Biology Learning Content Analysis on Aves Diversity: A Case Study at Kaduberureum Biodiversity Park's PT Chandra Asri Petrochemical Tbk, Indonesia

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Abstract

Biology learning must be delivered contextually, for example, by presenting content based on field facts related to biodiversity. One of the biodiversity conservation areas in Banten Province is Kadubeureum Biodiversity Park, as a form of PT Chandra Asri's contribution to environmental conservation. The biodiversity park acts as a protected area for flora and fauna species found in the area, including Aves. The existence of Aves affects the quality of an environment because Aves are an important component of the ecosystem. This study aims to analyze biology content based on Aves diversity in the Kadubeureum Biodiversity Park to be implemented as contextual learning material, especially in the biodiversity concept. The research was conducted in July-November 2022. The method used was a survey and case study, completed with the point count method for Aves data collection in Biodiversity Park's PT Chandra Asri at Kadubeureum Village, Serang, Banten, Indonesia. Based on the research identified 28 species of Aves including to 17 families. The results showed that there were several species of Aves endemic to Java, such as the "Javan Bondol" (*Lonchura leucogastroides*), the "Mountain Pijantung" (*Arachnothera affinis*), the "Paok Pancawarna" (*Hydrornis guajanus*), and the "Java Cinenen" (*Orthotomus sepium*). Furthermore, the facts obtained based on the Aves diversity observation can be used as contextual biology learning content, in the concept of biodiversity, such as for classification, biodiversity level, as well as threats and conservation effort learning.

Keywords: Aves, Biology Learning Content, Biodiversity Parks, PT Chandra Asri Petrochemical Tbk

INTRODUCTION

Indonesia is known as a mega-biodiversity country. However, on the other hand, public awareness about the importance of biodiversity still needs to increase. The low level of public understanding of the biodiversity value can be caused by inappropriate learning systems (Leksono & Rustaman, 2012). Biodiversity conservation teaching and learning should involve the use of the surrounding environment as a learning resource (Dikmenli, 2010; Ramadoss & Moli, 2011; Leksono, 2011), also known as contextual learning. Contextual learning is a learning concept that helps teachers connect the material they teach to students' real situations and encourages students to link their knowledge and its application in life (Sulistyono 2010; Sagala 2014). Contextual biology learning can be applied through content from field exploration data of flora and fauna, especially for biodiversity. In Banten Province, many conservation areas have a high biodiversity of flora and fauna. One of these conservation areas is the Biodiversity Park.

Biodiversity parks are conservation areas for local biological natural resources outside the forest that have in situ and/or ex-situ functions. Especially for plants, pollination and/or seed dispersal must be assisted by animals whose structure and composition can support the sustainability of pollinating and seed-dispersing animals. Biodiversity parks emphasize species diversity, rarity status, endemicity, authenticity, and locality (Gunawan & Sugiarti, 2015, 2016; Muzaki et al., 2022; Priyono & Abdullah, 2013). The development of biodiversity parks is implemented as an effort to save various local plant species or those that have a very high level of threat of extinction for the preservation of local biodiversity, including: 1) plant species or genetic resources; and 2) local endemic animals that develop naturally in certain areas (Ferhat et al., 2022; Gunawan et al., 2022). The Biodiversity Park has various benefits, such as a collection place for plants, especially local and rare plants; a place for breeding plants and animals; ecotourism for biodiversity conservation campaigns; and increasing awareness of environmental preservation for the community (Akbarini et al., 2019; Bimantio et al., 2022; Nurcahyani et al., 2022).

One of the biodiversity parks located in Banten is the biodiversity park in Kadubeureum Village, developed by PT Chandra Asri Petrocheica Tbk, which is located in Padarincang District, Serang Regency, Banten, with a total area of 6.5 hectares. The development of the Biodiversity Park in Kadubeureum Village is one of PT. Chandra Asri's efforts for environmental conservation concern. These contributions aim to improve the quality of biodiversity. In addition, the establishment of the Biodiversity Park in Kadubeureum village was also carried out to save various species of flora and fauna found in that area, including Aves.

