

## AVIFAUNAL ASSEMBLAGE IN THE EXPANSION SITES OF THE MT. HAMIGUITAN RANGE WILDLIFE SANCTUARY, MINDANAO, PHILIPPINES

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The Protected Area of the Mt. Hamiguitan Range Wildlife Sanctuary (MHRWS) was proposed for expansion in 2016 to protect the remaining biodiversity of the buffer zones and to fortify the core zone. This study provides data on avifaunal assemblage and assessment on the added value of the ca. 2.99 km<sup>2</sup> MHRWS expansion sites to the already protected zone. A combination of transect line survey and mist netting technique were used to sample bird species in four sampling sites in the MHRWS expansion sites. Our inventory of the MHRWS expansion sites revealed 41 species of birds distributed to 10 orders, 24 families and 34 genera. This adds 24 avifauna species to the previously reported birds in Mt. Hamiguitan Range making it a home to 83 species. The low species diversity in the MHRWS expansion sites could be attributed to the poor soil, low forest productivity and habitat loss. The presence of threatened and endemic species of birds in the Mt. Hamiguitan Range Wildlife Sanctuary expansion sites appeals for conservation initiatives by the stakeholders.

**Key words:** biodiversity, diversity index, species composition, threatened and endemic species, similarity index

### Introduction

The Philippines is one of the 18 mega biodiversity countries. It has been regarded by the World Conservation Union (IUCN) and other international conservation organisations as one of the highest priority countries in the world for conservation concern (Oliver & Heaney, 1996). The Philippines is home to 676 species of birds, of which 222 species (33%) are endemic to the Philippines, 325 (48%) are geographically restricted to Mindanao island and 90 (13%) globally threatened (Kennedy et al., 2000; Lepage et al., 2014).

The Mt. Hamiguitan Range Wildlife Sanctuary (MHRWS), Davao Oriental Province, Mindanao, is a protected area covering 68.34 km<sup>2</sup>. The highest peak in MHRWS reaches 1637 m a.s.l. It is characterised by a variety of vegetation types including a unique mossy pygmy forest (Amoroso et al., 2009; Amoroso & Aspiras, 2011). It is the only mountain peak in Mindanao with a pygmy forest inhabited by unique flora and fauna and is considered as the «hottest of the hotspots» (Ong et al., 2002). The mountain is a UNESCO World Heritage Site, ASEAN Heritage Park and also a Mindanao LTER Site. Recent surveys by Relox et al. (2011) in the different vegetation types (75–1500 m a.s.l.) and Mohagan et al. (2015) (lower

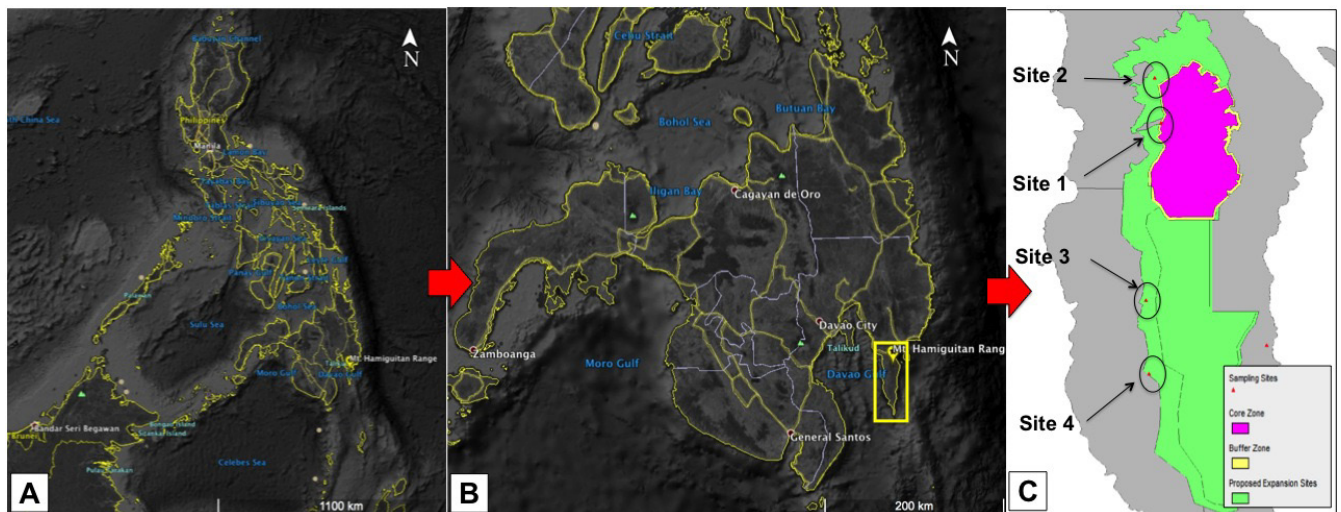
mountain forest, 1000–1100 m a.s.l.) in MHRWS identified 59 species of birds.

