THE DIVERSITY OF BIRDS AND ATTRACTIVE BIRDS AS AVITOURISM OBJECTS IN GUNUNG BROMO UNIVERSITY FOREST, KARANGANYAR, CENTRAL JAVA

KEANEKARAGAMAN BURUNG DAN BURUNG YANG MENARIK SEBAGAI OBJEK *AVITOURISM* DI KHDTK GUNUNG BROMO, KARANGANYAR, JAWA TENGAH

Aditya[1], Sugiyarto[2], Sunarto[2], Agung Budiharjo[2], Galuh Masyithoh[3], Ike Nurjuita Nayasilana[3]

[1]Kepak Sayap Study Club, Department of Biology, Faculty of Mathemathics and Natural Sciences, Universitas Sebelas Maret, Jalan Ir. Sutami 36A, Surakarta, Indonesia, 5712
[2]Department of Biology, Faculty of Mathemathics and Natural Sciences, Universitas Sebelas Maret, Jalan Ir. Sutami 36A, Surakarta, Indonesia, 5712
[3]Department of Forest Management, Faculty of Agricultures, Universitas Sebelas Maret, Jalan Ir. Sutami 36A, Surakarta, Indonesia, 5712
E-mail: *adityagamand@gmail.com*

ABSTRAK

KHDTK Gunung Bromo sebelumnya merupakan kawasan wisata yang harus direvitalisasi, salah satunya sebagai objek wisata avitourism, tetapi data tentang keanekaragaman burung masih sedikit. Penelitian ini bertujuan untuk mengetahui keanekaragaman burung dan burung yang menarik sebagai objek avitourism di KHDTK Gunung Bromo. Pengamatan burung menggunakan metode *encounter rates* dalam enam garis transek. Analisis deskriptif kuantitatif dan kualitatif digunakan untuk menjelaskan keanekaragaman burung dan burung yang menarik sebagai objek avitourism. Hasil penelitian mencatat 44 jenis burung tergolong dalam 26 famili. Keanekaragaman burung termasuk kategori sedang dengan indeks Shannon-Wiener sebesar 2,75. Kelimpahan burung dikategorikan menjadi melimpah sebanyak satu jenis, umum sebanyak tujuh jenis, sering sebanyak delapan jenis dan tidak umum sebanyak 28 jenis. Burung yang menarik di KHDTK Gunung Bromo sebagai objek avitourism meliputi tiga jenis raptor, enam jenis burung endemik, lima jenis burung berstatus konservasi tinggi, dan burung menarik lainnya seperti burung berwarna cerah dan bersuara merdu. Komunitas burung di KHDTK Gunung Bromo potensial untuk dikembangkan menjadi objek avitourism dengan beberapa pendukung dan kendala.

Kata kunci: Avitourism, Keanekaragaman Burung, KHDTK Gunung Bromo.

ABSTRACT

The Gunung Bromo University Forest is a former tourism area which must be revitalized, one of them is to be an avitourism object. However, the information of birds diversity is still lacking. The research aimed to determine bird diversity and attractive birds as avitourism object in Gunung Bromo University Forest. The bird observation was conducted using the encounter rates method in six line transects. The quantitative and qualitative descriptive analysis was used to describe bird diversity and attractive birds as avitourism objects. The research resulted 44 species of birds belong to 26 families were found in the area. The diversity of birds belongs to moderate category with Shannon-Wiener Index of 2.75. The relative abundance of birds were categorized into one species of abundant, seven species of common, eight species of frequent, and 28 species of uncommon. Attractive birds in Gunung Bromo University Forest as avitourism object were three species of raptor, six species of endemic birds, five species of high conservation value birds, and other attractive birds such as colorful birds and songbirds. The bird community in Gunung Bromo University Forest has the potential as an object of avitourism with some opportunities and obstacles.

Keywords: Avitourism, Birds Diversity, Gunung Bromo Universitas Forest.

INTRODUCTION

Birdwatching is the activity of viewing birds in their natural habitat (Moss 2004). This activity is popular in several countries like USA and South Africa, where they have become tourism industry known as avitourism. In USA, avitourism activities contributed 76 billion USD in 2016 (U.S. Fish & Wildlife Service 2016). Avitourism in South Africa gave benefits to develop local communities and biodiversity conservation sustainably (Bigss *et al.* 2011). The benefit of avitourism from conservation aspect is turning hunting tourism to non - consumptive tourism.