Aves are ecosystem components that play an important role in maintaining the continuity of the life cycle of organisms, for instance in the food chains and life webs that form their living systems with other components such as plants and insects (Dwifortunata et al., 2020; Hadinoto et al., 2012). In the ecosystem, Aves are animals that have a beneficial role, as seed dispersers and natural pollinators for plants, which help farmers cultivate food crops. In addition, Aves also act as predators and accelerate wood decomposition (Mackinnon, 2010 in Kurniawan et al., 2019) and are indicators of environmental change (Nurmaeti et al., 2018). Aves have a reciprocal relationship and are interdependent with their environment (Anggriana et al., 2018). Considering the important role of Aves in an environment, the Aves biodiversity data in Kadubeureum Biodiversity Park can be analyzed to be used as contextual-based biology learning content.

Based on the interview results and initial observations in some schools in Banten, there were still no learning resources that present factual examples of Banten's biodiversity. Most textbooks still use examples of the world's flora and fauna. Due to those conditions, the students were less familiar with the biodiversity around them. Therefore, according to curriculum requirements, this research was conducted to analyze biology content based on Aves diversity in the Kadubeureum Biodiversity Park to be implemented as contextual learning material, especially in the biodiversity concept.

METHOD

This research used the survey method and a case study using field observation as a data collection method. The research was conducted in July-November 2022. Survey and case study methods were performed through curriculum analysis and interviews with biology teachers in some senior high schools in Serang, Banten. While, data collection on Aves diversity was carried out at Biodiversity Park PT. Chandra Asri, Kadubeureum Village, Padarincang District, Serang Regency, Banten (Kadubeureum Biodiversity Park). Aves were observed in the morning (07.00 - 10.00 WIB) and afternoon (15.00 - 17.00 WIB). The tools used for this observation were binoculars (Nikon Action 10x50 6,5o), a camera, a voice recorder, and a GPS. The materials used were stationery, tally sheets, and field guidebooks. Sampling points at the study sites were shown in Figure 1.
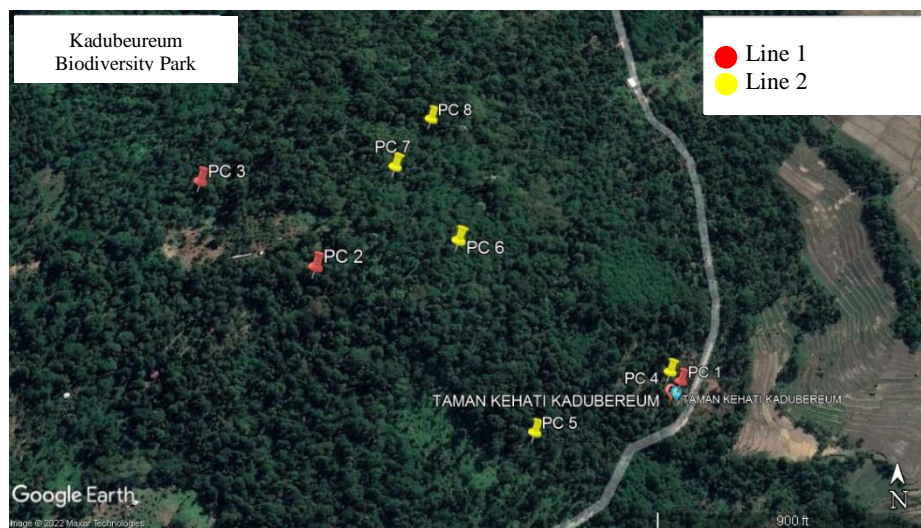

Figure 1. Aves biodiversity sampling point at research location (PC = point Count)

Aves biodiversity data collection used the point count method (Bibby et al, 2000; Budka et al., 2021). Point count allows an observer to stand still at one particular location (observation station) to record all the birds seen and heard for 10 minutes at each observing station. This counting was conducted across two lines. On the first line, there were three-point counts (PC); on the second line, there were five-point counts (Figure 1). Each point count has a distance of

200 m, and the observation radius for each point is 50 m in diameter. The point count method
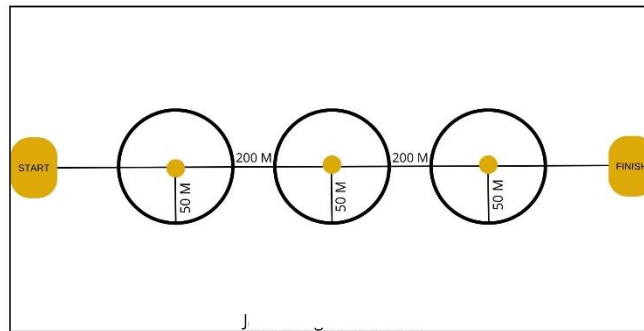
scheme shown in Figure 2.

