An inventory of the biodiversity of Kare Caves for the development of ecotourism karst district Pamotan Rembang

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Abstract. The karst area is a unique ecosystem area and has a wealth of abundant potential resources. On the one hand, it is vulnerable to environmental exploitation to improve the economy. Kare Cave is a non-natural formed cave located in a karst topography. The beauty of Kare Cave has the potential to be developed into an ecotourism object. This study aims to determine the diversity of fauna and flora and identify ecotourism's potential in Kare Cave, Pamotan District, Rembang Regency. This research used a quantitative descriptive study. Data were analyzed using the Shannon-Wiener Diversity Index formula. The diversity of flora and fauna in Kare Cave can be developed into ecotourism based on education and conservation with several efforts that must be developed, namely improving infrastructure and involvement of local communities. The fauna diversity index $H' = 1.35$ and the flora diversity index $H' = 1.81$, which means it is included in the medium category.

1. Introduction

Tourism is travel activities that have the purpose of getting entertainment. Nugroho et al [1] suggests that in the era of globalization, tourism began leading to the preservation of the environment and conservation, known as ecotourism. Ecotourism is tourism that is used by the community in enjoying various types of biodiversity without destroying it. Travel is synonymous with a variety of educational activities, such as research.

Karst is an area of unique ecosystems and arid where most of the contained carbonate rocks. Haryono and Day [2] stated that the karst as a resource with the potential to support life, on the one hand, has a wealth of potential and abundant resources but, on the other hand, is susceptible to the risk of damage to the environment. Before the deterioration of the function of the karst region reached the point of most low-need to look for an alternative to prevent it, so the function karst area in the ecological-social-economic-cultural and scientific can be maintained. The selection of an alternative to protect the karst function needs to be based on its characteristics and potential.

The karst region, in large part by people who do not know about the potential of karst be used as a mining mineral group C. It is also used as the primary raw material in cement plants. The resulting impact caused by the mining is the loss of underground rivers, caves, and springs and the existence of flora and fauna in it. Research conducted by Indarwati [3] concluded that the karst is a landscape that is easily degraded. It should be protected from the threat of damage to the ecosystem due to storing various
economic potential. Therefore, to preserve the natural, step-wise for the utilization in the economy is not mining, but it developed into its ecotourism.

Kare Cave is a cave that formed in a non-natural which is still located on the karst topography. However, its formation results from human activities that dig against the limestone, and then the rest is left alone, without any hoarding or backfill [4]. The cave has a unique character in the karst area, which had a beautiful view of a stone fossil coral and much more. Such conditions are likely to be developed as a tourist destination, which will undoubtedly bring many benefits for local communities. This study aims to determine the diversity of fauna and flora and identify ecotourism's potential in the Kare Cave District Pamotan, Rembang.

2. Methodology

The study is located in the Kare Cave, Pamotan District, Rembang Regency in the month of October-November 2020. The research method uses descriptive research quantity and at the if. The Data of this study consists of primary data and secondary data. Primary data collection was conducted through direct observation and interviews with the people around. Secondary Data was collected from various literature studies, book reports, journals, research results, and other supporting data associated with the research being conducted.

![Figure 1](image1.jpg)

**Figure 1.** The map location of Kare Cave.

![Figure 2](image2.jpg)

**Figure 2.** Topographic map of Kare Cave.

Materials and tools required in this study is a GPS, camera, meter, data inventory, stationery, count tool, a set of computers with the software ArcMap 10.3, machetes, and other supporting tools. The Data obtained were analyzed by using the Diversity Index of Shannon-Wienner to determine the level of diversity and the evenness to declare the total amount of scattered individuals in each species obtained as follows [5]:
\[ H' = -\sum p_i \ln p_i \]  

Description:

- \( H' \) = diversity Index of Shannon Wienner
- \( p_i \) = proportion of species to 1 in the total sample
- \( N_i \) = number of individuals of all types
- \( N \) = the total Number of individuals of all types

Criteria for diversity of types is determined as follows:

- \( H'< 1 \) = diversity is kind of low.
- \( 1<H'< 3 \) = the diversity of types of being.
- \( H'> 3 \) = the diversity of the type of high.

Data that has been collected, then tabulated, processed and analyzed descriptively qualitative. Analysis of the data includes the index of species diversity.

3. Result and discussion

Region Rembang Regency is located in the northern part of the Java Island, which directly borders the Java Sea, and in the section south is the straightness of the Karst Mountains Sukolilo that stretches from Grobogan, Pati and Blora set in the ESDM No.17 of 2012 On the Determination of the Landforms of Karst, or better known as Karst Kendeng Mountains of the North. Kare Cave is located in Pamotan District with the coordinates of 55383 E 9252848 S. the Condition of the cave has a moisture level of 65% and a temperature of 29°C. In general, the structure of a cave shaped horizontally elongated into the cave's mouth with a diameter of 6-7 meters facing the west direction.

