Advances in Tropical Biodiversity and Environmental Sciences
9(1): 44-52, February, 2025
e-ISSN:2622-0628
DOI: 10.24843/ATBES.2025.v09.i01.p08
Available online at: https://ejournal1.unud.ac.id/index.php/atbes/article/view/1065

Analysis of Bird Diversity and Birdwatching Tracks as EducationTourism in Ngesrepbalong Village, Mount Ungaran

Desyakawa Huril'in, Tamara Lu'lu' Dian Afifa, Selawati Nur Wahidah, Annisa Dwi Lestari, Margareta Rahayuningsih*

Department of Biology, Faculty of Mathematics and Natural Sciences
Semarang State University
Semarang, Central Java, Indonesia
*Corresponding Author: etak_sigid@mail.unnes.ac.id

Abstract. Education tourism is a sustainable activity aimed at reducing environmental impact, protecting ecosystems, promoting economic development, and improving the quality of life of local residents. Edutourism and recreation has important role in socio-economic development and environmental infrastructure. Ngesrepbalong Village is a rural area in Limbangan District, Kendal Regency, Central Java. The diversity of vegetation and the vastness of nature make this area an ideal habitat for various fauna, especially birds. Birdwatching is an edutourism activity that accordance with the potential of this village. Several areas show high potential to be utilized as birdwatching tracks. The research was conducted using the Index Point of Abundance (IPA) method, and the data were analyzed using the Shannon-Wiener Diversity Index and Simpson's Evenness Index. Based on observations of the tracks in Ngesrepbalong Village, the bird diversity index values from highest to lowest were: Watu Ondo (3.03), Curug (2.80), Gempol (2.62), and Tea plantation (2.09), with an average value of 2.635. These results indicate a medium level of bird species diversity. Therefore, Ngesrepbalong Village has potential to be developed into an ideal destination for birdwatching and edutourism, offering natural beauty and biodiversity supported by a rich variety of vegetation.

Keywords: Avifauna, *Birdwatching,* Diversity, Edutourism.

I. INTRODUCTION

Edutourism (Education Tourism) is a sustainable activity aimed at reducing environmental impacts, protecting the environment, encouraging economic development and improving the quality of life of local residents [1]. Edutourism can be a solution to preserve natural resources and provide economic benefits to local communities [2]. Education and recreation has important role in the development of socio-economic and environmental infrastructure in the area where activities are carried out [3].

Ngesrepbalong Village is located in Limbangan District, Kendal Regency, Central Java. Ngesrepbalong village is surrounded by a variety of forest types with high vegetation diversity due to the village's location right on the northern slope of Mount Ungaran with an altitude of 524-1437 MASL (Meters Above Sea Level) [4]. This vegetation diversity provides habitat and vital resources for a wide range of bird species. Bird species richness throughout the Green Open Spaces (GOS) depends on habitat structural characteristics, such as the extent of tree canopy cover, the percentage of impervious surfaces (such as concrete and asphalt), and the presence of shrubs, grasses, and trees [5]. These ecological conditions make Ngesrepbalong Village highly potential as an ecotourism destination capable of attracting visitors interested in nature and birdwatching.

Birdwatching is an edu-tourism activity in accordance with the potential of Ngesrepbalong Village. Birdwatching tourism is an ecological product and an essential part of edutourism. Recognizing its recreational value is crucial for improving human well-being and realizing the local benefits of ecosystem services in areas focused on biodiversity conservation, especially for bird species [6].

Ngesrepbalong Village has several areas at have high potential to be utilized as birdwatching tracks.

Birdwatching tracks consist of posts that have different vegetation characteristics [7]. Previous studies [8] have shown that bird species richness is influenced by habitat conditions, quality, and structural complexity, such as the presence of natural forests, vegetation cover, and landscape features—which has a vital role in supporting both the number and diversity of bird species. The importance of vegetation also provides a function as a food source for birds [9]. Therefore, this study aims to analyze the area's ecological potential and the distribution of bird diversity in Ngesrepbalong Village as a foundation for developing birdwatching trails for edutourism.

II. METHODS

Research Procedures

The research was conducted in Ngesrepbalong Village, Mount Ungaran, during June and July 2023, using the IPA (Index Point of Abundance) method, which is a technique for collecting bird data at specific locations and times. Data was collected at four locations: Gempol, Curug Lawe Secepit, Medini, and Watu Ondo. Observations at each site were repeated three times. Observations were made by documenting bird encounters and activities at each observation point. Birds were observed foraging on the banks of the waterways, perching and playing in vegetation, take shelter, moving from tree to tree, bush to bush, and fly in search of food sources [10].