Figure 2. Point count method for Aves biodiversity data collection

The research samples were Aves species that were seen and heard during the observation. The Aves observation data collection was carried out directly (by observing the presence of Aves using binoculars) and indirectly (by identifying the sounds of Aves). Meanwhile, the data processing was carried out by calculating the number of Aves species and the Aves diversity index using the Shannon-Wiener diversity index.

$$H : -\sum \frac{ni}{N} \ln \frac{ni}{N}$$

Notes:

H = Shannon-Wiener diversity index

ni = Number of individuals for each species

N = Total number of all species

Table 1. Diversity index criteria

H' Score	Category
H' > 3.0	High
1.6 < H' < 3.0	Medium
1.0 < H' < 1.5	Low

(Rachmawati *et al.*, 2019)

The dominance index is used to determine the dominance of species in an area. The dominance index is calculated using the Simpson Dominance Index formula:

$$C = \sum (\frac{ni}{N})^2$$

Note:

C = Simpson dominance index

ni = Number of individuals species-i

N = Total number of all species

Table 2. Dominance Index Criteria

Score	Category
$0,00 < C \leq 0,5$	Low
$0,50 < C \leq 0,75$	Medium
$0,75 < C \leq 1$	High

(Kurniawan *et al.*, 2018)

RESULTS AND DISCUSSION

Curriculum analysis was carried out at the beginning as a guide to identify the need for contextual-based biology content. Based on interview results, senior high schools in Banten are currently using the curriculum 2013 and the independent curriculum. The curriculum 2013 began to be massively implemented in schools in 2014 until now as a change or evaluation from the previous curriculum (Idi, 2016). Furthermore, in 2022, the Indonesian government has begun to establish a policy of implementing an independent curriculum in the context of mitigating learning loss due to the COVID-19 pandemic, which is taking place as an alternative curriculum (BBPMP, 2022). The analysis result of the curriculum 2013 obtained the core/basic competencies and learning indicators that students must achieve after the learning process, in the concept of biodiversity (Table 4). Meanwhile, based on independent curriculum, acquired learning outcomes, and the flow of learning objectives for the biodiversity concept (Table 5). Based on Tables 4 & 5, in biodiversity concept must be studied regarding the meaning of biodiversity, levels of biodiversity, threats, and conservation, as well as creating solutions to problems based on local or global issues of diversity. To facilitate understanding of these materials, it can be based on the results of field observations of Aves diversity in Kadubeureum Biodiversity Park.

Aves Species at Kadubeureum Biodiveristy Park

Based on the data collection of Aves diversity at Kadubeureum Biodiveristy Park, 28 Aves species were identified, including 17 families (Table 3). The families with the most species were Cuculidae (5 species) and Nectariniidae (3 species). The Cuculidae family is a group of insectivorous birds consisting of *Cacomantis merulinus*, *Cacomantis sepulcralis*, *Cacomantis sonneratii*, *Centropus bengalensis*, and *Surniculus lugubris*. Meanwhile, the Nectariniidae family is a group of honey-sucking Aves, or nectivoras, consisting of *Arachnothera affinis*, *Anthreptes malacensis*, and *Cinnyris jugularis*.