![Figure 3. The mouth of Kare Cave.](image-url)
3.1. The diversity of flora and fauna in the Kare Cave

| No | Species     | Variety | Scientific Name                      | Quantity | Pi     | ln     | Index  |
|----|-------------|---------|--------------------------------------|----------|--------|--------|--------|
| 1  | Aangsana    | Tree    | Pterocarpus indicus                  | 3        | 0.0024 | -6.021 | 0.0146 |
| 2  | Paku-pakuan | Semai   | Lycopodium cernuum                   | 44       | 0.0356 | -3.3354| 0.1187 |
| 3  | Red Onions  | Semai   | Allium Ascalonicum L                 | 65       | 0.0526 | -2.9452| 0.1549 |
| 4  | Holm Oak    | Trees   | Quercus Ilex                         | 1        | 0.0008 | -7.1196| 0.0058 |
| 5  | Earrings    | Semai   | Acalypa indica                       | 8        | 0.0065 | -5.0402| 0.0326 |
| 6  | Teak        | Tree    | Tectona grandis sp                   | 134      | 0.1084 | -2.2218| 0.2409 |
| 7  | Leucaena    | Tree    | Leucaena leucocephala                | 78       | 0.0631 | -2.7629| 0.1744 |
| 8  | Puzzles     | Semai   | Cyperus rotundus                     | 257      | 0.2079 | -1.5706| 0.3266 |
| 9  | Bananas     | Pole    | Musa acuminata                       | 5        | 0.004  | -5.5102| 0.0223 |
| 10 | Cassava     | Stake   | Manihot esculenta                    | 15       | 0.0121 | -4.4116| 0.0535 |
| 11 | Elephant    | Semai   | Pennisetum purpureum                 | 524      | 0.4239 | -0.8581| 0.3638 |
| 12 | Turmeric    | Semai   | Swietenia macrophylla                | 55       | 0.0445 | -3.1123| 0.1385 |
| 13 | Mahogany    | Tree    | Samanea saman                        | 7        | 0.0057 | -5.1737| 0.0293 |
| 14 | Tamarind    | Tree    | Colocasia esculenta                  | 17       | 0.0138 | -4.2864| 0.059  |
| 15 | Taro        | Stake   |                                    | 23       | 0.0186 | -3.9841| 0.0741 |

| Number | 1236 | H'   | 1.8089 |

| No | Species             | Scientific Name | Quantity | pi      | ln      | Index  |
|----|---------------------|-----------------|----------|---------|---------|--------|
| 1  | Bat Wings Bent      | Miniopterus Sp. | 1003     | 0.23847 | -1.4335 | 0.34185 |
| 2  | Cockroaches Wood    | Cryptocercus    | 500      | 0.11888 | -2.1297 | 0.25317 |
| 3  | Black Ants          | Lacius niger    | 2000     | 0.47551 | -0.7434 | 0.35348 |
| 4  | Millipedes or       | Chilopoda       | 200      | 0.04755 | -3.0459 | 0.14484 |
| 5  | Orong-orong         | Gryllotalpidae  | 502      | 0.11935 | -2.1257 | 0.25371 |
| 6  | White Owl           | Tyto alba       | 1        | 0.00024 | -8.3443 | 0.00198 |

| Number | 4206 | H'   | 1.34902 |

There are 15 species of flora found in the Kare Cave that has a value of H’=1.81 which means with a value of 1≤H’≤3 then including the diversity of plants being and the stability of the community are. Flora was found in the area of the Kare Cave with a radius of 0-20 meters. Grass and elephant grass has the most number of lots in the category of sowing, while the teak tree has the most number of lots in the
tree category. It is in line with research [6] that found the seven types of trees in the Area of Karst Gombong Selatan; one of them is teak (*Tectona grandis*) and mahogany (*Swietenia mahagoni*).

There are six species of fauna found in the area of the springs mudal has a value of $H' = 1.35$ which means with a value of $1 \leq H' \leq 3$ then including the diversity of the fauna being and the stability of the community are. Bats and black ants red ranks number, which is a lot compared to other fauna. Bats are characteristic of endemic animals in the cave. Rahmadi and Yayuk [7] states that the bat has a vital role in the ecosystem in the cave. According to Aguirre et al [8], bats are the counterweight to what is essential in the process of the ecological complex through interactions, such as seed dispersal, pollination, and a counterweight of insect populations. According to Fachrul [9], the components of the environment (biotic and abiotic) will affect the biota abundance and diversity in one place so that the high abundance of individuals of each type can be used to assess the quality of a habitat.

### 3.2. The efforts of ecotourism development

The concept of tourism is that tourists enjoy the beauty of nature without destroying it but have inculcated the concern for the preservation of the environment. Tourism potential that can be developed in Kare Cave is the potential of flora and fauna and the socio-cultural potential. The surrounding community has conservation activities by planting various plants around the cave-like tree soursop, types of onions-exactly in the Sunday market, yam, cassava and others. In addition, often once, Kare Cave is used for meditation by people outside the city.

Based on the research, the Kare Cave has often been used to search the cave, which is done by High school students from around the area. It indicates that visitors are interested in the cave so that it has the potential to be used as an attraction. It is supported by research conducted by Indrayati and Setyaningsih [4] which states that the Kare Cave is one of the attractions with high potential to be used as a geotourism and the laboratory nature of geography.

Things that need to be considered in the development of ecotourism, namely the first is taken to the cave is repaired and given a sign name board, which both involve the local people in ecotourism management. Nugroho [10] said that the development of ecotourism is to engage residents. It is because residents have an incentive for environmental conservation if involved in services ecotourism. According to Syarifah [11], tourism principles are expected to maintain the quality of the environment and culture and provide economic benefits to the local community, the region, and the government.

The diversity of flora and fauna in Kare Cave can be developed into ecotourism based on education and conservation. The data collection results on the diversity index of flora and fauna are in the category of moderate diversity. Based on research Djafar and Mappiasse [12], flora and fauna diversity index data is included in the medium diversity category due to the uneven distribution of the number of individuals of each species and has different competitiveness.

### 4. Conclusion

The diversity of flora and fauna in Kare Cave can be developed into conservation-based ecotourism and education with several efforts that must be developed, namely infrastructure improvement and local community involvement. The fauna diversity index $H' = 1.35$ is included in the medium category, and the flora diversity index $H' = 1.81$ is included in the medium category.

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