Birdwatching also supports bird conservation through citizen science who collects data, monitors population, species distribution, and habitat use of birds (MacFarlane & Boxall 1996).

Indonesia is one of popular avitourism destinations in the world where 17% of the world bird species recorded in the area (Jepson 1997). The destination of avitourism in Indonesia is very diverse such as national parks, coastal areas, offshore islands, and urban areas like Jakarta and Bogor Botanical Garden (Jepson 1997). In Java, avitourism is concentrated in Western and Eastern Java, while Central Java is less popular than other parts of the island (Taufiqqurahman 2019). Research on the development of new avitourism object in Central Java is conducted only in few places i.e Karimun Jawa National Park, Gunung Merbabu National Park, Curug Cipendok, and Jatimulyo Village (Budiman 2014, Susmiyati 2016, Afif *et al*. 2018, Aditya *et al*. 2019). Thus, more research must be conducted to develop new avitourism object in Central Java, especially urban and suburban areas.

There are three stages for the development of avitourism area such as making strategic plan, managing bird habitat, and birdwatching practice (Ahyadi *et al.* 2014). The first strategic plan that must be conducted is collecting information about bird species diversity. The information on bird diversity can determine which attractive bird can be the object for avitourism. The information on bird diversity in Gunung Bromo University Forest (hereafter GBUF) is lacking. This research aims to know bird diversity and attractive birds as avitourism object in GBUF. This paper discusses bird diversity, relative abundance, and

avitourism. For the scope of avitourism, it focuses on attractive birds. Other factors for tourism such as accessibility, infrastructure, tour guides, etc. are less discussed.

MATERIALS AND METHODS
Study Area

The research was conducted in GBUF (Figure 1). Administratively, the area is part of Delingan Village and Gedong Village, Karanganyar District, Central Java Province. This area was a former pine and timber production forest. It was also a tourism forest which managed by Perum Perhutani KPH Surakarta. In 2018, the status of the area was shifted to forest area for forestry education and training which managed by Universitas Sebelas Maret.

Procedures
Bird Observation

The observation of bird was performed by encounter rates method with line transect following pathways in May-August 2019. Encounter rates method is retrieval of bird data with particular place and time (Bibby *et al*. 2000). Line transects was performed in six different habitats such as mixed forest, riverstream, cropland, pine monocultures, pine *Pinus merkusii* and mahogany *Swietenia* sp. plantation, mixed industrial plants plantations i.e. pine, mahogany, rosewood *Dalbegia latifolia*, and cassia tree *Senna siamea*. Transect length of daytime observation was 1500m, divided into 5 points each, with 300m distance, except in cropland. The transect length in cropland was 1000m, divided into 5 points each, with 200m distance. For night observation, the transect length was 900m, divided into 3 points each, with 300m distance
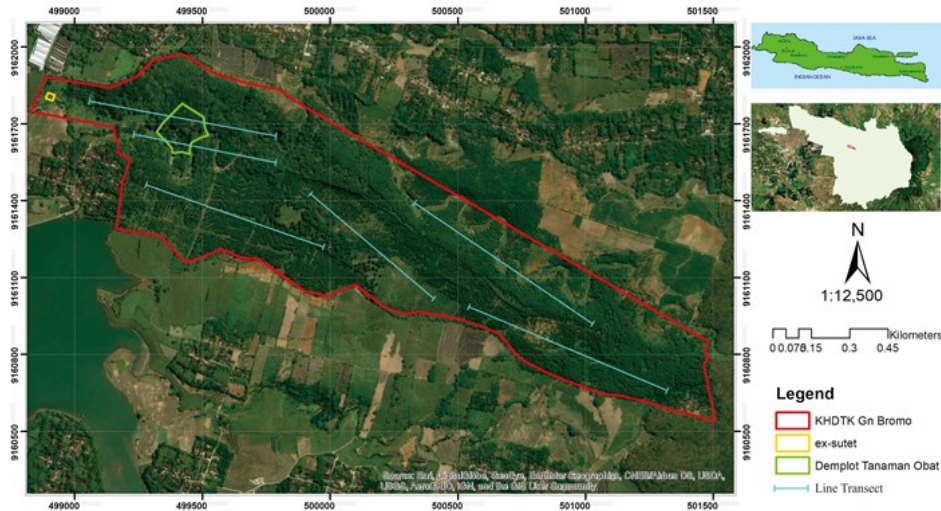
Figure 1. Maps of Gunung Bromo University Forest.

in all line transects. The observation was conducted by walking within steady pace in all transects and stopped at the point with 10 minutes period. The daytime observation was conducted in the morning (6-10 am) and afternoon (1-5 pm), while night observation was at 7-10 pm. The daytime observation was conducted twice for each transect in different days, while night observation was conducted only in one-time observation. The tools for bird observation used binocular Celestron 10x25mm, bridge camera Canon PowerShot, sound portable, field notebook, flashlight, and stationery. The sound portable was used in the night observation to attract nocturnal bird.