Tabel 3. Aves Species found at Kadubeureum Biodiversity Park

No	Family	Scientific Name of Species	Lokal Name of Species	Total	IUCN Status
1	Accipitridae	*Spilornis cheela*	Elang ular bido	2	*LC*
		Nisaetus cirrhatus	Elang Berontok	1	*LC*
2	Aegithinidae	*Aegithina tiphia*	Cipoh kacat	14	*LC*
3	Alcedinidae	*Todiramphus chloris*	Cekakak sungai	8	*LC*
4	Apodidae	*Collocalia linchi*	Walet linci	9	*LC*
5	Campephagidae	*Lalage nigra*	Kapasan Kemiri	1	*LC*
		Pericrocotus cinnamomeus	Sepah kecil	13	*LC*
6	Cisticolidae	*Orthotomus sepium*	Cinenen Jawa	6	*LC*
7	Columbidae	*Ptilinopus melanospilus*	Walik kembang	3	*LC*
		Streptopelia chinensis	Tekukur biasa	1	*LC*
8	Cuculidae	*Centropus bengalensis*	Bubut alang alang	1	*LC*
		Cacomantis sepulcralis	Wiwik uncuing	1	*LC*
		Cacomantis merulinus	Wiwik kelabu	3	*LC*
		Cacomantis sonneratii	Wiwik lurik	4	*LC*
		Surniculus lugubris	Kedasi hitam	2	*LC*
9	Dicruridae	*Dicrurus leucophaeus*	Srigunting kelabu	2	*LC*
10	Estrildidae	*Lonchura leucogastroides*	Bondol jawa	3	*LC*
11	Megalaimidae	*Psilopogon haemacephalus*	Takur ungkut-ungkut	2	*LC*
12	Nectariniidae	*Anthreptes malacensis*	Burung-madu kelapa	11	*LC*
		Arachnothera affinis	Pijantung gunung	1	*LC*
		Cinnyris jugularis	Burung-madu sriganti	2	*LC*
13	Pellorneidae	*Malacocincla sepiaria*	Pelanduk semak	2	*LC*
		Pellorneum capistratum	Pelanduk topi hitam	2	*LC*
14	Picidae	*Dendrocopos moluccensis*	Caladi tilik	2	*LC*
		Dinopium javanense	Pelatuk besi	2	*LC*
15	Pittidae	*Hydrornis guajanus*	Paok pancawarna	3	*LC*
16	Pycnonotidae	*Pycnonotus aurigaster*	Cucak Kutilang	14	*LC*
17	Strigidae	*Otus lempiji*	Celepuk reban	1	*LC*
			Total	116	

Note: LC = least concern

Based on Table 3, it can be seen that the most number of individual species were the "Cipoh Kacat" (*Aegithina tiphia*), "Cucak Kutilang" (*Pycnonotus aurigaster*), "Sepah Kecil" (*Pericrocotus cinnamomeus*), and "Burung-madu kelapa" (*Anthreptes malacensis*). The larger number of individuals was due to the sufficient food availability, suitable habitat, and vegetation that allowed these species of birds to live and reproduce (Hadinoto & Suhesti, 2021). These Aves species eat fruit, insects, and seeds as their main food sources. Based on observations, these Aves were also seen eating caterpillars, flower nectar, or small insects.

Aves species found in line two (25 species) were more than in line one (19 species) (Figure 3). Line two's location was at an altitude of 283 m with environmental conditions dominated by trees, poles, and shrubs. Line two was a path that was not passed by humans, while line one was a path that was usually passed for human activities in the Kadubeureum Biodiversity Park, so that it allowed the Aves to have environmental pressure. Aves in the wild have a high sensitivity, including to human activity, so they prefer to make nests in places far from human existence as a form of self-protection or defense from illegal hunting (Indra et al., 2020; Putra et al., 2021). Habitat conditions greatly affect Aves. The existence of Aves species in an area was influenced by differences in plant species and surrounding habitats. The safety factor was also taken into account, such as disturbances, vegetation structure and composition, and wide areas (Alim et al., 2020; Martin et al., 2021; Nurmaeti et al., 2018).

The availability of food sources in a habitat influences the existence of Aves species in the Kadubeureum Biodiveristy Park. The Aves species found were insectivores (insect eaters), carnivores (meat eaters), frugivores (fruit eaters), nectarivores (honey suckers), and granivores (seed eaters). There were 16 insectivorous species of Aves, i.e., *Aegithina tiphia*, *Cacomantis merulinus*, *Cacomantis sepulcralis*, *Cacomantis sonneratii*, *Centropus bengalensis*, *Collocalia linchi*, *Surniculus lugubris*, *Dendrocopos moluccensis*, *Dinopium javanense*, *Dicrurus leucophaeus*, *Hydrornis guajanus*, *Lalage nigra*, *Malacocincla sepiaria*, *Orthotomus sepium*, *Pellorneum capistratum*, and *Pericrocotus cinnamomeus*. Insectivore group dominance was a common condition in Aves communities, especially in forests (Novarino et al., 2008), and it was influenced by the presence of insect species in the area (Muhammad et al., 2018). As for insects, they are an easy-to-find type of Aves feed because insects are a group of animals that exist throughout the year, are diverse, and can be found in any layer of the forest (Abdussalam et al., 2021; Hardina et al., 2019; Supartono et al., 2015). The insects that were observed during research at the Kadubeureum Biodiversity Park included orthoptera (grasshoppers) and lepidoptera (butterflies). Orthoptera are the main group preyed upon by more than a hundred species of birds, besides Lepidoptera and Coleoptera. This is because the Orthoptera has a visible body size, relatively easy to attack, and available in large quantities (Fadhillah, 2020).