Data Analysis

The data analysis used in this study refers to the description of bird diversity and attractiveness as the potential to increase birdwatching enthusiasts. Therefore, data analysis was used calculation of Shannon-Wiener Index of diversity and Evenness Index.

Shannon-Wiener Diversity Index (H')

The species diversity index (H') is a value that indicates the diversity of a community [11] In this study, the value of the bird species diversity index was measured using the Shannon-Wiener index formula:

$$H' = -\sum \frac{ni}{N} ln \frac{ni}{N}$$

Where H' (Shannon-Wiener) is the diversity index; ni is the number of individuals; N is the total number of all species [12].

The categories of Shannon Wiener's species diversity index are as follows [13]:

- H ' <1 : Low species diversity
- 1<H ' <3: Medium Species diversity
- H '> 3 : High species diversity

The high bird species diversity is attributed to the relatively even distribution of individuals across the identified species [14].

Simpson's Evenness Index

$$Es = \frac{Ds}{Dmax}$$

Description:
Es = Simpson's species evenness index
Ds = Simpson's species diversity index
Dmax = Simpson's species richness index

Simpson's species evenness index value criteria are divided into 3 categories [Odum, 1993 in [15]]:

- Es = 0 - 030: Low level of evenness
- Es = 0.31 - 0.60: Medium level of evenness
- Es = 0.61 - 1.0: High degree of evenness

The value of the species evenness index indicates the stability of a species assemblage with an evenness threshold value exceeding 0.60, meaning that the species assemblage is said to be stable. the smaller the species evenness index, it can be said that the distribution of species is uneven, which means that the species assemblage does not show the dominance of species so that there may be no competition in meeting life needs [16].

III. RESULTS AND DISCUSSION

Distribution of Avifauna Diversity

The results of observations and analysis of four potential areas that can be used as birdwatching tracks in Ngesrepbalong Village. The results of observations in the four tracks found 34 species and 29 families, and total of 1384 individual birds.

The diversity of species in Ngesrepbalong Village shows that it is in the medium category with an average of 2.635 (Table 2.). The track that has the highest species diversity is the track of Watu Ondo is 3.03. This track has diverse and dense vegetation and is far from settlements and human activities. The track that has the lowest species diversity category is the Medini or tea plantation which is 2.09. In the Tea Plantation track, the vegetation level of trees is low and dominated by shrubs, so there are not many birds that can roost and find food.

Avifauna Species Diversity on Gempol

The Gempol track one of the place observed for avifauna diversity that can be used as a birdwatching track. The Gempol track consists of 10 points with lots of tree vegetation, and also a transportation track for local residents.

The results of observations on the Gempol track show that the number of individuals (N) recorded was 419, while the total species (S) recorded was 33 and the total families (F) was 22 with a species diversity index (H') of 2.6. Based on the criteria (1 < H' < 3), this indicates a medium level of species diversity along the track.

On the Gempol track, the most dominant species is Walet linchi (*Collocalia linchi*). Walet linchi is a very common bird found from the lowlands to highlands that based on observations always moves in groups. Walet linchi is a small insect-eating bird, which feeds by snatching. Walet's food is insects come from plants. An environment that has many trees is the main source of food for Walet. The abundance of tree vegetation along the Gempol track is the reason why many Walet linchi are found.