Online Questionnaire

An online questionnaire was used to know people's perspective about attractive birds in GBUF. The questionnaires were sent to WhatsApp Group 'Pengamat Burung Indonesia' and 'Kelompok Studi Kepak Sayap' which all member of groups are Indonesian birdwatchers. The number of respondents were 30 people who randomly filled the questionnaires. The content of questionnaire were general identities as birdwatcher such as name, age, domicile, last grade education, how long have become a birdwatcher, motivation as a birdwatcher, and frequency of birdwatching; as well as birdwatcher's perspectives about the attractiveness of each bird species in GBUF with score 1-10 (1=not attractive until 10=very attractive). The list of bird was showed to respondents based on the result of study with the addition information such as picture of species, size of species, the relative abundance, and the criteria of attractiveness for each species.

Data Analysis

The quantitative and qualitative descriptive analysis were used to describe bird diversity and attractive birds as an attraction of avitourism.

Shannon-Wiener Index and Evenness Index

The diversity of birds was calculated using Shannon-Wiener Index (H') and Evenness Index (J) (Magurran 1998). The total

number of individual species-i (ni) resulted from the total number of individuals in all line transects which the maximum number between two time observations.

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

H' : Shannon-Wiener Index

ni : total number of individual species-i

N : total number of all individual in the community

Category of diversity based Magurran (1998) namely:

H'< 1.5 = low diversity

$1.5 \leq H' \leq 3.5$ = moderate diversity

H'> 3.5 = high diversity.

$$J = \frac{H'}{\ln S}$$

J : evenness index

H' : Shannon-Wiener Index

S : number of species.

Encounter Rates

Relative abundance was calculated using encounter rates (ER) that the total number of bird individuals divided by total period of observation, then divided into crude cardinal categories (e.g. abundant, common, frequent, uncommon, and rare) (Lowen *et al.* 1996 in Bibby *et al.* 2000) (Table 1). The total number of encountered individuals derived from the total number of two times observations for diurnal bird and one observation for nocturnal bird. The total period of observations were 64 hours for diurnal bird and 18 hours for nocturnal bird.

$$ER = \frac{\text{The total number of individuals encountered}}{\text{The total period of observation}} \times 10$$

Table 1. Encounter rates to ordinal scale of relative abundance.

Encounter Rates	Ordinal Scale
<0.1	Rare
0.1–2.0	Uncommon
2.1–10.0	Frequent
10.1–40.0	Common
40.0+	Abundant

Attractiveness of Birds

Criteria for attractive bird as avitourism object follow Green & Jones (2010), Dalem *et al.* (2014), and Garnet *et al.* (2018). The score of attractiveness was calculated by mean with standard deviation from score of all respondents. The score was assigned into four categories, namely very attractive (score ≥ 8.00), attractive (5.00 ≤ score < 8.00), less attractive (2.00 ≤ score < 5.00), and not attractive (score < 2.00).

RESULTS AND DISCUSSION

The Diversity of Birds in GBUF

The research resulted 44 species of birds belong to 26 families found in GBUF (Table 2). The dominant family is Pycnonotidae with four species followed by Estrildidae with three species (Table 2). The Pycnonotidae is a family of birds which tolerant to disturbance so it is common in human-modified habitats (Corllet 1998). Its feeding source is relatively wide-ranging from fruit to insects so it is easily found in various places (Shakya & Sheldon 2017). The family Estrildidae is granivore so it is supported by the existence of farmland bordering GBUF (MacKinnon *et al.* 2010).

The diversity of birds in GBUF belongs to moderate category with value of 2.75. Previous research showed that the plantation

forest has moderate bird diversity (Kaban *et al.* 2017). It correlated with the structure and composition of vegetation which dominated by industrial plants i.e. Merku's Pine *Pinus merkusii*, Mahagony *Swietenia* spp., rosewood *Dalbegia latifolia*, and cassia tree *Senna siamea* in GBUF. This structure and composition of vegetation was less complex i.e. uniform and dominated only by some plants. The complexity of vegetation was correlated with place viability for feeds, roosts, and nesting sites (Sutopo 2008).