There were four species of carnivorous Aves: *Nisaetus cirrhatus*, *Otus lempiji*, *Spilornis cheela*, and *Todiramphus chloris*. The presence of predatory birds (carnivores) in an ecosystem is an indication of a stable ecosystem. Predatory birds in the food chain occupy a peak level that functions to control the prey population and is more sensitive to changes in the number of prey (Sekercioglu, 2006). Whelan et al. (2008) stated that predatory Aves can help other carnivores, such as reptiles or mammals, get their prey. Granivores in agro-ecosystems are

considered pests, but in natural ecosystems they contribute to the transfer of biomass to second and third consumers (Turcek, 2010). This means that the granivorous group was the first consumer to process energy from plants and then distribute it to the next consumer in the food chain (Muhammad et al., 2018). There were two granivore species discovered at Kadubeureum Biodiversity Park: *Lonchura leucogastroides* and *Streptopelia chinensis*.

There were three frugivore species: *Pycnonotus aurigaster*, *Psilopogon haemacephalus*, and *Ptilinopus melanospilus*. The frugivore is an important element for forest sustainability because they function as plant seed dispersers (Kartika et al., 2018). The frugivore is an effective endozoochoric agent in assisting the release of fruit flesh and seed coat, as well as contributing to seed germination in their digestive tract (Whelan et al., 2008). Furthermore, based on the research, there were three nectarivore species: *Arachnothera affinis*, *Anthreptes malacensis*, and *Cinnyris jugularis*. Nectarivore species live in small niches because they always depend on the flowering period. Flowering does not occur all year round, so the existence of nectarivorous Aves will depend on flowering time. Nevertheless, the nectarivore species play an important role in pollinating flowers (Sozer et al., 2009 in Sitanggang et al., 2020).

Aves Conservation Status

The conservation status of Aves can indicate the level of a species' threat of extinction. The determination of the conservation status of a species aims to provide protection and sustainability for the species (Kurniawan et al., 2019). Based on IUCN status, all Aves species identified in this research were included in the status of "least concern" (LC-less risk). The least concern (LC) category is for species that have been evaluated but do not yet meet the criteria in the threatened category (near threatened, vulnerable, critical, or critical) (Ministry of Environment and Forestry LIPI, 2019). On the other hand, the Aves in the Kadubeureum Biodiversity Park area were still classified as having a low risk of extinction, and their numbers were still relatively large (Nainggolan et al., 2019). However, based on the criteria of the Indonesian Ministry of Environment (2018), there were 3 (three) protected Aves species, namely the "paok pancawarna" (*Hydrornis guajanus*), "bido eagle" (*Spilornis cheela*), and "brontok eagle" (*Nisaetus cirrhatus*) (Figure 4i). "Bido eagles" (*Spilornis cheela*) and "Brontok eagles" (*Nisaetus cirrhatus*) are diurnal predatory Aves species, these eagles were found in line two of the research location. "Brontok eagles" (*Nisa etus cirrhatus*) have a high tolerance for human activity, so they can be found near housing areas (Sayogo, 2017).

The "brontok eagle" (*Nisaetus cirrhatus*) is an Asian eagle species that has a wide distribution, spreading around Asia from India, Sri Lanka, Nepal, Andaman Island, to Southeast

Asia through Bangladesh, Myanmar, Indochina, the Malay Peninsula, the Great Sunda (Sumatra, Kalimantan, Java, Sulawesi), and the Philippines (Rifaldo et al., 2020). Currently, all species of predatory Aves in Indonesia are protected by law, but there is still a lot of illegal hunting by humans. The "brontok eagle" (*Nisaetus cirrhatus*) is a species that needs more attention. Although the conservation status of the "brontok eagle" (*Nisaetus cirrhatus*) is low risk (LC; Least Concern), major threats such as illegal hunting, deforestation, human interference, and habitat fragmentation can cause a decline in the number of this species in nature (Safanah et al., 2018).

Eagles are predators that have a vital role as controllers in the ecosystem. The existence of predatory birds in an ecosystem is very important because of their position as the top predator in the food chain pyramid (Regos et al., 2022), and as balance consumers in the food chain. When one of the components in the food chain is missing, the stability of the ecosystem as a whole can be disrupted (Kuvaini *et al.,* 2021). In addition, the eagle is also used as an indicator of a good environment. If environmental conditions are disrupted, it is highly possible that the eagle will become extinct soon (Luthfi *et al.*, 2020). The presence of eagles in the Kadubeureum Biodiveristy Park of Kadeubeureum showed that the area was considered a healthy environment and had become a protected area.