TABLE 1.
BIRD SPECIES DIVERSITY IN NGESREPBALONG VILLAGE, MOUNT UNGARAN

Family	Local Name	Name of Spesies	Track				Grand Total
			1	**2**	**3**	**4**	
Aegithinidae	Cipoh kacat	*Aegithina tiphia*	2	5	7	2	16
Aegithalidae	Cerecet Jawa	*Psaltria exilis*		1		1	2
Nectariniidae	Madu Kelapa	*Anthreptes malacensis*		3			3
	Pijantung gunung	*Arachnothera affinis*		2	10		12
	Pijantung besar	*Arachnothera robusta*			1		1
	Madu sriganti	*Cinnyris jugularis*	15	15	5	1	36
Dicruridae	Srigunting kelabu	*Dicrurus leucophaeus*	1				1
Sturnidae	Perling Kumbang	*Aplonis panayensis*		5			5
Cuculidae	Wiwik Kelabu	*Cacomantis merulinus*		3	1	2	6
	Wiwik Lurik	*Cacomantis sonneratii*	2		1	3	6
	Wiwik Uncuing	*Cacomantis variolosus sepulcralis*				4	4
	Bubut alang alang	*Centropus bengalensis*				3	3
	Kadalan birah	*Phaenicophaeus curvirostris*	1	3	4		8
	Kadalan kembang	*Zanclostomus javanicus*	3	1	2		6
	Kedasi hitam	*Surniculus lugubris*	2	1	5		8
Apodidae	Layang-layang Loreng	*Cecropis striolata*	2				2
	Walet linci	*Collocalia linchi*	118	69	47	136	370
Picidae	Caladi ulam	*Dendrocopus analis*	2	3			5
Dicaeidae	Cabai bunga api	*Dicaeum trigonostigma*	13	8	1	5	27
	Cabai jawa	*Dicaeum trochileum*	6	12	1	6	25
Eurylaimidae	Sempur Hujan Rimba	*Eurylaimus javanicus*	1	1	2		4
Alcedinidae	Cekakak jawa	*Halcyon cyanoventris*	1	2	3		6
	Cekakak sungai	*Todiramphus chloris*	12	12		1	25
Hemiprocnidae	Tepekong Jambul	*Hemiprocne longipennis*	26	40	20	2	88
Vangidae	Jinjing Batu	*Hemipus hirundinaceus*		11	5	4	20
Hirundinidae	Layang-layang Batu	*Hirundo javanica*	23	1	5	2	31
	Layang-layang asia	*Hirundo rustica*		4			4
Pittidae	Paok pancawarna	*Hydrornis guajanus*	3				3
Estrildidae	Bondol Jawa	*Lonchura leucogastroides*	37	3	4	11	55
	Bondol haji	*Lonchura maja*			2		2
	Bondol peking	*Lonchura punctulata*	26			2	28
	Bondol hijau binglis	*Erythrura prasina*			1		1
Psittacidae	Serindit jawa	*Loriculus pusillus*	1	2	34		37
Pellorneidae	Pelanduk semak	*Malacocincla sepiaria*	1	1	3		5

Locustellidae	Cica koreng jawa	*Megalurus palustris*				3	3
Meropidae	Kirik-kirik senja	*Merops leschenaulti*	1				1
Accipitridae	Elang jawa	*Nisaetus bartelsi*		2		5	7
	Elang ular-bido	*Spilornis cheela*	2	2	2	8	14
	Elang Brontok	*Nisaetus cirrhatus*		1			1
	Elang hitam	*Ictinaetus malaiensis*			1	2	3
Cisticolidae	Cinenen pisang	*Orthotomus sutorius*	12	1	4		17
	Perenjak padi	*Prinia inornata*	3				3
Campephagidae	Sepah kecil	*Pericrocotus cinnamomeus*	30	29	15	6	81
	Sepah hutan	*Pericrocotus flammeus*	3	4	14	1	22
Pnoepygidae	Berencet kerdil	*Pnoepyga pusilla*		1		1	2
Megalaimidae	Takur tohtor	*Psilopogon armillaris*		1			1
	Takur Tenggeret	*Psilopogon australis*	6	36	35	11	88
	Takur tulung-tumpuk	*Psilopogon javensis*	2	1	14	4	21
Vireonidae	Ciu kunyit	*Pteruthius aenobarbus*		3	2	2	7
	Ciu jawa	*Pteruthius flaviscapis*				1	1
Columbidae	Walik kembang	*Ptilinopus melanospilus*				7	7
	Punai penganten	*Treron griseicauda*	5		3		8
	Punai gading	*Treron vernans*	1				1
Pycnonotidae	Cucak kutilang	*Pycnonotus aurigaster*	56	32	38	91	217
	Merbah cerukcuk	*Pycnonotus goiavier*		2	9	6	17
	Merbah corok-corok	*Pycnonotus simplex*		5	1		6
Sittidae	Munguk loreng	*Sitta azurea*		1			1
TOTAL			419	329	303	332	1384

Description:
Track 1: Gempol Track 3 : Watu Ondo
Track 2 : Curug Lawe Secepit Track 4 : Medini track

TABLE 2.
BIRD DIVERSITY ANALYSIS IN NGESREPBALONG VILLAGE

Parameters	Gempol	Curug Lawe Secepit	Watu Ondo	Medini	Total
S	33	39	34	29	34
N	419	329	303	332	1384
F	22	24	21	18	21
H’	2.62	2.8	3.03	2.09	2.635
E	0.7	0.8	0.8	0.6	0.7

Description: S: Number of species, N: Number of individuals, F: Number of families, H': Species diversity index, and E: Evenness index

