Do morning and afternoon bird surveys have the same results? A case of bird survey in Dramaga Campus, IPB University, Indonesia

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Abstract. During bird surveys using the point count technique, observers assume that early morning and late afternoon observations will have the same result. This assumption is rarely tested prior to the field observation. This paper’s objective was to compare morning and afternoon bird counts in Dramaga Campus, IPB University. Bird data were collected at 6-8 am and 3-5 pm using a standard point count method in four different habitat types: forest, riparian, plantation, and built-up areas. The number of species, bird abundance, as well as Shannon indices (H') and their corresponding t-tests were calculated. There were 52 bird species found in all habitat types. Time-wise, the number of species found was very similar (morning: 47 species, afternoon: 46 species). H' in all habitat types were slightly differed between both times, non-significant by t-tests (H' in morning and afternoon: forest 2.64, 2.66; plantation 2.33, 2.34; built-up area 2.43, 2.55; riparian 2.38, 2.30; t-test values were 0.28, 0.17, 1.42, 0.52, P>0.05 for all comparisons). Bird abundance was also similar between morning and afternoon counts. Based on this result, the assumption that morning observation is the same as afternoon observation can be accepted as a replication of bird survey in the study area.

1. Introduction

IPB University has several campuses in the Bogor area, one of which is the Dramaga Campus, located in Dramaga District, Bogor. The Dramaga IPB University Campus has an area of 267 ha and was founded in 1963. At that time most of the Dramaga Campus area was an old rubber plantation with few buildings. The Dramaga Campus environment has gradually undergone a gradual transformation from rubber plantations to various types of land uses to meet human needs. Currently, the landscape of Dramaga Campus consisted of forest, riparian, plantation, and built-up areas. Diverse types of land use have resulted in the formation of various types of animal habitats, i.e. for birds.

Different types of habitats can cause different bird communities in them [1]. The bird community in a place is closely related to how the condition of the place is, such as the disturbance, size of habitat area, and vegetation in that place [2,3]. Differences in bird communities can be evaluated based on habitat type.

In bird observation, the method most often used is the point count method with two observation times in one day, in the morning and afternoon. Usually, the morning and afternoon bird survey are considered a replication and is considered the same. However, sometimes in certain habitats, the results of bird surveys in the morning and afternoon can be different. Based on it, it is necessary to test whether the results in the morning and afternoon are the same or not. The objective of this study is to compare the morning and afternoon bird counts at the Dramaga Campus, IPB University.

2. Methods

2.1 Time and location

The study was conducted at the Dramaga Campus, IPB University (figure 1). Data collection and data analysis were carried out in September 2020.
2.2 Tools and objects
The tools used in this study are binocular, field guides for bird observation in Sumatra, Java, Bali, and Kalimantan [4], digital camera, Global Positioning Systems (GPS), tally sheet, and writing instruments. The object of this study is the birds observed at the observation points.

2.3 Bird survey method
Bird data was collected using the point count method [5]. Data were collected at 30 observation points in 4 types of habitat (figure 1). Habitat types that are known to exist at the Dramaga Campus are forest, riparian, plantation, and built-up areas. The observation radius used is 50 meters, and the distance between the observation points is 300 meters (figure 2). The observer counted and recorded all detected birds within the observation radius for 15 minutes. Bird species identification was based on the field guide’s knowledge of bird observation in Sumatra, Java, Bali, and Kalimantan [4]. Data were collected at two observation times, morning and afternoon. Observation in the morning was at 6 - 8 am and the afternoon was at 3 - 5 pm. Observations were conducted when the weather was not raining. The data recorded included species and numbers of individual birds.

Figure 1. Map of study location in Dramaga Campus, IPB University.

Figure 2. Illustration of the observation plot using the point count method.
2.4 Data analysis

a) Species diversity

To determine the diversity of bird species in each habitat type, the analysis was carried out using the Shannon-Wiener index formula [6]:

$$H' = - \sum p_i \ln p_i; \ p_i = n_i / N$$  \hspace{1cm} (1)

Information:  
- $H'$ = index of species diversity 
- $p_i$ = proportion of important value 
- $\ln$ = natural logarithm 
- $n_i$ = number of individuals of species - i 
- $N$ = total number of individuals

The diversity of bird species in each habitat type was then analyzed for differences using the t-test. The hypothesis used in this test is as follows:

$H_0$ = there is no difference in bird species diversity between habitat 1 and habitat 2

$H_1$ = there is a difference in bird species diversity between habitat 1 and habitat 2

The formula of t-test for species diversity is as follows [7]:

$$t\text{-test} = \frac{H'^1 - H'^2}{(\text{Var } H'^1 + \text{Var } H'^2)^{1/2}}$$  \hspace{1cm} (3)

Information:  
- t\text{-test} = t-test value 
- $H'^1$, $H'^2$ = species diversity index in habitat - 1,2 
- $\text{Var } H'^1$, $\text{Var } H'^2$ = variance $H'$ value in habitat - 1,2

To test the difference of species diversity ($H'$) between each habitat type, the statistical equation formula is used as follows:

$$df = \frac{(\text{Var } H'^1 + \text{Var } H'^2)^2}{N1 \left(\frac{(\text{Var } H'^1)^2}{N1} + \frac{(\text{Var } H'^2)^2}{N2}\right)}$$  \hspace{1cm} (4)

