The Utilization of *Burungnesia* to Detect Citizen Scientist Participation Preference in Birding Sites Observation in Java Island

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**Abstract**

The contribution of citizen scientist in conservation field has been recognized important, but it is few studied in Indonesia. Citizen Science especially important in bird conservation. The aims of the research is to assess the citizen scientist preference in site selection and its relationship to the success to complete observer’s checklist in Java Island. This study confirmed that citizen sciences is effective in collecting field data of birds. It is especially useful to record common birds, birds with high population number, and general birds. Special birds and birds in small population seems to be rarely reported by citizen scientist. Lowest preferred location often has limitation of accessibility. Citizen scientist has more preference to select sites for bird observation in wild habitat.

**Keywords:** Birds conservation, conservation, public participation, *Burungnesia*.

**INTRODUCTION**

Recently, many people involve voluntarily in biodiversity and environmental monitoring and report as a citizen scientist [1]. Citizen scientist has been considered as an important instrument in conservation program. Many local people involve in investigation and make report which are important in science development, especially in ecology conservation and field biology [2].

The contribution of citizen scientist in collecting data and monitoring has been identified important. There are however, limitation of data quality which are collected by citizen scientist. Effort to improve the voluntary skill of citizen scientist has been implemented in many countries. Many citizen scientists has been trained to read instruments and protocol, use the equipment, and records data. There is also effort to provide actual data which are useful for scientist and government in order to make decision. The development of skill and ability of citizen scientist is important in providing basic data, evaluating and monitoring the status of biodiversity [3,4].

Java Island (Indonesia) has high bird’s diversity levels in which many of them endemic to Java Island and its surrounding islands. Birds, ecologically and culturally is important animals in Java Island. Bird’s diversity in Java Island has been documented and reported in numerous book and scientific journals [5-8]. Birds inhabits various habitat ranging from big city in Jakarta to remotes islands. Many birds with high conservation status remain conserved in protected habitat, including national park, nature-strict reserve and other protected area category. Java Island, however, is densely populated island, in which many wild area converted into settlement and industrial area. It becomes threats to birds in Java Island [9].

Citizen scientist participation in a scientific survey has been reported from numerous countries, but only few reports comes from Indonesia. With the total forest estimated about 160 million km², the conservation of biodiversity in Indonesian forest and its surrounding area is important. These forest is important habitat for numerous birds’ species. Decrease of forest and rapid land uses changes lead to the decrease of birds. Recently, birds has been pressured, and many species went extinct [10]. Bird’s survey face numerous limitation, including number of skilled – semi skilled observer, techniques and equipment. Few researchers cannot be effective to record the super abundance of birds in Indonesian archipelago.

The available data that generated from citizen scientist will provide information on the distribution of bird in Java Island. There are, however, still limited empirical aspect on the advantage of citizen science involvement in birds monitoring to support conservation. While there are potential number of citizen scientist in Java, few studies has been conducted to evaluate the contribution of citizen scientist in birds to support conservation. The aims of the research is

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to examine the utilization of Burungnesia and citizen scientist preference in site selection and its relationship to the success to complete bird observer’s checklist in Java Island.

**MATERIALS AND METHOD**

**Data Collection**

Authors develop Burungnesia application which is freely downloaded in Google Playstore at https://goo.gl/Q6lPdh. Authors introduces the application to the birdwatcher community in Indonesia through social media and birdwatcher community network. Birdwatcher only able to use the application if they register to the system. The program was launched at 2016 and has been downloaded by 1,300 users. From these number, 760 user make registration and involve in voluntary birds observation in numerous sites in Java Island.

We collected geographic data of birds watcher site when they make observation from July 2016 to March 2017. The data was automatically saved at www.birdpacker.org, in which author act as the administrator of server.

We also distributes questionnaires to the registered user of Burungnesia through email and face book of Pengamat Burung Indonesia (Indonesian association of Birdwatcher). The distribution of questionnaire was aimed to generate complementary data which are important in spatial analysis. The collected questionnaire also essentially provides data related to the qualification of users based on the recorded and identified birds. The birds list was known as personal checklist. There is assumption that high number of reported checklist shows the ability of better identification on birds. From 194 distributed form by email, only 139 was send back to researcher.

**Spatial Analysis**

The observation point which is reported by observer was stored and overlay with environmental variable which influence the observer decision in observation site selection. The environmental variable are encompasses (a) distance from observer home, (b) distance from main road, in which observer able to reach by walking, (c) slope, and (d) lands coverage. The land coverage was derived from map produce by Ministry of Environmental and Forestry 2012. It can be downloaded from https://goo.gl/70CBe8. The map of land slope was downloaded from goo.gl/jeAs0j, using NASA SRTM3 SRTMGL3s. The road was generated from BAKUSORTANAL through goo.gl/6Xo6FD.

