micromacromus leytensis</i>	Leyte plumed-warbler	Mindanao PAIC Endemic
	Corvidae	<i>Corvus macrorhynchos</i>	Large-billed crow	Resident
	Estrildidae	<i>Lonchura atricapilla</i>	Chestnut munia	Resident
	Irenidae	<i>Irena cyanogastra</i>	Philippine fairy-bluebird	Philippine Endemic
	Laniidae	<i>Lanius cristatus</i>	Brown shrike	Resident
		<i>Lanius schach</i>	Long tailed shrike	Resident
	Monarchidae	<i>Terpsiphone cinnamomea</i>	Rufous paradise-flycatcher	Philippine Endemic
	Motacillidae	<i>Motacilla cinerea</i>	Gray wagtail	Resident
	Nectariniidae	<i>Aethopyga pulcherrima</i>	Metallic-winged sunbird	Mindanao PAIC Endemic
	Oriolidae	<i>Oriolus chinensis</i>	Black-naped oriole	Resident
	Pachycephalidae	<i>Pachycephala philippinensis</i>	Yellow-bellied whistler	Philippine Endemic
	Passeridae	<i>Passer montanus</i>	Eurasian Tree sparrow	Resident
	Pycnonotidae	<i>Hypsipetes philippinus</i> <i>saturator</i>	Philippine bulbul	Philippine Endemic
		<i>Hypsipetes everetti</i>	Yellowish bulbul	Mindanao PAIC Endemic
		<i>Pycnonotus goiavier</i>	Yellow-vented bulbul	Resident
	Sturnidae	<i>Sarcops calvus</i>	Coletto	Philippine Endemic
		<i>Aplonis panayensis</i>	Asian glossy starling	Resident
Pelecaniformes	Ardeidae	<i>Bubulcus ibis</i>	Cattle egret	Resident

Table 3. List of vertebrate fauna species in Basey, Samar (Source: Patindol, 2016) (continued).

ORDER	FAMILY	SPECIES	COMMON NAME	DISTRIBUTION
Pelecaniformes	Ardeidae	<i>Nycticorax caledonicus</i>	Rufous night heron	Resident
Psittaciformes	Psittaculidae	<i>Loriculus philippensis</i>	Philippine hanging-parrot	Philippine Endemic
		<i>Bolbopsittacus humulatus</i>	Guaiabero	Philippine Endemic
Strigiformes	Strigidae	<i>Bubo philippensis</i>	Philippine eagle-owl	Philippine Endemic
Mammals				
Artiodactyla	Suidae	<i>Sus philippensis</i>	Philippine warty pig	Philippine Endemic
	Cervidae	<i>Cervus mariannus</i>	Philippine brown deer	Philippine Endemic
Carnivora	Viverridae	<i>Paradoxurus philippinensis</i>	Common palm civet	Resident
		<i>Viverra zangalunga</i>	Malay civet	Resident
Chiroptera	Pteropodidae	<i>Pteropus vampyrus</i>	Large flying fox	Resident
Insectivora	Soricidae	<i>Suncus murinus</i>	Asian house shrew	Introduced
Primates	Tarsiidae	<i>Tarsius syrichta</i>	Philippine tarsier	Mindanao PAIC Endemic
	Cercopithecidae	<i>Macaca fascicularis</i>	Long-tailed macaque	Resident
Rodentia	Muridae	<i>Rattus tanezumi</i>	Asian house rat	Introduced

Table 4. List of threatened fauna species in Basey, Samar.

ORDER	FAMILY	SPECIES	CONSERVATION STATUS	
			IUCN	DAO 2019-09
Amphibians				
Anura	Megophryidae	<i>Megophrys stejnegeri</i>	LC	OTS
Reptiles				
Squamata	Agamidae	<i>Draco mindanensis</i>	VU	None
		<i>Hydrosaurus pustulatus</i>	VU	OTS
	Gekkonidae	<i>Gekko gecko</i>	LC	OTS
	Boidae	<i>Malayopython reticulatus</i>	LC	OTS
	Elapidae	<i>Naja samarensis</i>	LC	OTS
Testudinata	Emydidae	<i>Ophiophagus hannah</i>	VU	OTS
		<i>Cuora amboinensis</i>	EN	OTS
Birds				
Accipitriformes	Accipitridae	<i>Pithecophaga jefferyi</i>	CR	CR
Anseriformes	Anatidae	<i>Anas luzonica</i>	VU	VU
Bucerotiformes	Bucerotidae	<i>Buceros hydrocorax semigaleatus</i>	VU	EN
Columbiformes	Columbidae	<i>Gallicolumba crinigera</i>	VU	VU
Coraciiformes	Alcedinidae	<i>Ceyx melanurus</i>	VU	VU
	Megapodiidae	<i>Megapodius cumingii</i>	LC	VU
Passeriformes	Cisticolidae	<i>Micromacronus leytensis</i>	DD	VU
Psittaciformes	Psittaculidae	<i>Loriculus philippensis</i>	LC	CR
Strigiformes	Strigidae	<i>Bubo philippensis</i>	VU	EN
Mammals				
Artiodactyla	Suidae	<i>Sus philippensis</i>	VU	VU
	Cervidae	<i>Cervus mariannus</i>	VU	EN
Chiroptera	Pteropodidae	<i>Pteropus vampyrus</i>	NT	EN
Primates	Tarsiidae	<i>Tarsius syrichta</i>	NT	OTS
	Cercopithecidae	<i>Macaca fascicularis</i>	VU	None

*CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, OTS – Other Threatened Species, LC – Least Concern

CONCLUSION AND RECOMMENDATIONS

This study has shown the unique biodiversity of the limestone forests of Basey, Samar Island. The lists of flora and fauna have shown some endemic and threatened species. While the karst landscape has provided opportunities such as ecotourism, livelihood, and resources to its locals, the human activities in the forests can also cause impacts on biodiversity. Thus, there should be a concerted effort among local sectors on environment, education, culture, and the arts to conserve and sustainably manage the biodiversity in Basey, Samar. Local programs should also promote the active involvement of the women and the youth in the conservation efforts.

The available information from this study is a good baseline for educating the people on the biodiversity of Basey. It can also be used in the formulation of local policies that is supportive of the forest conservation and sustainable use. However, to augment and update this information, on-site monitoring on the limestone forests is still recommended for validation.

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