In 2016 municipal ordinances to expand the protected area of the MHRWS were issued to protect the remaining biodiversity of the buffer zones and to fortify the core zone. This study aimed to provide insights on the bird community and assessment of the added value of the ca. 2.99 km<sup>2</sup> expansion sites to the already protected core zone.

### Material and Methods

#### *Study sites and emersion*

Avifaunal inventories were carried out at the MHRWS expansion sites from late October to December 2016 and from February to April 2018. The study sites were distributed in the municipalities of San Isidro, Governor Generoso and Mati City in the province of Davao Oriental, Mindanao, Philippines (Fig. 1). The sites consisted of lowland mixed dipterocarp forest about 100 m to 5 km away from human habitation. The emergent trees were *Shorea polysperma* (Blanco) Merr., *Ochrosia* spp. and *Gymnostoma rumphianum* (Miq.) L.A.S. Johnson, reaching heights up to 32 m. *Ficus* spp., other fruit plants, and fallen logs were common (80%) on study site 1 but rare (20%) on study sites 2–4. Exposed rocks were common on all the study sites.



**Fig. 1.** The study sites at Mt. Hamiguitan Range Wildlife Sanctuary expansion sites. A: Philippine map; B: Mindanao map; C: Sampling sites. Site 1: Sitio Tumulite, Barangay La Union, San Isidro (622 m a.s.l.); Site 2: Sitio Tibanga, Barangay Maputi, San Isidro (292 m a.s.l.); Site 3: Sitio Tagibo, Barangay Oregon, Governor Generoso (169 m a.s.l.); Site 4: Sitio Tagaytay, Barangay Luzon, Governor Generoso (175 m a.s.l.).

#### Permit statement

Prior informed consent from the communities was obtained by presenting the research to the stakeholders and members of the Protected Area Management Board (PAMB) of MHRWS for approval and issuance of the Gratuitous Permit (GP) from the Department of Environment and Natural Resources Reg. XI in the Philippines.

#### Sampling, processing and identification

Birds were caught during a total of 170 net days using  $12 \times 2$  m mist nets. A total of 42 net days were installed on sites 1–4. Mist nets were strategically placed in flyways, forest border, foraging areas and forest interior in a vertical forest stratum on the ground (1–5 m), middle canopy (5–10 m) and upper canopy (10–15 m). The nets were left open from 06:00 a.m. to 5:00 p.m. in order to capture diurnal birds and from 5:00 p.m. to 06:00 a.m. to collect nocturnal birds. The nets were monitored at least after every half an hour, and not more than one hour to prevent bird mortality.

Captured birds were immediately marked, photo documented and measured. Standard external measurements such as bill length, tarsus length, wing cord and total length were obtained from each bird. Age, sex and other distinguishing morphological characteristics of each species, if possible, were noted for taxonomic purposes. The captured birds were immediately released on the site of capture. The study employed captured, marked and released methods in which the captured birds' tarsus was tied with a thread to obtain an accurate count of the number of individuals per site.

To supplement the avifauna data, opportunistic sighting/point counting was done along the 2 km transect line. The birds were identified using «Birds of the Philippine Island» by Kennedy et al. (2000). The assessment of conservation and ecological status were based on the existing literature from the International Union for Conservation of Nature (IUCN) Red List and other published literature. The data were treated using BIOPRO software ver. 2.0.