Each variables are further classified based on the accessibility level. Slope class was classified following the Decree of Agricultural Ministry (SK Mentan Nomor 837/Kpts/Um/11/80) about criteria and methods of protection forest declaration. The variable of distance of observer home to observation sites, nearest road to observation sites and land uses category was evaluated using questionnaire.

For data analysis, spatial data was analyzed using ESRI ArcGIS 10.3 that run using Windows 10 OS. All of the environmental variable were processed in raster format with similar property: cell size (X,Y): 959.435617, 959.435617; upper extent: 9442137.44312, left: -155159.448956, right: 1085390.80388, lower: 9023823.51409; with spatial reference: WGS1984/UTM Zone 49S; datum: D_WGS_1984; Units of length in meter and unit of angle in degree (0.0174532925199433).

**RESULT AND DISCUSSION**

The application of Burungnesia lead to the rapid data input for the further data analysis. Within 8 months of the data generated from informant, about 13,036 lines, from 1,436 observation sites has been reported by 195 user. From Java Island area, there were about 7,338 lines, from 841 observation sites was reported by 143 user. The distribution of observation sites was given in Figure 1. There was possibility of the number on point of observation which was reported, but some point was disappear during the analysis as a technical problem. Most of the disappear point was distributes along the coast line. It is especially occur during the clipping process in coordinates sites analysis. Point beyond map border and low accurate in recording automatically affect point disappears during clipping stages in ArcGIS analysis.

This analysis shows that the distribution of birds observed was concentrated in Jakarta-Bogor-Bandung area (25.77%), Purwokerto (5.15%), Semarang (8.25%), Jogyakarta-Solo area (31.96), Malang area (12.37%), Surabay (11.34), and other sites in Java Island (5.14%). These cities has been deeply analyzed and used as reference sites in defining and analyzing observer’s origins distance to the observation site. Distance were divided into 5, 10, 30, and 60 km.
Burungnesia Utilization for Birding Sites Observation in Java Island (Winasis, et al.)

Figure 1. Distribution of Birdwatcher which are Recorded from Burungnesia between July 2016 to March 2017 in Java Island

Figure 2. Accessibility Level of the Bird Watching Location. The accessibility level was derived from environmental variable, including distance from bird watcher originality, distance from main road, slope and vegetation coverage.

Table 1. Distribution of Observation following Each Environmental Variable

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of observation point</th>
<th>Distance from road</th>
<th>Vegetation cover</th>
<th>Slope</th>
<th>Distance from observer origins</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN</td>
<td>203</td>
<td>180</td>
<td>168</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>Very easy</td>
<td>590*</td>
<td>35</td>
<td>400*</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Easy</td>
<td>1</td>
<td>76</td>
<td>110</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>38</td>
<td>213</td>
<td>92</td>
<td>313*</td>
<td></td>
</tr>
<tr>
<td>Difficult</td>
<td>7</td>
<td>337*</td>
<td>58</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>Very difficult</td>
<td>2</td>
<td>-</td>
<td>13</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Total of point observation</td>
<td>841</td>
<td>841</td>
<td>841</td>
<td>841</td>
<td></td>
</tr>
</tbody>
</table>

Notes: NN = area not includes in all category or because the point beyond the border of Java islands. These location includes area in small island (Kepulauan Seribu, Kepulauan Karimunjawa and small islands surrounding Kangean Island.

The nearest distance (5 km) mostly located at house yard, open green space, City Park, and campus. The far distance often includes forest, coastal area, national park and production forest. Based on the observation, distance was not limitation factor for birdwatcher observation. The highest point observation category was found at medium category (10-30 km) with number of shell 313 (Table 1). This phenomena similar with the result of questionnaire, in which distance was not problem factor in observation (10.8 %). Scholar point out that people with specific hobby and interest to observe particular objet often ignored the distance. Distance is sensitive aspect in selection of recreation sites. Among the ecotourism or nature-based tourism, object attractiveness is important [11,12]. Most of the respondent state that time was the crucial factor and became the important problem for an observation.

Similar evidence was found in the category of land cover. The highest number of observation point was found at difficult category with number of shell 337. Interestingly, the very easy category has lowest conservation point (Table 1). There were numerous ecosystem categories involved as difficult category, namely primary mangrove forest, primary peat, and wild shrubs.
The moderates accesses category includes primary and secondary dry land, secondary mangrove, forest plantation, dry land agriculture with shrubs, savanna, wild shrubs, fish pond and water body. The observer has less interest to make observation in settlement area, paddy field and open lands. There were no report to the very difficult land category.