The diversity of birds is not yet maximum, shown from the evenness index (J) which only 0.73 showing there are dominant bird species such as Sooty-headed Bulbul *Pycnonotus aurigaster* and Javan Munia *Lonchura leucogastroides* (Table 2). This is due to the diversity of habitat that has been medium varied, consisting of only four types, namely oligoculture forest, mixed forest, cropland, and river stream. The varied habitat will increase the diversity of birds because it relates to the activity of birds in the search for feed and drinking (Warsito & Bismarch 2009).

Relative Abundance of Birds in GBUF

The abundance of birds can be seen from encounter rates although it lacks the accuracy of abundance (Bibby *et al.* 2001). Only one species namely Sooty-headed Bulbul (64.38) belongs to the abundant category (>40.0). It is a member of Pycnonotidae which included in the tolerant birds because it has many variations of feed from fruit to insects (Shakya & Sheldon 2017). Sooty-headed Bulbul is a generalist bird encountered in various habitats such as open area, bush habitats, forest edges, secondary forest, parks, and even urban areas (MacKinnon *et al.*

2010). Seven species included in the common category (10.1-40.0), namely Javan Munia (27.66), Common Iora *Aegithina tiphia* (18.75), Olive-backed Sunbird *Cinnyris jugularis* (15.78), Cave Swiftlet *Collocalia linchi* (15.63), Yellow-vented Bulbul *Pycnonotus goiavier* (14.38), Eastern Spotted-dove *Spilopelia chinensis* (11.25), and Small Minivet *Pericrocotus cinnamomeus* (10.31). Javan Munia is a tolerant granivore is not confined to rice grain but can also eat grass seeds (MacKinnon *et al.* 2010). Common Iora is an insectivore bird and slightly consuming fruit (MacKinnon *et al.* 2010). It is widespread and common in coastal lowlands up to 1000m in Sumatra, Kalimantan, Java, and Bali (MacKinnon *et al.* 2010). Olive-backed Sunbird is a nectarivore bird but also feeds on insects. It is the most common sunbird in the open lowland area (MacKinnon *et al.* 2010). Cave Swiftlet is the most common species of swiftlet in all altitude of Java Island (MacKinnon *et al.* 2010). Yellow-vented Bulbul is also a member of Pycnonotidae family but compete with Sooty-headed Bulbul that has same niche so the abundance was lower. Eastern Spotted-dove is common to encounter in Greater Sundas, especially in open areas and rural areas (MacKinnon *et al.* 2010). Small minivet is widespread and common in Java-Bali lowland (MacKinnon *et al.* 2010). Other birds were included in the frequent category (8 species) and the uncommon category (28 species). These species of birds were mostly birds of prey (e.g. Changeable Hawk-eagle, Crested Serpent-eagle, Sunda Scops-owl), have a specific niche (e.g. Blue-eared Kingfisher, Common Flameback, Pin-tailed Parrotfinch), feral species (e.g.

Tabel 2. List of Bird Species in GBUF.