## Results

#### Species richness and composition

The avifaunal inventory in the Mt. Hamiguitan Range Wildlife Sanctuary (MHRWS) expansion sites revealed 41 species of birds distributed to 10 orders, 24 families and 34 genera. Of the total number of species, six (15%) bird species were assessed as threatened: *Nisaetus pinskeri* Preleuthner & Gamauf, 1998 (Mindanao Hawk-eagle), *Ceyx mindanensis* Steere, 1890 (South Philippine Dwarf-kingfisher), *Ceyx argentatus* Tweeddale, 1877 (Silvery Kingfisher), *Todirhampus chloris* Boddaert, 1783 (Collared Kingfisher), *Lonchura punctulata* Linnaeus, 1758 (Scaly-breasted Munia), *Arachnothera flammifera* Tweeddale, 1878 (Orange-tufted Spider hunter) (Fig. 2); 14 (34%) are Philippine endemic species and three (7%) are Mindanao Island endemic species. This current study adds 24 avifauna species to the previously documented birds in Mt. Hamiguitan Range (Relox et al., 2011, Mohagan et al., 2015) making it a home to 83 species. To date the MHRWS expansion sites is home to 49% of the bird species occurring in the entire range.

**Table.** Avifaunal species composition, conservation status and ecological status in the Mt. Hamiguitan Range Wildlife Sanctuary expansion sites

Order/Family	Species	Common name	Assessment		Sampling site			
					1	2	3	4
<b>Accipitriformes</b>					Observed individuals			
Accipitridae	<i>Nisaetus pinskeri</i> Preleuthner & Gamauf, 1998*	Pinsker's Hawk-Eagle	EN	PE	1	–	–	–
	<i>Haliastur indus</i> Boddaert, 1783	Braminy Kite	–	–	1	–	–	5
	<i>Spilornis cheela</i> Latham, 1790*	Crested Serpent Eagle	–	–	1	–	–	–
	<i>Pernis steeri</i> Sclater, 1919*	Philippine Honey Buzzard	–	PE	–	–	1	–
<b>Bucerotiformes</b>								
Bucerotidae	<i>Penelopides affinis</i> Tweeddale, 1877*	Mindanao Hornbill	–	ME	2	1	5	–
<b>Caprimulgiformes</b>					–	–	–	–
Caprimulgidae	<i>Caprimulgus manillensis</i> Walden, 1875	Philippine nightjar	–	–	1	1	2	–
Podargidae	<i>Batrachostomus</i> sp.*	Frogmouth	–	–			3	3
<b>Columbiformes</b>								
Columbidae	<i>Chalcophaps indica</i> Linnaeus, 1758	Common Emerald Dove	–	–	1	2	5	–
	<i>Macropygia phasianella</i> Temminck, 1821	Brown Cuckoo-dove	–	–	–	1	–	–
	<i>Phapitreron leucotis</i> Temminck, 1823	White-eared Brown Dove	–	PE	3	4	1	3
	<i>Phapitreron amethystinus</i> Bonaparte, 1855	Amethyst Brown Dove	–	PE	2	3	–	1
<b>Coraciiformes</b>								
Alcenidae	<i>Ceyx argentatus</i> Tweeddale, 1877*	Southern Silvery Kingfisher	NT	ME	2	–	–	–
	<i>Ceyx mindanensis</i> Steere, 1890*	South Philippine Dwarf Kingfisher	VU	ME	–	1	–	–
	<i>Todiramphus chloris</i> Boddaert, 1783*	Collared Kingfisher	LC	–	–	–	1	–
<b>Galiformis</b>								
Phasianidae	<i>Gallus gallus</i> Linnaeus, 1758*	Junglefowl	–	–	–	–	2	3
<b>Passeriformes</b>								
Corvidae	<i>Corvus macrorhynchos</i> Wagler, 1827	Large-bellied Crow	–	–	2	1	5	2
Dicaeidae	<i>Dicaeum australe</i> Hermann, 1783	Red-keeled Flower Pecker	–	PE	5	–	5	–
Dicruridae	<i>Dicrurus hottentottus</i> Linnaeus, 1766*	Hair-crested Drongo	–	–	1	–	–	–
Estrildidae	<i>Lonchura atricapilla</i> Vieillot, 1807*	Chestnut Munia	–	–	–	–	4	–
	<i>Lonchura leucogastra</i> Blyth, 1846*	White-bellied Munia	–	–	–	–	2	1
	<i>Lonchura punctulata</i> Linnaeus, 1758*	Scaly-breasted Munia	LC	–	–	–	1	–
Hirundinidae	<i>Hirundapus</i> sp.*		–	–	–	7	2	–
Laniidae	<i>Lanius cristatus</i> Linnaeus, 1758*	Brown Shrike	–	–	2	1	5	2
Muscicapidae	<i>Ficedula crypta</i> Vaurie, 1951	Cryptic Flycatcher	–	PE	–	–	4	–
	<i>Rhinomyias ruficauda</i> Sharpe, 1877	Rufous-tailed Jungle-flycatcher	–	–	–	2	–	–
Nectariniidae	<i>Arachnothera flammifera</i> Tweeddale, 1878*	Orange-tufted Spiderhunter	LC	–	1	–	–	–
	<i>Nectarinia jugularis</i> Linnaeus, 1766	Olive-backed Sunbird	–	–	4	3	5	–
	<i>Leptocoma sperata</i> , Linnacus, 1766*	Purple-throated Sunbird	–	PE	–	–	–	2
Pachycephalidae	<i>Pachycephala philippinensis</i> Walkden, 1872	Yellow Bellied Whistler	–	PE	1	–	–	–
Phylloscopidae	<i>Phylloscopus olivaceus</i> Moseley, 1891*	Philippine Leaf Warbler	–	PE	1	–	–	–