Fig.1. Observation Track Map

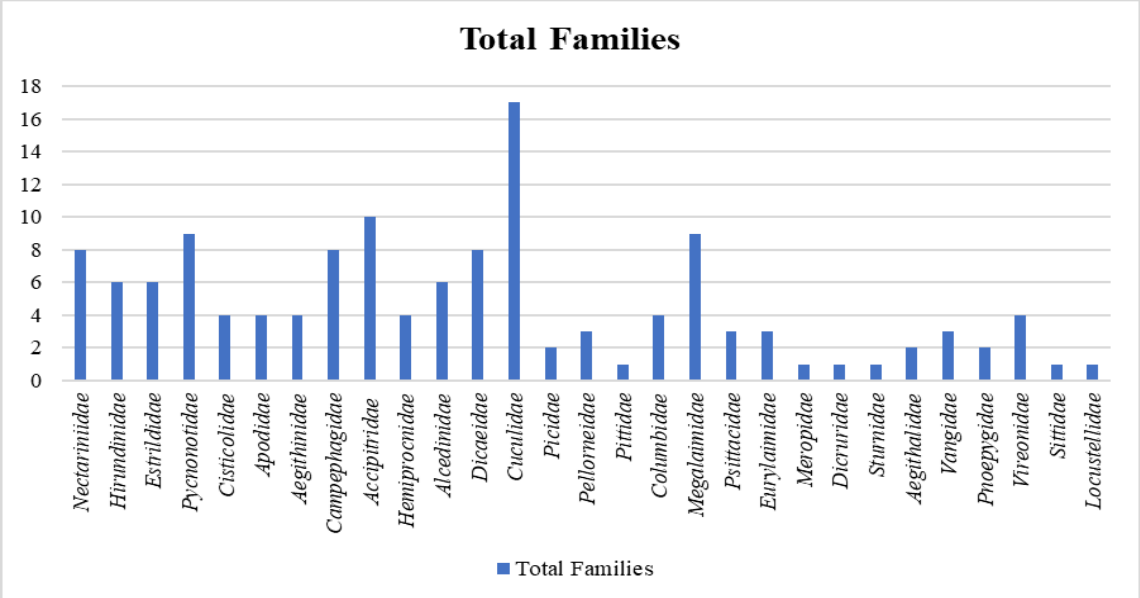

Fig.2. Graph of Total Families

Avifauna Species Diversity on Curug Lawe Secepit

The Curug Lawe Secepit track consists of a forest edge area with a variety of heterogeneous trees and shrubs that can support the lives of various bird species. On the Curug Lawe Secepit track there are 6 points, with the first point being at Kopi Pucu'e Kendal (KPK) and the final point at Curug Lawe Secepit. The number of individuals found was 329 (N), with 39 species (S) belonging to a total of 24 families (F).

The existence of forests that are still maintained in their authenticity can be a home for a variety of animals including birds. Because of that reason, the results of the calculation of the diversity index value (H') of birds in the Curug Lawe Secepit track amounted to 2.8 which indicates that the level of diversity of bird species is medium. This can also be seen from the factor of the existence of trees that are bear fruit, that made an attraction for many birds to perch looking for food.

The Curug Lawe Secepit track is dominated by the Walet linci *(Collocalia linchi)* with the highest number being at the last point in waterfall area. The next species that dominates is Tepekong Jambul (*Hemiprocne longipennis*) which is found at point 2 because the tree vegetation is not too much so that Tepekong Jambul can be seen in flight. Curug Lawe Secepit track can be used as a birdwatching place, this can be seen from the medium species diversity index and high evenness index of 0.8. Therefore, at each point on the Curug Lawe Secepit track there is an even distribution of species. In addition, the scenery that is still beautiful and natural can be a plus point to be used as an edutourism.

Avifauna Species Diversity on Watu Ondo

The Watu Ondo location meets the criteria for a good birdwatching track. Based on the results of observations, this track presents 21 families (F) with 34 species (S), and 303 individuals (N). The species diversity analysis on this track reached 3.02 with a high level of diversity. The most common species found was the Walet linci *(Collocalia linchi).* Some endemic species found on this track include Cekakak jawa *(Halcyon cyanoventris)*, Serindit jawa *(Loriculus pusillus)*, and Takur tulung-tumpuk (*Psilopogon australis*).

Factors influencing the high species diversity are that this track has the potential for a variety of plant vegetation, river flow, and a quiet atmosphere because it is separated from residential areas. Some trees are in a state of fruiting which is a source of food for birds. For example, Cucak kutilang *(Pycnonotus aurigaster)* always stays around coffee trees that bear fruits. In addition, there are also several trees in the flowering phase, where many birds stop to collect nectar and help with pollination.