Families	Scientific Name	English Name	Σ Max Individual (s) Number	Encounter Rates (ind/h)	Ordinal Scale
Acanthizidae	*Gerygone sulphurea*	Golden-bellied Gerygone	4	0.63	Uncommon
Accipitridae	*Spilornis cheela*	Crested Serpent-eagle	8	1.41	Uncommon
	Nisaetus cirrhatus	Changeable Hawk-eagle	7	1.25	Uncommon
Aegithinidae	*Aegithina tiphia*	Common Iora	79	18.75	Common
Alcedinidae	*Todiramphus chloris*	Collared Kingfisher	16	3.75	Frequent
	Halcyon cyanoventris	Javan Kingfisher	15	3.13	Frequent
	Alcedo meninting	Blue-eared Kingfisher	2	0.47	Uncommon
Apodidae	*Collocalia linchi*	Cave Swiftlet	69	15.63	Common
	Apus nipalensis	House Swift	2	0.31	Uncommon
Artamidae	*Artamus leucoryn*	White-breasted Woodswallow	2	0.31	Uncommon
Champepagidae	*Pericrocotus cinnamomeus*	Small Minivet	42	10.31	Common
	Lalage nigra	Pied Thiller	2	0.31	Uncommon
Cisticolidae	*Orthotomus sepium*	Olive-backed Tailorbird	8	2.03	Uncommon
	Orthotomus sutorius	Common Tailorbird	16	2.81	Frequent
	Prinia inornata	Plain Prinia	5	0.78	Uncommon
Columbidae	*Spilopelia chinensis*	Eastern Spotted Dove	53	11.25	Common
	Chalcophaps indica	Grey-capped Emerald Dove	2	0.31	Uncommon
	Geopelia striata	Zebra Dove	1	0.16	Uncommon
Corvidae	*Crypsirina temia*	Racquet-tailed Treepie	5	0.78	Uncommon
Cuculidae	*Cacomantis sonerratii*	Banded Bay Cuckoo	8	1.72	Uncommon
	Centropus bengalensis	Lesser Coucal	3	0.47	Uncommon
	Centropus nigrorufus	Javan Coucal	1	0.16	Uncommon
Dicaeidae	*Dicaeum trochileum*	Scarlet-headed Flowerpecker	3	0.47	Uncommon
Estrildidae	*Lonchura leucogastroides*	Javan Munia	127	27.66	Common
	Lonchura punctulata	Scaly-breasted Munia	6	0.94	Uncommon
	Erythrura prasina	Pin-tailed Parrotfinch	1	0.16	Uncommon
Hemiprocnidae	*Hemiprocne longipennis*	Grey-rumped Treeswift	1	0.31	Uncommon
Hirundinidae	*Hirundo tahitica*	Tahiti Swallow	1	0.16	Uncommon
Laniidae	*Lanius schach*	Long-tailed Shrike	1	0.16	Uncommon
MegalaImidae	*Psilopogon haemacephalus*	Coppersmith Barbet	16	2.97	Frequent
Monarchidae	*Hypothymis azurea*	Black-naped Monarch	13	2.03	Uncommon
Nectarinidae	*Cinnyris jugularis*	Olive-backed Sunbird	69	15.78	Common
Pellorneidae	*Malacocincla sepiaria*	Horsfield's Babbler	23	5.78	Frequent
Phasianidae	*Gallus varius*	Green Junglefowl	3	0.47	Uncommon
Picidae	*Dinopium javanense*	Common Flameback	4	0.78	Uncommon
	Dendrocopos analis	Sunda Pygmy Woodpecker	9	1.56	Uncommon
	Dendrocopos macei	Fulvous-breasted Woodpecker	32	5.31	Frequent
Pycnonotidae	*Pycnonotus goiavier*	Yellow-vented Bulbul	57	14.38	Common
	Pycnonotus aurigaster	Sooty-headed Bulbul	273	64.38	Abundant
	Pycnonotus melanicterus	Black-capped Bulbul	1	0.16	Uncommon
	Alophoixus bres	Brown-cheeked Bulbul	1	0.16	Uncommon
Strigidae	*Otus lempiji*	Sunda Scops-owl	11	6.11	Frequent
Sturnidae	*Acridotheres javanicus*	Javan Myna	3	0.47	Uncommon
Turnicidae	*Turnix suscitator*	Barred Buttonquail	23	5	Frequent
Total number of all individual in community (N)			1027		
Shannon-Wiener Index (H')			2.75		
Eveness Index (J)			0.73		