Based on the questionnaire survey, the observer motivation to choose difficult land category was influenced by the motive to increase number of personal record (25.9 %) or find the specific birds taxa (20.9%). The bird species which area related to these reason includes birds with specific habitat. These birds naturally distribute in habitat category moderate and difficult. The highest reason were there were no preference or random in selection (33.8 %).

In the variable of observation distance from road and slope, there were similar respondent answers. Many respondents select habitat with very easy category. There were tendency among observer to found the easy access point for observation. With the assumption that bird is dynamic object, in which animals actively move, the selection of observation plot in wild area will be better that unpredictable sites. Based on the observe tendency to select sites (Table 1), the spatial preference of birds observed was mapped as shown in Figure 3.

From Figure 3, the location with sharp slope such as mountainous and karts area has less tendency to visit. Administratively, these area are conservation area under the management of conservation authority such as PERHUTANI (Indonesian Forest Enterprises), office of forestry, both provincial and regency, and Ministry of Environment and Forestry. These area includes Halimun Salak National Park, Gunung Gede-Pangrango National Park, Gunung Ciremai National Park, Gn. Wilis-Kelud (KPH Kediri), R. Soeryo Grand Forest (under management of Provincial office of forestry), Mt. Kawi (PERHUTANI KPH Malang), Bromo-Tengger-Semeru National Park, mountainous area from Mt. Argopuro, Mt. Raung to Mt. Ijen (East Java Nature Conservation Office, BKSDA) and Baluran National Park. Some area with flat lands includes conservation area in Ujung Kulon National Park, Alas Purwo National Park, Meru Betiri National Park and Nusa Barung Island (Strict Nature Reserve, BKSDA). Empirically, these area has been reported as an important habitat for birds [8,10,13]. While the conservation area has diversity and abundance of birds, these sites had been less visited due to the accessibility limitation. The observer mostly select sites with accessibility with medium land contour.

There were report from nearest location to observer home (sites within <5 km), in which observer make observation in numerous place such as house yards, campus, city park, etc. In the context of citizen science, the observation surround observer home is still important. In developed countries, the backyard birds programs receive a lot of attention from public.

Respondent has specific perception in bird watching. About 52.5% stated that they like to observe birds in natural and wild habitat. There were also reason related to the birds conservation in natural habitat (24.5%). This also significant and important as educational tools to increase knowledge and skill (11.5%). About 10.1% state that it is part of the jobs.
In the aspect of sites selection, about 33.8% respondent stated that the selection of sites was randomly picked or there were no preference in sites observation. About 25.9% select particular sites with the objective to increase checklist of the bird. About 15.1% stated that the selection is based on the reason that the place had never been visited before, or rarely monitored.

The main problem for bird watching activities includes limitation of available time (41.7%), inadequate birding instrument (29.5%) distance and accessibility (10.8%), and ability to identify birds species (9.4%). Only 8.6% respondent stated there were no problems in observation. Bird-watchers available time for birds observations became crucial limitation factor to explore bird in the field. Birdwatchers avoid place with difficult accessibility to save time and energy.

The Preference Sites Selection and Birds Species

There are interesting relationship between observer sites preference and birds encounter. The relationship was drawn in Figure 4. The preferred sites of observation has significant relationship to the increase number of birds, as shown in dotted line. The ratio of number of lines and point of observation, and there are positive relationship between huge number of observation point with preferred sites. However, comparative ratio of bird’s diversity and number of data and point of observations were decreased in the preferred location category.

This phenomena shows that location with high preference provides common list of birds in which population abundance and easily recognized. The endemic birds, special and birds in small population often inhabited in the place with less preferred by observers.

Based on the Figure 4 number and species diversity of birds are very low in not preferred sites, and increase gradually in moderate to very preferred sites. However, ratio between number of birds and endemic birds was highest in less preferred and tend to decrease in preferred area. In less preferred area, special, endemic and small
population birds often found easily. This area often become the target of bird watcher with the specific object observation. Observer in this category often includes professional and persons with specific interest, including researchers. Based on the questionnaire, bird observers has been successfully identified 177 species. The highest number of species which has been reported was 800 species. As a reference, number of birds in Java Island was estimated about 541 species.

CONCLUSION

From this study, it is clear that citizen science effective to collect field data of birds. It is especially useful to record common birds, birds with high population number, and general birds. Special birds and birds in small population seems to be rarely reported by citizen scientist. Lowest prepared location often has limitation accessibility. Citizen scientist has preference to select sites for birds observation in wild habitat. Observer select particular sites for bird observation following several aspect, including budget availability, accessibility and physical ability of observer to conduct observation. It is shown by the few number of observation conducted in sites with sharp slope and far from main road.

REFERENCES