Avifauna Species Diversity on Medini (Tea Plantation)

The Medini tea plantation track is a 7 point track with regional characteristics dominated by *Camellia sinensis* vegetation. Medini track starts from tea plantation and ends at Dam as the last point. Based on the results of observations, the total number of individuals (N) found was 332, with the number of species (S) being 29 which were included in a total of 18 families (F).

Species diversity (H') in the tea plantation track only reaches 2.09 which falls into the medium category, but of all the existing tracks, the tea plantation has the lowest species diversity with bird species dominated by Walet linci *(Collocalia linchi)* with the number of individual species, 136. This proves that the environmental conditions in the tea plantation trackway affect the low diversity of bird species found, because the vegetation is not diverse and is only a large area dominated by *Camellia sinensis* vegetation, and there are not many tall trees for birds to perch on.

Various Families Found

There were 29 families found in the four track (Fig.2). The graph shows that the most common family is Cuculidae, with 17 individuals belonging to the Cuculidae family. In each track, the Cuculidae family was also found to be the most common. One of the characteristics of this bird is the shape of its feet zygodactyl, which is two fingers facing forward and two other fingers facing backward. Birds belonging to this family have a long tail [17].

Birds of the Cuculidae family are known as parasitism birds. This is because their way of life is detrimental to other individuals. Cuculidae family breeding phase characteristics are depositing their eggs in the nests of other birds, then the eggs are incubated until they are nurtured to flight by the host bird. This also leads to competition between the young of the Cuculidae and the young of its host. The nest of the bird itself also hitches a ride on other host birds by tricking them, so it is called an impostor bird [18].

Species belonging to cuculidae found in all four tracks are Wiwik lurik *(Cacomantis sonneratii)*, Kadalan kembang *(Zanclostomus javanicus*), Kadalan birah (*Phaenicophaeus curvirostris*), Kedasih hitam (*Surniculus lugubris*), Wiwik kelabu (*Cacomantis merulinus*), Bubut alang-alang (*Centropus bengalensis*), and Wiwik uncuing (*Cacomantis variolosus sepulcralis*). One of the most notorious birds that refuses to take care of its young is Kedasih hitam.

The Inventory of Protected Avifauna Species

Field observations of the four birdwatching tracks in Ngesrepbalong village (Gempol, Curug Lawe Secepit, Watu Ondo, and Medini), showed that the average number of species (S) found was 34 of 7 species were found are protected based on P.20/MENLHK/SETJEN/KUM.1 /6/2018 concerning protected plant and animal species (Table 3). The Accipitridae family has the highest number of species, consisting of Elang Brontok *(Nisaetus cirrhatus),* Elang hitam *(Ictinaetus malaiensis),* Elang jawa *(Nisaetus bartelsi),* and Elang-ular bido *(Spilornis cheela).*

In the Accipitridae family, the most abundant individual species was Elang-ular bido. In observations of all members of the Accipitridae family, the most common activity found was soaring. Soaring activity is a way to defend or protect territory from predators or competitors [19].

Fig.3. A) Kadalan Birah; B) Wiwik Lurik

Other protected species found were Paok ancawarna *(Hydrornis guajanus)*, Serindit jawa *(Loriculus pusillus)* and Takur ulung-tumpuk *(Psilopogon javensis)* (Table 3). Serindit jawa is the protected avifauna species that has the highest number of individuals found overall than members of the Accipitridae, Pittidae, and Megalaimidae families.

There is one bird species recorded as having EN (Endangered) conservation status in the IUCN, namely the Elang jawa *(Nisaetus bartelsi).* This indicates that the risk of extinction is very high in the near future (within 20 years or 5 generations has a risk of extinction> 20%) and is at risk of becoming critical. Then there are four bird species that have a conservation status of LC (Least Concern) including Elang brontok *(Nisaetus cirrhatus)*, Elang hitam *(Ictinaetus malaiensis),* Elang-ular bido *(Spilornis cheela),* and Paok pancawarna *(Hydrornis guajanus).*

This means that these species are not threatened with extinction or have a low risk of extinction. Then there are two bird species whose conservation status is NT (Near Threatened), which means they are almost extinct, including the Serindit jawa *(Loriculus pusillus)* and the Takur tulung-tumpuk *(Psilopogon javensis).* A species is approaching the vulnerable category, but is not currently classified as endangered.