Table 3. The Attractiveness of Bird Species in GBUF

English Name	Criteria of Attractiveness	Score of Attractiveness (Max=10)	Categories of Attractiveness Score
Changeable Hawk-eagle	R, P	8.6 ± 1.33	Very Attractive
Common Flameback	C	8.6 ± 1.67	Very Attractive
Grey-capped Emerald Dove	C	8.33 ± 1.52	Very Attractive
Black-naped Monarch	C	8,33 ± 1.71	Very Attractive
Javan Coucal	P, VU, E1	8.27 ± 1.82	Very Attractive
Pin-tailed Parrotfinch	C	8.1 ± 1.73	Very Attractive
Blue-eared Kingfisher	C	8 ± 1.66	Very Attractive
Racquet-tailed Treepie	P	8 ± 1.86	Very Attractive
Brown-cheeked Bulbul	S	7.97 ± 1.81	Attractive
Banded Bay Cuckoo	-	7.93 ± 1.78	Attractive
Crested Serpent-eagle	R, P	7.87 ± 2.06	Attractive
Javan Kingfisher	E2	7.8 ± 1.73	Attractive
Sunda Scops-owl	R, N	7.7 ± 2.29	Attractive
Green Junglefowl	E3	7.67 ± 2.37	Attractive
Black-capped Bulbul	S, C	7.57 ± 1.79	Attractive
Grey-rumped Treeswift	-	7.43 ± 1.94	Attractive
Lesser Coucal	-	7.27 ± 2	Attractive
Fulvous-breasted Woodpecker	-	7.17 ± 1.98	Attractive
Barred Buttonquail	-	7.17 ± 2	Attractive
Pied Thiller	-	7.1 ± 1.69	Attractive
Javan Myna	S, VU	7 ± 2.03	Attractive
Sunda Pygmy Woodpecker	-	6.93 ± 1.86	Attractive
Olive-backed Tailorbird	E3, S	6.83 ± 1.86	Attractive
Golden-bellied Gerygone	S	6.8 ± 2.37	Attractive
Long-tailed Shrike	S	6.63 ± 2.19	Attractive
Scarlet-headed Flowerpecker	E4	6.63 ± 2.46	Attractive
Coppersmith Barbet	-	6.6 ± 2.06	Attractive
Plain Prinia	-	6.5 ± 1.98	Attractive
Small Minivet	-	6.5 ± 2.19	Attractive
Common Iora	S	6.47 ± 2.1	Attractive
Zebra Dove	-	6.4 ± 1.89	Attractive
Collared Kingfisher	-	6.37 ± 2.25	Attractive
Common Tailorbird	S	6.33 ± 1.54	Attractive
Horsfield's Babbler	-	6.27 ± 1.96	Attractive
House Swift	-	6 ± 2.38	Attractive
Yellow-vented Bulbul	S	5.9 ± 2.09	Attractive
Tahiti Swallow	-	5.8 ± 2.07	Attractive
White-breasted Woodswallow	-	5.7 ± 2.38	Attractive
Olive-backed Sunbird	-	5.63 ± 1.97	Attractive
Javan Munia	E4	5.13 ± 2.57	Attractive
Scaly-breasted Munia	-	4.97 ± 2.24	Less Attractive
Sooty-headed Bulbul	S	4.87 ± 2.36	Less Attractive
Eastern Spotted Dove	-	4.83 ± 1.84	Less Attractive
Cave Swiftlet	-	4.43 ± 2.16	Less Attractive

R= Raptor, N=nocturnal bird, E1=endemic in Java, E2=endemic to Java and Bali, E3=endemic to Java, Bali, and Nusa Tenggara, E4=Indonesian endemic, P=protected. VU=vulnarable, C=Colorful, S=Songbirds

Zebra Dove, Long-tailed Shrike, Brown-cheeked Bulbul), or visitors of the GBUF areas (e.g. House Swift, Pacific Swallow).

Attractive Birds as Avitourism Object in GBUF

The criteria of birds for avitourism objects are endemic, migrant, high status conservation, large size, colorful, melodious, raptors, parrots, and nocturnal (Green & Jones 2010, Dalem *et al.* 2014, Garnet *et al.* 2018). Following Green & Jones (2010), the endemicity or rarity is the main criteria for attractive bird based on tourist perspectives. It correlates with this result which top three highest score of bird have lower abundance and top bottom score of bird have higher abundance (Table 2). Avitourism can be challenging for manager of the tourism object. The manager must have a trustworthy experience of birdwatching for the tourist, so they can see rare birds. The complete data of birds must be provided by manager such as diversity, abundance, spatial locality, temporal locality and other biological and ecological aspect (Son *et al.* 2011; Widyasari *et al.* 2013). A complete information about diversity, abundance, and spatial locality of attractive bird in GBUF is beyond the scope of this research. There were diverse attractive birds in GBUF as avitourism object such as three species of raptor, six species of endemic birds, five species of high conservation status birds, and other attractive birds such as colorful birds and songbirds.

Raptor

Following Green & Jones (2010), raptor is one of favorite birds in avitourism. Raptor is charismatic bird with interesting morphology (Aditya *et al.* 2019). There were three species of raptor in GBUF namely Changeable Hawk-eagle *Nisaetus cirrhatus*, Crested Serpent-eagle *Spilornis cheela*, and Sunda Scops-owl *Otus lempiji* (Table 3). Changeable Hawk-eagle is a very attractive bird, has the highest score among raptors and other birds in GBUF (Table 3). The two last raptors belong to attractive bird by Indonesian birdwatcher perspectives (Table 3).