Based on observations, there were several Aves species that were included as the endemic Java Aves, such as "Java Bondol" (*Lonchura leucogastroides*), "Mountain Pijantung" (*Arachnothera affinis*), "Paok Pancawarna" (*Hydrornis guajanus*), and "Java Cinenen" (*Orthotomus sepium*) (Rahayuningsih *et al.*, 2018). "Java Bondol" (*Lonchura leucogastroides*) is endemic to Java, Bali, Sumatra, and Sumbawa. While "Mountain Pijantung" (*Arachnothera affinis*) and "Paok Pancawarna" (*Hydrornis guajanus*) are endemic to Java and Bali. "Paok Pancawarna" (*Hydrornis guajanus*) is often found in forests where the floor is covered with leaf litter and is near running water (Iskandar *et al.*, 2021). The "Java Cinenen" (*Orthotomus sepium*) has a limited distribution in Java, Bali, and Lombok (Akbar *et al.,* 2020). Based on the Javan endemic Aves species discovered in this study, it showed that the Kadubeureum Biodiversity Park and the surrounding forest area were still well preserved. The existence of public awareness of the environment and the role of various parties concerned can help preserve existing birds (Dewantara *et al.,* 2015).
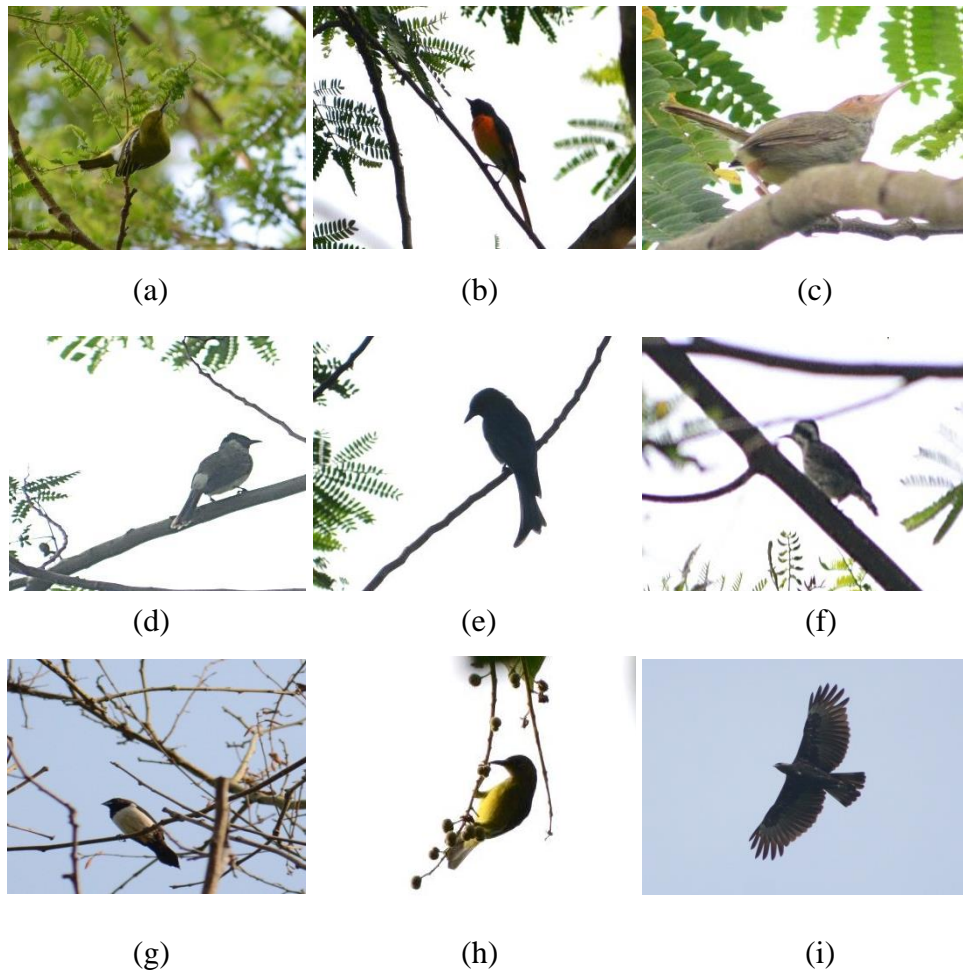
Figure 4. Documentation of several Aves in the Kehati Park of Kadubeureum Village
(a) *Aegithina tiphia*; (b) *Pericrocotus cinnamomeus*; (c) *Orthotomus sepium*;
(d) *Pycnonotus aurigaster*; (e) *Dicrurus leucophaeus*; (f) *Dendrocopos
moluccensis*; (g) *Lonchura leucogastroides*; (h) *Anthreptes malacensis*;
and (i) *Nisaetus cirrhatus*