TABLE 3.
LIST OF PROTECTED BIRD SPECIES

No	Local Name	Species Name	Family	Consevation status		
				IUCN	CITES	P. 106
1	Elang Brontok	*Nisaetus cirrhatus*	Accipitridae	LC	Appendix II	✓
2	Elang Hitam	*Ictinaetus malayensis*	Accipitridae	LC	Appendix II	✓
3	Elang Jawa	*Nisaetus bartelsi*	Accipitridae	EN	Appendix II	✓
4	Elang Ular Bido	*Spilornis cheela*	Accipitridae	LC	Appendix II	✓
5	Paok Pancawarna	*Hydrornis guajanus*	Pittidae	LC	Appendix II	✓
6	Serindit Jawa	*Loriculus pusillus*	Psittacidae	NT	Appendix II	✓
7	Takur Tulung Tumpuk	*Psilopogon javensis*	Megalaimidae	NT	0	✓

Activities of the Accipitridae Family in Ngesrepbalong Village.

The Accipitridae family is highlighted because it has high ecological importance and strong potential as a main attraction for edutourism. Members of the Accipitridae family are apex predators that has crucial role in maintaining ecosystem balance, making them biologically significant. Additionally, their large size, striking appearance, and charismatic behavior make them highly appealing to the public and ideal for raising awareness about bird conservation.

The Accipitridae family species that found in this research are Elang brontok *(Nisaetus cirrhatus)*, Elang hitam *(Ictinaetus malaiensis),* Elang jawa *(Nisaetus bartelsi),* and Elang-ular bido *(Spilornis cheela).* The activities of the Accipitridae family belong to the raptor species. Raptors are birds with a reputation for hunting, that has body size varies from small to large. Its unique and captivating morphology includes a sharp, durable beak and toes, a large and stout wingspan, and the best eye focus for long-distance hunting. Birds hunting prey have distinctive

habits and actions, such as soaring and swooping quickly to pounce on prey [20].

In some plantation tracks such as the KPK and Watu Ondo tracks, the Elang jawa was found to have a similarity where coffee plants become food for langurs, squirrels and birds. Thus, the availability of Elang jawa's food in the plantation area is also sufficient. At the time of observation, the activity of Elang-ular bido *(Spilornis cheela)* was seen flying high by circling (soaring) while making sounds in the morning before noon. The sound released by the Bido snake eagle when flying in the KPK area has a distinctive tone, namely "kiu-liu or ke-liik-liik". The presence of the Elang-ular bido can be seen in all four observation tracks Gempol, Curug Lawe Secepit, Watu Ondo and Medini. The bird's flying activity was carried out during sunny weather in the morning to afternoon from 08.30 - 14.30 WIB to look for prey. The soaring activity was also found in other eagles, namely Elang hitam *(Ictinaetus malaiensis)* and Elang brontok *(Nisaetus cirrhatus).*

Observations was conducted in June and July were months, when the raptors went through a pre-migration period. Pre-migration in birds refers to a series of activities undertaken by birds before they embark on a long distance migratory journey. This is an important preparation period that involves several physical and behavioral changes to help them face the challenging journey. It is also important to note that at this stage, eagles, like other birds, develop a keen migratory instinct. The main reason birds migrate from their home range is to avoid adverse weather conditions due to seasonal changes, which lead to reduced food resources. Moving birds to other areas where conditions are more conducive will ensure their survival [22].

They migrate in search of tropical places with warm temperatures, such as Indonesia. Birds have a natural ability to navigate and locate their migratory destinations using various methods such as, using their senses of sight, hearing and smell to understand their surroundings. They observe the patterns of the sun, stars and moon to determine direction.

With the migration of raptors from other regions, there is competition for territory between the migrating raptors and the native raptors of the region. Therefore, during the pre-migration period, many raptors are found flying for a long time until the afternoon even though the heat has decreased. Defense behavior can also be done by vocalizing during flight. This aims to notify raptors of their territory, feeding calls to their mates and offspring, and possible threats.

Ngesrepbalong Village as a Place for Birdwatching & Educational Tourism

Ngesrepbalalong Village, located on the northern slopes of Mount Ungaran in Central Java, is a tourist destination renowned for its abundant natural beauty and biodiversity. There are various types of plants located in Ngesrepbalong Village, ranging from low to high level, as well as unique animals that still exist. Some interesting attractions in the region include Promasan Temple, Japanese Cave, Sendang Pengilon, Ungaran Peak Nature Tourism, Curug Lawe Secepit, and Medini Tea plantation.

The facilities provided have also made it easier for visitors such as parking areas, meeting halls, cafes, forest trails, public bathrooms, and wifi areas. Souvenir products from this village, such as endemix coffee, oyol tea, tisane kembang telang, and majipa, can be found at KPK. Ngesrepbalong village can be said to be a complete destination for a diverse natural and cultural experience.