Changeable Hawk-eagle has a unique morphology. There are two morphotypes, namely dark morph and light morph. In GBUF, it is often perched at Cotton Tree *Bombax ceiba*, a deciduous tree which has straight tall trunk so it is easy to observe. Crested Serpent-eagle in GBUF often seen soaring in group with a distinctive loud voice. Although uncommon, these raptors were easy to encountered in the afternoon. It was often soaring and gliding in the sky. The unique pattern of raptor's way of flying such as soaring and gliding can be the main attraction for raptor observation. Higher place and open areas like cropland are the best place to see raptor with a clear view. Sunda Scops-owl is the only nocturnal bird species in GBUF. It can be a night birding object as another experience for avitourism attraction. It was the only nocturnal bird which common and easy to encounter in all types of habitat in GBUF, except cropland (Table 2).

Endemic Birds

Endemic birds are favorite birds, with high hope to encounter and an excellent promotion object for avitourism (Puhakka *et*

al. 2011). The higher number of endemic birds in the avitourism area, will attract more avitourists (Puhakka *et al.* 2011). Endemic birds which were found in GBUF namely Javan Kingfisher *Halcyon cyanoventris*, Olive-backed Tailorbird *Orthotomus sepium*, Javan Coucal *Centropus nigrorufus*, Scarlet-headed Flowerpecker *Dicaeum trochileum*, Javan Munia, dan Green Junglefowl *Gallus varius* (Table 3).

All endemic birds are included in the attractive bird category, except Javan Coucal (Table 2). The Javan Munia has the lowest score (5.73 ± 2.36) among the endemic birds because it is a common species in Sumatra, Java, and Bali (MacKinnon et al. 2010). It was common and very easy to encounter in all of GBUF areas (Table 2). Scarlet-headed Flowerpecker, Olive-backed Tailorbird, and Green Junglefowl have medium score which included as uncommon bird in GBUF (Table 2). They were found in a specific habitat like a flowering tree, bush, and cropland, respectively. Javan Kingfisher has the second-highest rank among endemic birds (7,8 ± 1,73) (Table 3). It is often seen close to river stream habitat (Table 2). Javan Coucal was categorized as very attractive bird and has the highest score (8,27 ± 1,82) among other endemic birds. However, this species was very rare in GBUF which only one individual encountered in this study (Table 2).

High Conservation Value Birds

The high conservation value bird is known from IUCN Redlist criteria and protection status by Indonesian law. The high conservation value of IUCN Redlist are categorized as Vulnerable, Endangered, and Critically Endangered (IUCN 2012). These criteria occurred because of the declining population, small population, and narrow distribution area (IUCN 2012). High conservation value indicated by the small bird population in nature, therefore they need serious attention from many parties (Dalem *et al.* 2014). Rare birds can also serve as the flagship species to increase attention for their conservation (Verissimo *et al.*, 2009). There were five species of high conservation value in GBUF namely one species of vulnerable bird, three species of protected bird by Indonesian law, and one species of vulnerable and protected bird (Table 3).

All birds with high conservation status have high scores because of its rarity which make them included in the very attractive and attractive bird categories (Table 3). Javan Myna *Acridotheres javanicus* is a vulnerable bird with the lowest score among high conservation value birds (Table 3). It was the most common myna in the farmland and urban areas in Java-Bali (MacKinnon *et al.* 2010). Changeable Hawk - eagle, Crested Serpent-eagle, Racquet-tail Treepie *Crypsirina temia* found in GBUF, are protected birds based on the Ministy of Environment and Forestry Regulation number 106 year 2018 (Table 2). Javan Coucal is included in the very attractive bird and has the most complete criteria of attractiveness such as endemic, vulnerable, and protected bird (Table 3). The majority of all high conservation value birds in GBUF are categorized as uncommon because only few individuals can be encountered. Therefore it is challenging to view these birds (Table 2).