Aves Diversity Index and Dominance Index

The Aves diversity index in the Kadeubeureum Biodiversity Park was 2.92 (H' = 2.92), included in the medium category. Furthermore, the Aves dominance index in the Kadeubeureum Biodiversity Park was 0.071, indicating that it was not dominated by one or only a few species of Aves. If the dominance index value is close to zero (0), that means there are no dominance species, and vice versa, if the dominance index value is close to one (1) that means there are dominance species (Fikriyanti *et al.,* 2018). These results were strongly influenced by the condition of the ecosystem, which is sufficient to provide a carrying capacity for the birds (Sukandar *et al.,* 2016). The diversity of Aves species is often associated with environmental conditions (Kurniawan *et al.*, 2019; Tu *et al.*, 2020), the higher the diversity of Aves species, the more balanced an ecosystem (Endah & Partasasmitaa, 2015). According to Aryanti, *et al.* (2018), ecological conditions fully support the diversity index. Aves will live in

a habitat that suits their requirements. Kadubeureum Biodiversity Park is a good habitat for animal species, including Aves, due to the availability of the necessities of life, such as food, nesting sites, and activity sites (Alim *et al.*, 2020; Ekowati et al., 2016; Fadhillah, 2020; Kurniawan *et al.*, 2019). A high level of Aves species diversity in an area indicates that the area has good environmental conditions (Fadhillah, 2020; Maulidah *et al*., 2022).

Analysis of Biology learning content based on Aves Diversity Observation Data

Facts obtained from research on the diversity of Aves in Kadubeureum Biodiversity Park can be used as biology learning content in accordance with the Indonesian curriculum requirements. Table 4 showed the results of the "curriculum 2013" analysis, and Table 5 showed the results of the "curriculum Merdeka" analysis for the content of the Aves diversity in biodiversity concept. Based on the "curriculum 2013" analysis, the research data on Aves diversity can be implemented for biology learning materials such as biodiversity level and classification, biodiversity threats and conservation efforts, and recommendations for fauna conservation efforts in the environment. Research facts that can be delivered for understanding biodiversity-level and classification such as Aves species observed in the Kadubeureum Biodiversity Park, including 28 species in 17 families; the diversity of Aves in the Kadubeureum Biodiversity Park is mostly inhabited by Cuculidae species; and the classification of Aves based on the type of feed in the Kadubeureum Biodiversity Park is dominated by insectivorous species. As for biodiversity threats and conservation efforts, learning material can be facilitated by research facts; for instance, the diversity of Aves in the Kadubeureum Biodiversity Park is included in the group with the conservation status of "least concern," and the eagle and "Paok birds" species found in the Kadubeureum Biodiversity Park are protected animals even though their conservation status is least concern. Then, for recommendations for fauna conservation efforts in the environment, learning material can be taught by result facts, including biodiversity parks as one of the efforts to protect and conserve Aves (fauna) diversity. It is important to emphasize biodiversity conservation content at school due to the vital role of biodiversity for humans, so its sustainability is important to maintain (Abidin *et al*., 2020).

Based on independent curriculum analysis, in the biodiversity concept, the research data on Aves diversity can be applied for biology learning material such as level of biodiversity, classification of biodiversity, and roles of Aves in the environment. To deliver the level of biodiversity, learning material can be explained through data research; for example, different morphological characteristics in Aves diversity at Kadubeureum Biodiversity Park can be used as a basis for understanding species-level biodiversity. Next, for classification of biodiversity, it can refer to the data diversity of Aves in the Kadubeureum Biodiveristy Park, which is mostly

species from Cuculidae, and classify Aves based on the type of feed. Then, for the role of Aves in the environment, learning material can be obtained from literature data showing that many conservation areas were built for the purpose of protecting and maintaining the sustainability of flora and fauna, both in situ and ex situ. Biology content based on field research data on biodiversity can be implied for contextual-based learning, which can improve understanding of learning concepts (Satriawan *et al.*, 2017), environmental literacy (Apriana, 2017), and students' knowledge of their local potential (Sarah & Maryono, 2014; Prabowo *et al.,* 2016; Ismiati, 2020).