Order/Family	Species	Common name	Assessment	Sampling site			
				1	2	3	4
	<i>Phylloscopus borealis</i> Blasius, 1858*	Arctic Warbler	– –	–	–	1	–
Pittidae	<i>Pitta erythrogaster</i> Temminck, 1823*	Red Bellied Pitta	– –	–	–	–	–
Pycnonotidae	<i>Ixos philippinus</i> Forster, 1795*	Philippine Bulbul	– PE	4	6	6	2
	<i>Pycnonotus goiavier</i> Scopoli, 1786	Yellow-vented Bulbul	– –	2	–	–	–
	<i>Pycnonotus urostictus</i> Salvadori, 1870	Yellow-wattled Bulbul	– PE	1	–	3	2
Sturnidae	<i>Aplonis panayensis</i> Scopoli, 1783*	Asian Glossy Starling	– –	1	–	–	7
	<i>Sarcops calvus</i> Linnaeus, 1766	Coletto	– –	–	–	–	1
Timalidae	<i>Macronous striaticiceps</i> Sharpe, 1877	Brown tit-babbler	– PE	3	–	1	–
<b>Pelacaniformes</b>							
Ardeidae	<i>Bubulcus ibis</i> Linnaeus, 1758*	Cattle Egret	– –	–	–	3	2
<b>Piciformes</b>							
Picidae	<i>Chrysocolaptes lucidus</i> Scopoli, 1786*	Greater Flameback Woodpecker	– PE	1	–	–	–
<b>Trogoniformes</b>							
Trogonidae	<i>Harpactes ardens</i> Temminck, 1826	Philippine Trogon	– PE	3	–	–	–
<b>Total number of observed individuals</b>				<b>46</b>	<b>33</b>	<b>67</b>	<b>36</b>
<b>Total number of species</b>				<b>24</b>	<b>13</b>	<b>21</b>	<b>13</b>

Note: \*Species which have not been observed in the previous studies by Relox et al. (2011) nor by Mohagan et al. (2015) in Mt. Hamiguitan Range.

EN – Endangered, VU – Vulnerable, NT – Near Threatened, LC – Least Concern, PE – Philippine Endemic, ME – Mindanao Endemic.



Fig. 2. Some endemic and threatened avifauna in the Mt. Hamiguitan Range Wildlife Sanctuary proposed expansion sites: A) *Ceyx mindanensis*, B) *Phapitreron amethystinus*, C) *Phapitreron leucotis*, D) *Ficedula crypta*, E) *Pachycephala philippinensis*, F) *Chrysocolaptes lucidus*, G) *Phylloscopus olivaceus*, H) *Ixos philippinus*, I) *Pycnonotus urostictus*. Red dot – Philippine endemic, yellow dot – Mindanao endemic, blue dot – vulnerable species.