Colorful birds and Songbirds

Colorful birds can be found in GBUF namely Blue-eared Kingfisher *Alcedo meninting*, Grey-capped Emerald Dove *Chalcophaps indica*, Pin-tailed Parrotfinch *Erythrura prasina*, Common Flameback *Dinopium javenense*, and Black-caped Bulbul *Pycnonotus melanicterus*. Blue-eared Kingfisher has a nice combination of body color that is a metallic blue-colored on the back and lighted red-orange at the lower body (MacKinnon *et al.* 2010). Grey-capped Emerald Dove is a bird with a metallic green color on the wings with a reddish-orange body combination and has red leg and bill (MacKinnon *et al.* 2010). Pin-tailed Parrotfinch has colorful body such as yellow, blue, red, and green (MacKinnon *et al.* 2010). Common Flameback is a unique bird because of the habit of pecking tree trunk. It is characterized by red crest for males, black-white crest for female, and has a golden yellow body color for both (MacKinnon *et al.* 2010). Black-capped Bulbul predominantly has yellow-lit body color with a black head and crest, and a red throat for the Javan and Sumatran races (MacKinnon *et al.* 2010). The most colorful bird belongs to very attractive bird category based on Indonesian birdwatcher perspectives. Colorful birds were loved by ecotourists who are interested in photography (Green & Jones 2010). It correlates with Indonesian birdwatchers who like bird photography while birdwatching.

Songbirds found in GBUF belong to family of Pycnonotidae, namely Long-tailed Shrike *Lanius schach*, Common Iora, Zebra Dove *Geopelia striata*, and Golden-bellied Gerygone *Gerygone sulphurea*. The Pycnonotidae family is a confident bird, with loud and melodious voice in several species (MacKinnon *et al.* 2010). Long-tailed Shrike has melodious chirping which is often imitates other species (MacKinnon *et al.* 2010). Common Iora has variety of sound ranging from monotonous and rhythmic vibrations and distinctive whistling (MacKinnon *et al.* 2010). Zebra Dove has melodious, smooth, flowing voice (MacKinnon *et al.* 2010). It is most reared by Javanese people because they believed it will bring luck in life (Jepson 2010). Golden-bellied Gerygone has a whistle that is difficult to guess from, three to five weak tones vibrate, multifaced from tone to tone in the variation of decreasing phrase (MacKinnon *et al.* 2010). However, songbirds have lower score than other criteria of attractive bird based on Indonesian birdwatcher perspectives (Table 2). It is maybe counter-movement to songbird-keeping in Indonesia which threat some bird species to extinction. Some birds in GBUF have become high attention of Asian songbird crisis from bird trading such as Black-capped Bulbul, Long-tailed Shrike, Pin-tailed Parrotfinch, Javan Myna, and Grey-cheeked Bulbul (Lee *et al.* 2010). Therefore, these birds can be used to educate tourists to enjoy birds only with birdwatching without having to keep bird in a cage.

The Opportunity and Obstacles of Development Avitourism

The opportunity variables of GBUF to become avitourism object are moderate diversity of bird community, accessibility, the status of area, and cultural site. GBUF has diversity index of 2.75 for bird community

which includes in moderate diversity category. It was supported by habitat diversity in GBUF such as mixed forest, oligoculture forest, cropland and river stream. According to Puhakka *et al.* (2010), various birds and habitat diversity make the area for avitourism advantageous. GBUF was strategically located in a suburban area only 7 km away from the city center of Karanganyar so the accessibility is easy. The change of GBUF management, now by the Universitas Sebelas Maret with the aim of education and research, makes the people in the region more awake. Conservation areas or protected areas can be used as avitourism area with the excess more conserve than the unprotected area (Son *et al.* 2011). Another supporting attraction in GBUF is the cultural site of Petilasan Nyai Serang with the uniqueness of Teak *Tectona grandis* that grow in the trunk of *Ficus* sp. so it is called 'teak brackets—Jati Kurung in Indonesian literally'. According to Puhakka *et al.* (2011), cultural attractions can be combined with avitourism to add traction.

The development obstacles of avitourism in GBUF are illegal hunting and noise. Illegal hunting is still found in GBUF using an air shotgun which hunters use to shoot birds and Plaintain Squirrel *Callosciurus notatus* for hobby activities. In addition, the noise from the motocross visitors can disrupt the presence of birds. Some birds are sensitive to noise especially raptor. It may interfere its breeding activities (Grubb & King 1991). This obstacle can be prevented by formulating conservation regulations in GBUF from Universitas Sebelas Maret. Another obstacle is the geographic factor with the slope of the land is quite steep especially on the north side of GBUF.

CONCLUSION

The bird community in GBUF has the potential as an object of avitourism with moderate diversity category. There were diverse attractive birds with the criteria raptor, endemic, high conservation value, colorful and songbirds. Therefore management and planning of the development of a comprehensive area based on conservation and research by the Universitas Sebelas Maret are needed, so the benefits and ecosystem sustainability can be maintained.

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