Based on the level of species diversity (H') in Ngesrepbalong Village, it shows that it is in the medium category with an average of 2.635, with the track that has the highest species diversity is the Watu Ondo track, which is 3.03. Each track has its own characteristics, such as the Watu Ondo track with natural diversity that is still beautiful, characterized by a lot of plant vegetation, river flow, and a quiet atmosphere because it is separated from residential areas, making it a suitable place for birds to live and not rule out the possibility of bird species diversity on the Watu Ondo track is suitable to be used as a place for birdwatching and edutourism.

The track that has the potential to be a place for birdwatching and further education is the Curug Lawe Secepit track. This track has a bird species diversity level of 2.8 making it suitable for birdwatching, besides that the Curug Lawe Secepit track also has lush vegetation with a wide viewing area.

Natural wealth that can be seen from a variety of flora and fauna such as the presence of Javan langurs and forest edge areas with a variety of heterogeneous trees that support wildlife. The Curug Lawe Secepit track also has the potential to become an educational site with a place to relax at KPK as the starting point and the waterfall as the endpoint.

The Gempol track with a bird species diversity level of 2.62 certainly makes the track worthy of birdwatching. The abundance of tree and shrub vegetation along the track makes it home to several species of birds. The Gempol track consists of the transportation track for residents, but only a handful of residents go through this track so that the situation along the track seems quiet and far from noise. However, it does not rule out the possibility of the Gempol track becoming a birdwatching spot, precisely with the

road already available making it easier for migrants who will carry out birdwatching activities.

The last track is the Medini Tea plantation track, with a bird species diversity level of 2.09. The Medini Tea plantation track has undiversified vegetation consisting of shrub vegetation and low levels of tree vegetation, so not many birds were found roosting. Species that dominate this track include *Collocalia linchi* and *Pycnonotus aurigaster*.

Ngesrepbalong Village has the potential for birdwatching and eco-tourism destinations that offer natural wealth and significant bird species diversity. Based on the analysis of the level of bird species diversity, Watu Ondo, Curug Lawe Secepit, and Gempol tracks are ideal places for birdwatching, with diverse vegetation.

In addition, these places can be planned with the addition of facilities, such as live-in, homestay, camping, and cultural tourism, making Ngesrepbalong Village a complete destination. There are also facilities that facilitate visitors, such as cafes, tracking tracks, and parking areas. Thus, Ngesrepbalong Village is a suitable place for nature and bird lovers and offers a diverse and memorable educational experience.

CONCLUSION

Based on observations of existing tracks in Ngesrepbalong Village, the highest species diversity index values were recorded at Watu Ondo (3.03), followed by Curug Lawe Secepit (2.8), Gempol (2.62), and the Tea Plantation (2.09), with an overall average of 2.635. The evenness index values were also relatively high: Watu Ondo (0.8), Curug Lawe Secepit (0.8), Gempol (0.7), and the Tea Plantation (0.6), averaging 0.7. These results indicate that bird species diversity in Ngesrepbalong Village is classified as medium, while species evenness is high. Therefore, Ngesrepbalong Village holds strong potential as a birdwatching and edutourism destination, offering natural beauty, species richness, and diverse vegetation.

ACKNOWLEDGMENT

This journal article is written based on the results of research (Analysis of Birdwatching tracks as a Means of Educational Tourism in the Village of Ngesrepbalong, Mount Ungaran) funded by LPPM State University of Semarang through the PKK Ormawa Program (Organizational Research). The opinions expressed here are those of the authors and do not necessarily reflect the views of the funding agency.

REFERENCES

[1] Gigović L, Pamučar D, Lukić D, Marković S. GISFuzzy DEMATEL MCDA model for the evaluation of the sites for ecotourism development: A case study of "Dunavski ključ" region, Serbia. Land use policy. 2016 Dec 15;58:348-65.

[2] Khazaee Fadafan F, Soffianian A, Pourmanafi S, Morgan M. Assessing ecotourism in a mountainous landscape using GIS - MCDA approaches. Applied Geography. 2022 Oct 1;147.

[3] Alrawaf TI, Abubakar IR, Alshabibi NM, Al-Matar KM, Dano UL, Elhadi EMA, et al. The distribution o f ecotourism activities and potential consequences for the Saudi desert ecosystem. J Arid Environ [Internet]. Jun 2023;213:104950. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0140196323000216

[4] Kaushik M, Tiwari S, Manisha K. Habitat patch size and tree species richness shape the bird community in urban green spaces of rapidly urbanizing Himalayan foothill region of India. Urban Ecosyst. 2022 Apr 1;25(2):423-36.