Diversity and similarity index

The sites 1 ( $H' = 1.27$ ) and 3 ( $H' = 1.26$ ) had the most diverse bird fauna, which was low on the sites 2 ( $H' = 1.08$ ) and 4 ( $H' = 1.11$ ). This could be attributed to the presence of more intact forest community with emergent trees (e.g. *Shorea polysperma*, *Lithocarpus* spp.), that are 26–30 m high on site 1 and 3 compared to site 2 and 4. The sites 1 and 3 may be providing suitable habitats for avifauna species.

Most of the bird species were discordant as shown in Fig. 4. The species compositions of the sites were unique with a low similarity ( $< 50\%$ ). Sites 1 and 3 have the greatest similarity value of 43%. Moreover sites 2 and 1 were related with 40% similarity value, as these sites were adjacent.

Discussion

The result is comparable to the 20 species of birds recorded in the lower montane forest, 0.01 km<sup>2</sup> plot of Mt. Hamiguitan and upper montane forest in Mt. Kitanglad (27 species), Mt. Malindang (32 species) and Mt. Apo (38 species) (Mohagan et al., 2015). Lowland and upper dipterocarp forest has the highest species richness and relative abundance compared to the mountain forest and mossy forest (Silvosa et al., 2007; Caro & Nuñez, 2008).

On the contrary the work of Peterson et al. (2008) in Mt. Kitanglad showed that species richness is low at the lowest elevations. The sites sampled in this work ranged from 169-622 meters above sea level.

Sites 1 and 3, which harbours 24 and 21 species of birds respectively, were the most species rich. Sites 2 and 4 had a low species composition with only 13 species of birds on each site. This could be attributed to the presence of more intact forest community with emergent trees (e.g. *Shorea polysperma*, *Lithocarpus* spp.), reaching heights from 26 to 30 m high on sites 1 and 3.

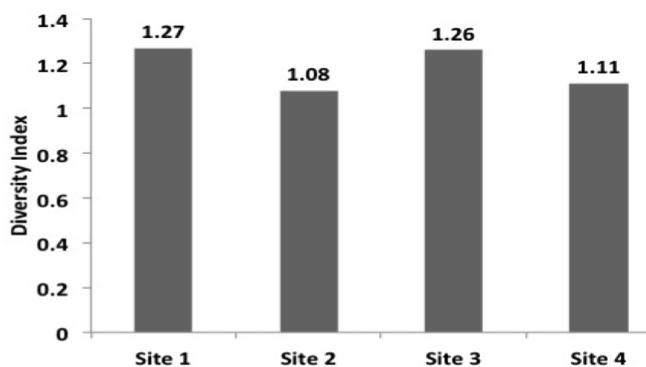


Fig. 3. Shannon-Wiener Diversity index of birds in the Mt. Hamiguitan Range Wildlife Sanctuary expansion sites.

Bray-Curtis Analysis (Single Link)

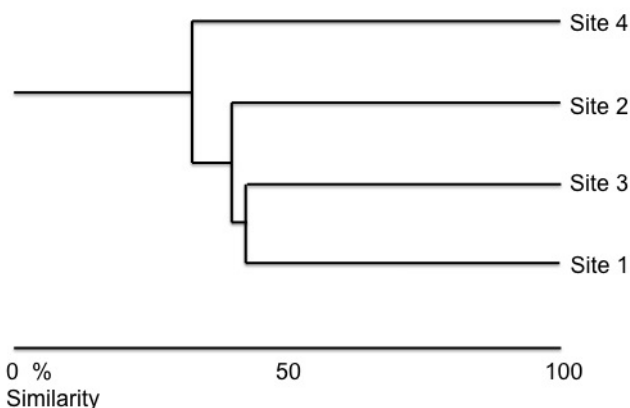


Fig. 4. Dendrogram on the similarity of species composition of birds in the Mt. Hamiguitan Range Wildlife Sanctuary expansion sites.

The vegetation type can influence the avian species diversity and any reduction to the forest will also cause decrease in the species population (Joshi et al., 2012). Moreover, big trees are important determinant of avian species preferred habitat (Mallari et al., 2011). The presence of anthropogenic activities like mining and illegal logging has caused habitat degradation, which leads to biodiversity loss (Suarez & Sajise, 2010). An increase in anthropogenic activities causes the decline of local populations by limiting habitat sustainability, breeding and foraging opportunities and increasing the rate wildlife local extinctions (Sheta et al., 2010). The low species diversity in the MHRWS expansion sites could be attributed to the poor soil (UNESCO, 2014), leading to low forest productivity (Kumar & Maiti, 2013) and habitat loss due to illegal logging, mining and shifting cultivation observed in the sampling sites. The past avifauna surveys in the Philippines revealed that birds were vulnerable or even extinct in the wild due to habitat loss and conversion of forestland (Oliver & Heaney, 1996).