Information:  
- df = degree of freedom 
- $\text{Var } H'^1$, $\text{Var } H'^2$ = variance $H'$ value in habitat - 1,2 
- $N1$, $N2$ = total number of individuals in habitat - 1,2

If the value of t-test < t-table then accept $H_0$ and if the value of t-test > t-table then accepts $H_1$ at the 95% confidence level with degree of freedom (df).
b) Bird abundance

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\text{Bird abundance} = \frac{\text{number of bird individuals}}{\text{point observation}} = \frac{\text{number of bird individuals}}{15 \text{ minutes}}
\]  

Information: Time duration of observation in a point observation = 15 minutes

3. Results

3.1 Number of bird species

There were 52 bird species found in all habitat types. Time-wise, the number of species found was very similar (morning: 47 species, afternoon: 46 species). Bird species commonly found on Dramaga Campus are Red-breasted Parakeet, Sooty-headed Bulbul, Olive-backed Tailorbird, Plaintive Cuckoo, Javan Kingfisher, Collared Kingfisher, Scarlet-headed Flowerpecker and Cave Swiftlet. Comparison of the number of bird species found in the morning and afternoon observations in each habitat type also shows similar results with small differences. The number of bird species in the morning and afternoon observation in each habitat type can be seen in figure 3 below.

![Figure 3](image-url)  

**Figure 3.** Number of bird species in the morning and afternoon observation in each habitat types in Dramaga Campus, IPB University.

3.2 Species diversity

Shannon indices value in each habitat type between morning and afternoon observation is similar with small differences. Further analysis using t-test showed that none of the differences was significantly different. These results indicate that there is almost no difference in bird species between morning and afternoon observations (table 1).
Table 1. Shannon indices value and t-test value of Shannon indices in the morning and afternoon observation in each habitat types in Dramaga Campus, IPB University (September 2020).

| Type of Habitat | Observation Time | Shannon Indices (H’) | t-test Value |
|-----------------|------------------|----------------------|--------------|
| Forest          | Morning          | 2.636                | 0.28 (ns)    |
|                 | Afternoon        | 2.664                |              |
| Riparian        | Morning          | 2.376                | 0.52 (ns)    |
|                 | Afternoon        | 2.299                |              |
| Plantation      | Morning          | 2.325                | 0.17 (ns)    |
|                 | Afternoon        | 2.345                |              |
| Built-up Areas  | Morning          | 2.425                | 1.42 (ns)    |
|                 | Afternoon        | 2.549                |              |

Note: α = 0.05, ns = non significant

3.3. Bird abundance
The abundance of birds in each habitat type between morning and afternoon observations were similar. These results indicate that there is no difference between bird abundance in the morning and afternoon observations (table 2).

Table 2. Bird abundance in the morning and afternoon observation in each habitat types in Dramaga Campus, IPB University (September 2020).

| Observation Time | Bird Abundance (number of bird individuals/15 minutes) |
|------------------|-------------------------------------------------------|
|                  | Forest | Riparian | Plantation | Built-up areas |
| Morning          | 32.3   | 21.8     | 38         | 45.3           |
| Afternoon        | 40.2   | 22.2     | 36.2       | 40.8           |

4. Discussion
In surveying birds using the point count technique, observers usually make observations in the morning and afternoon to observe diurnal birds. The two times are chosen because these times are the time for birds to be active and are effective times for diurnal bird observation [5]. Bird observers usually assume that bird survey in the morning and afternoon is a replication and is considered the same. Based on it, it will be interesting to test whether the results in the morning and afternoon bird survey in a place are the same or not, because there could be differences.

Based on the study result conducted in Dramaga Campus, IPB University, the number of species, the Shannon Index value, and the abundance of birds in each habitat type at Dramaga Campus, IPB University in the morning and afternoon are not different and could be said to be similar. This indicates that conditions in the study area have not changed in the morning and afternoon, thus the result can be accepted as a replication of the bird survey in the study area. Birds are sensitive to disturbances in their environment. When the place undergoes changes or disturbances that affect bird habitat conditions, the bird species composition in that place will change. The diversity of bird species in a community is influenced by habitat characteristics and disturbances from human activities [8,9].

No significant differences between morning and afternoon observations mean that there is no difference in the level of disturbance of habitat condition in each habitat during the study. Since there is no difference in bird habitat conditions in the morning and afternoon, arguably there is no significant difference in bird presence at both times. The occurrence of birds is closely related to the condition of their habitat.

Differences in habitat conditions in the morning and afternoon can cause differences in the presence of birds in one place. For example, if during the morning time human activities are higher than during
the afternoon, it is possible that there will be differences in the presence of birds. The occurrence of birds in a place will be different according to the time and conditions of the bird habitat. Birds are sensitive to human activity. Thus their occurrence will need preconditions, i.e. far from human or safe from all disturbances of human activity [10].

5. Conclusions
Based on the study results, it can be concluded that the number of species, the Shannon Indices value, and the abundance of birds in each habitat type at Dramaga Campus, IPB University in the morning and afternoon are not different. No significant differences between morning and afternoon observation mean that there is no difference in the level of disturbance of habitat condition in each habitat in the morning and afternoon in the study area. The results of this study indicate that bird survey in the morning and afternoon can be accepted as a replication in the study area.

6. References
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