[5] Garizábal-Carmona JA, Mancera-Rodríguez NJ. Bird species richness across a Northern Andean city: Effects of size, shape, land cover, and vegetation of urban green spaces. Urban For Urban Green. 2021 Sep 1;64.

[6] Liu T, Ma L, Cheng L, Hou Y, Wen Y. Is ecological birdwatching tourism a more effective way to transform the value of ecosystem services a case study of birdwatching destinations in mingxi county, china. Int J Environ Res Public Health. 2021 Dec 1;18(23).

[7] Sari DP, Fadzillah S, Trianingsih W. Birdwatching Track: Peluang Konservasi Burung di RPH Tambah Ngaryoso Karanganyar Jawa Tengah. Techno: Journal of Research. 2020 May 27;9(1):297.

[8] Ming Tu H, Fan M, Jen Ko JC. Diferent Habitat Types Afect Bird Richness and Evenness. Scientific reports. 2020 Jan 1221(2020)

[9] Afif Fuadi, Aisyianita RA, Hastuti SDS. Potensi Birdwatching Sebagai Salah Satu Daya Tarik Wisata di Desa Wisata Jatimulyo, Kecamatan Girimulyo, Kabupaten Kulon Progo. MWS [Internet]. 2021;16(2). 1007-1015

[10] Sunarno, Rahadian R, Wiradarma H, Kurniawan A, Tamar IM. The species diversity of avifauna in Bukit Cinta Klaten in supporting the development of birdwatching area of Gunung Gajah Village Klaten. In: Journal of Physics: Conference Series. Institute of Physics Publishing; 2019.

[11] Anjani, W., Umam, A. H., & Anhar, A.. Keanekaragaman, Kemerataan, dan Kekayaan Vegetasi Hutan Raya Lae Kombih Kecamatan Penanggalan, Kota Subulussalam. Jurnal Ilmiah Mahasiswa Pertanian. 2022. 7(2), 770–778. https://doi.org/10.17969/jimfp.v7i2.20136

[12] Wahyuningsih F, Arthana IW, Saraswati SA. Echinodermata Community Structure in Seagrass Meadow Area of Samuh Beach, South Kuta District, Badung Regency. Current Trends in Aquatic Science. 2020;3(2):52-8.

[13] Asrianny, Hendra Saputra, Amran Achmad. Identifikasi Keanekaragaman dan Sebaran Jenis Burung untuk Pengembangan Ekowisata Birdwatching di Taman Nasional Bantimurung Bulusarung. Jurnal Perennial. 2018;14(1):17-23

[14] Ardiansyah IN, Matovani RT, Pertiwi DA, Salsabila G, Aryanti NA. Potensi Pengembangan Jalur *Birdwatching* Berdasarkan Distribusi Keanekaragaman Burung di Hutan Lindung RPH Sumbermanjing Kulon KPH Malang. Conservation Media. 2019 Aug 2;24(2):200-206.

[15] Wahyuningsih E, Faridah E, Budiadi, Syahbudin. Komposisi dan Keanekaragaman Tumbuhan Pada Habitat Ketak (Lygodium circinatum (Burm. (Sw.)) di Pulau Lombok Island, Nusa Tenggara Barat. Journal of Tropical Forest. 2019;7(1):92-105.

[16] Adelina M, Harianto SP, Nurcahyani N. Keanekaragaman Jenis Burung Di Hutan Rakyat Pekon Kelungu Kecamatan Kota Agung Kabupaten Tanggamus. Journal of Sylva Lestari. 2016;4(2):51-60.

[17] Mulyani, Y. A., & Iqbal, M. Birds in the Sembilang Dangku Area. 2020.

[18] Widodo, W., & Widiyaningrum, P. Selection of Cuculidae to the Hosts Based on the External Characteristics of the Eggs. Bioscience: Journal of Biology & Biology Education. 2018;10(1), 1-8.

[19] Rohman, F., Ginantra, I. K., & Dalem, A. A. G. R. Habitat use by brontok eagles, bido snake eagles and white-bellied sea eagles in Lake BuyanDanau Tamblingan Nature Park and surrounding areas. Journal of Metamorphosa. 2019;6(1), 25-32.

[20] Iswandaru, D., & Rohman, F. Birding and Avitourism: Potential Analysis of Birds in the Buffer Villages Around Conservation Area. Journal of Sylva Lestari. 2023;11(2), 247-269

[21] Putra, A. D. K. Migratory Birds of North Maluku. Ministry of Environment and Forestry. Jakarta. 2023.