The avifauna diversity value ( $H' = 1.25$ ) of MHRWS expansion sites is comparable to Mt. Hamiguitan protected area ( $H' = 1.098$ ), Mt. Malindang ( $H' = 1.256$ ) and Mt. Kitanglad ( $H' = 1.141$ ) (Mohagan et al., 2015). The vegetation type can influence the avian species diversity and any reduction to the forest will also cause a decrease in the species population (Joshi et al., 2012). Moreover, big trees are an important determinant of avian species preferred habitat (Mallari et al. 2011). The presence of anthropogenic activities like mining and illegal logging has caused habitat degradation, which leads to biodiversity loss (Suarez & Sajise,

2010). An increase in anthropogenic activities causes the decline of local populations by limiting habitat sustainability, breeding and foraging opportunities and increasing the rate wildlife local extinctions (Sheta et al., 2010). The low species diversity ( $H' = 1.25$ ) (Fig. 2) in avifauna is attributed to Mt. Hamiguitan's ultramafic soil (UNESCO, 2014) leading to poor plant productivity and sparse vegetation (Mohagan et al., 2015) and habitat loss (Oliver & Heaney, 1996; Mohagan et al., 2015).

The low similarity (43%) on sites 1 and 3 can be attributed to less anthropogenic disturbances on both sites. Moreover, anthropogenic activities can result to the decline of bird populations by limiting foraging and breeding success that further leads to local extinction (Sheta et al., 2010).

### Conclusions and Recommendations

Our inventory of the MHRWS expansion sites revealed 41 species of birds distributed to 10 orders, 24 families and 34 genera. This adds 24 avifauna species to the previously reported birds in Mt. Hamiguitan Range making it a home to 83 species. The low species diversity ( $H' = 1.25$ ) in the MHRWS expansion sites could be attributed to the poor soil, low forest productivity and habitat loss. The species compositions in the four sampling sites (5–15 km apart) were unique with a low similarity (< 50%). Six (15%) avifauna species were threatened and 17 (ca. 42%) species are endemic to the Philippines. As the MHRWS expansion sites is home to 49% of the bird species occurring in the entire mountain range and habitats, the current study supports the need for conservation initiatives by the stakeholders.

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## СООБЩЕСТВА ПТИЦ НА УЧАСТКАХ, РАСШИРЯЮЩИХ ТЕРРИТОРИЮ ЗАКАЗНИКА ДИКОЙ ПРИРОДЫ ГОРНОГО ХРЕБТА ХАМИГУТАН (МИНДАНАО, ФИЛИППИНЫ)

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Особо охраняемая природная территория (ООПТ) «Заказник дикой природы горного хребта Хамигутан» была предложена к расширению в 2016 г. для сохранения биоразнообразия охранной зоны и укрепления позиций «ядра» ООПТ. В настоящем исследовании представлены данные о сообществах птиц и оценке территории (около 2.99 км<sup>2</sup>), увеличивающей современную площадь охраняемой зоны заказника дикой природы. Для изучения видового состава птиц на четырех исследуемых участках на территории, расширяющей площадь ООПТ, мы использовали комбинацию метода маршрутных исследований на учетных линиях и метода ловчих паутинных сетей. Наше исследование участков, расширяющих территорию заказника дикой природы горного хребта Хамигутан, выявило 41 вид птиц, относящихся к 34 родам, 24 семействам, 10 отрядам. Эти результаты дополняют состав орнитофауны ООПТ на 24 вида птиц, который теперь составляет 83 таксона. Низкое видовое разнообразие участков, увеличивающих площадь заказника дикой природы горного хребта Хамигутан, может объясняться бедными почвами, низкой продуктивностью леса и утратой среды обитания. Наличие угрожаемых и эндемичных видов птиц на территории исследования требует разработки природоохранных инициатив со стороны властей и заинтересованных лиц.

**Ключевые слова:** биоразнообразие, видовой состав, индекс разнообразия, индекс сходства, угрожаемые и эндемичные виды