Table 4. Analysis of the Curriculum 2013 using Aves Diversity Data for Biology Learning Content

Grade and Concept	Core Competency	Learning Indicators	Fact and Research Result	Learning Material	
10th grade class Biodiversity	Analyze various levels of biodiversity in Indonesia, their threats and conservation	Describe the classification of living things	• Aves species observed in the Kadubeureum Biodiversity Park, including 28 species in 17 families (*) • The diversity of Aves in the Kadubeureum biodiversity park is mostly inhabited by Cuculidae species (*) • Classifying of Aves based on the type of feed in the Kadubeureum biodiversity park is dominated by insectivorous groups (*)	Make a diagram of the results of classifying Aves diversity based on the observations result.	Biodiversity-level and classification
		Analyze biodiversity threats and conservation efforts	• The diversity of Aves in the Kadubeureum Biodiversity Park is included in the group with the conservation status of Least Concern (*) • The eagle and "Paok birds" species found in the Kadubeureum Biodiversity Park are protected animals even their conservation status is Least Concern (*)	Analyzing threats and efforts to conserve Aves in the environment	Threats and conservation effort
	Presents the observation results of various biodiversity levels in Indonesia and recommendations for their conservation	Make observations result of biodiversity in the environment	• Aves species observed in the Kadubeureum Biodiversity Park, including 28 species in 17 families (*)	Make a table of Aves biodiversity observations in the environment	Biodiversity-level and classification
		Presents efforts to conserve biodiversity in the environment based on observation	• Biodiversity Park as one of the efforts to protect and conserve Aves diversity (*)	Analyzing Aves conservation efforts in the environment	Recommendation for fauna conservation effort in the environment

Table 5. Analysis of the Independent Curriculum using Aves Diversity Data for Biology Learning Content

Grade and Concept	Learning outcome per year	Flow of learning objective	Fact and Research Result	Learning Material	
10th grade class Biodiversity	At the end of 10th grade, students have the ability to create solutions to problems based on local or global issues from their understanding of the diversity of living things and their roles, viruses and their roles, the application of biotechnology, ecosystem components and interactions between components and environmental changes.	10.6 Identify the level of biodiversity by presenting reports from observations in the surrounding environment	• Aves diversity in Kadubeureum Biodiveristy Park have different characteristics based on morphological structure (*) • In the Kadubeureum Biodiveristy Park observed many species-level diversity of Aves (*)	Analyzing species-level biodiversity of Aves	Level of biodiversity
		10.8 Present the results of classifying biodiversity based on certain characters in the form of posters	• The diversity of Aves in the Kadubeureum Biodiveristy Park is mostly inhabited by species from the family Cuculidae (*) • The classifying of Aves based on the type of feed in the biodiversity parks is dominated by insectivorous species (*)	Make a diagram of Aves classifying based on the results of observations	Classification of diversity
		10.9 Describe the benefits of biodiversity by presenting data using various media	• In the Kadubeureum Biodiveristy Park, eagle species are found as top predators which play an important role as controllers in the ecosystem (*) • Aves in the ecosystem have an important role for the environment (**)	Make a table of the role of Aves based on the observation results of observations in environment	Roles of Aves in the environment

Notes: (*) based on research result, (**) based on literature study

CONCLUSION

Identifying Aves diversity in Kadubeureum Biodiversity Parks revealed 28 species in 17 families. Insectivores dominate the Aves in Kadubeureum Biodiversity Parks. There are also Aves species that are endemic to Java, such as "Java Bondol" (*Lonchura leucogastroides*), "Mountain Pijantung" (*Arachnothera affinis*), "Paok Pancawarna" (*Hydrornis guajanus*), and "Java Cinenen" (*Orthotomus sepium*). Most Aves species were in the least concern conservation status. The diversity index of Aves species was 2.92, included in the medium category, and the Aves dominance index was 0.071, indicating some species did not dominate it. Furthermore, the research results can be used as contextual biology learning content, following the curriculum 2013 and independent curriculum requirements, especially on the biodiversity concept. Based on the curriculum 2013 analysis, the research data on Aves diversity can be implemented for biology learning materials such as biodiversity level and classification, biodiversity threats and conservation efforts, and recommendations for fauna conservation efforts in the environment. Based on independent curriculum analysis, in the biodiversity concept, the research data on Aves diversity can be applied for biology learning material such as biodiversity level, biodiversity classification, and roles of Aves in the environment.

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