



## Human activities and their awareness in the existence of Bagendit Lake as a tourism site, Garut West Java

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### ABSTRACT

**Background:** Bagendit Lake is a tourist lake located in Garut (West Java) and has experienced a decline in water quality. This research was conducted in settlements around Bagendit Lake with the aim of studying human activities and the level of concern for the existence of Bagendit Lake. **Method:** Mix method (Quantitative and Qualitative) was used in this study to collect data about the activities, knowledge education and environmental ethics of the community. The data collection technique was carried out by purposive sampling involving 40 respondents aged between 18-60 years. Data were obtained by conducting field observations, interviews, questionnaires and document recording. **Findings:** The results showed that the community received environmental knowledge education from schools (54%) and parents (46%). Surprisingly, as many as 93% of respondents stated that they played an active role in preserving the Bagendit Lake. However, various activities (such as tourism, fisheries, agriculture and settlements) have resulted in environmental damage to Bagendit Lake. It can be concluded that the level of knowledge and public awareness about the impact of activities on the environment has not been maximized. It is necessary to support the local government's role in implementing environmental improvement and conservation.

**KEYWORDS:** community activities, environmental knowledge, environmental care.

### 1. Introduction

The dynamic phenomena in the environmental ecosystem is motorized by people with the presence of natural resources. Human dependence on the environment is started in the beginning of humans living on the surface of the earth. Starting from their traditional way of life, they often moves from one place to another place for settlement in order to maintain their survival. They collected some foods (plants and animals) as natural resources. This tradition disappeared when the number of family members and residents increased, because the dependence on the environment and the need for natural resources also increased. They started to settle down and do the activities in breeding and cultivation. Due to the existence of a settlement, therefore the development of civilization is growing rapidly and society is starting to form a system of government, belief, and culture (Violatti, 2018).

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Human dependence on natural resources created several human views upon the environment. Different views are implied in the forming of community behaviour in utilizing environmental natural resources.

In this study, Bagendit Lake (tourist area) is one of the natural resources is utilized by the surrounding community. This tourist lake has an area of 124 ha and is located in a protected area in West Java. According to Darsiharjo (2015) the existence of Bagendit Lake is very supportive for people living in their surrounding. This is also supported by a very strategic location in the middle of five villages. Community activities that are commonly carried out in utilizing Bagendit Lake are tourism, fisheries and agriculture. These anthropogenic activities have a negative impact, namely producing organic waste which causes a decrease of the water quality of Situ Bagendit. Based on the results of previous research reports (Surtikanti & Syahinsyah 2021) the water quality of Situ Bagendit is in a eutropic-hypotropic status. This means that the nutrient content (N-P) and primary productivity are very high due to the presence of organic waste that flows or is dumped into the Bagendit Lake. Increasing number of population may increase the number of nutrient load in the water (Mokaya, et al. 2005). The effect of this status may decrease of dissolved oxygen concentration in the bottom layer of the water body (Rashid & Romshoo 2012).

According to Azevedo *et al.* (2015), eutrophication is a common water problem in lakes. This fast rate of eutrophication is the impact of the unbalanced use of water bodies and land around the lake and lake conservation (Kumurur, 2002). Eutrophication may threaten aquatic ecosystems, causing the death of aquatic flora and fauna due to the lack of oxygen in the water so that it can interfere with tourism and recreational activities in lake waters (Chislock, 2013). Huijbregts & Seppala (2001) informed that aquatic biota has differences in biological availability of nutrients and the sensitivity of aquatic environments. Eutrophication of waterbodies caused the excessive growth of aquatic weeds and phytoplankton (murky waters), blooms of harmful (toxic) algae and effects on fish populations (Withers et al. 2014).

To avoid a sustainable impact, it is necessary for the participation of the community in maintaining the environmental condition of Bagendit Lake. Therefore, it is necessary to conduct research on human activities and the level of concern for the existence of Bagendit Lake. This can be the initial basis for efforts to improve the environment of Bagendit Lake.

## 2. Methods

This study employs a quantitative descriptive method aimed at understanding the patterns of community activities surrounding Bagendit Lake and assessing their impacts on the lake's environment. The research targets individuals and groups actively involved in or residing near Bagendit Lake, including government officials overseeing the area, local residents participating in lake-related activities, and tourists who frequent the lake. A sample of 42 respondents was selected, ranging in age from 18 to 60 years. Data collection involved gathering primary data through structured interviews, questionnaires, and direct field observations, ensuring a comprehensive view of community engagement. In addition to primary data, secondary data was obtained from prior research studies relevant to the environmental and social dynamics at Bagendit Lake.

The data analysis process followed a structured approach, beginning with data collection and proceeding through data selection, grouping, reduction, interpretation, and ultimately, drawing conclusions and verifying findings. To enhance the validity of the study, a triangulation technique was employed, which involved examining data from various perspectives to minimize potential biases inherent in the data collection and interpretation processes. This triangulation ensures a more reliable representation of findings, achieving a higher level of accuracy in understanding the social and environmental interactions at Bagendit Lake (Rahardjo, 2010). Through this methodical approach, the study aims to provide insights that can inform sustainable management practices for the lake and its surrounding areas.

### 3. Results and Discussion

The findings of this study offer insights into the background and environmental context of Situ Bagendit, highlighting its role and significance for the local community. Situ Bagendit, a lake of cultural and ecological importance, serves as both a natural resource and a focal point for various social and economic activities in the area. The lake's surroundings host diverse activities such as fishing, tourism, and agriculture, making it a vital element in the lives of the people who live around it. Understanding the lake's background provides context for evaluating how these activities, if unmanaged, may pose risks to the lake's environmental health and sustainability.

In addition to exploring the lake's background, the study also investigates the level of environmental awareness among the community members living near Situ Bagendit. This aspect of the research assesses the community's knowledge regarding environmental conservation practices and their awareness of the ecological impact of their activities. The findings indicate varying degrees of environmental understanding, which influence how individuals interact with the lake ecosystem. By assessing community knowledge, the study aims to identify areas where environmental education could be beneficial, ultimately contributing to more sustainable practices around Situ Bagendit.

#### 3.1 The background of Situ Bagendit

The secondary data on the background of the Bagendit Lake was obtained from the Prodeskel of the Ministry of Home Affairs 2015. The Bagendit Lake has an area of 124 hectares and a body of water covering an area of 87.75 hectares. Geographically, the position of Bagendit Lake is at coordinates 7°09'43.2"LS and 107°56'35.0"E. The lake is bordered by five villages, namely Banyuresmi in the North, Sukamukti in the North extending to the West, Sukaratu in the South, and Cipicung in the East. The community around Situ Bagendit (30,885 people) are predominantly Muslim (97%) with very diverse livelihoods, namely as farmers or farm laborers (38%), self-employed (27%), civil servants (8) and other jobs (27%). The education background of the Situ Bagendit community is very diverse, namely: elementary school (36%), junior high school (15.5%), senior high school (14%), Diploma I- Diploma III (0.1%), Diploma IV- Graduate (0.2%) and those who not in school (32.4%).

The government system consists of the organizational structure and government programs. The organizational structure is that Situ Bagendit is under the ownership of the Garut Province Tourism and Culture Office. This management is carried out by the Regional Technical Implementation Unit of Situ Bagendit. Meanwhile, the government programs are: cleaning the waters of Situ Bagendit which (2 times a week), plans to build a dam on the Ciojan river which will be the source of the water supply, planting *Tilapia* and *Mujair* fish (twice a year) and supervising the management and maintenance of Situ Bagendit. Those monitoring data is then reported to the Garut Province Disparbud for evaluation.

#### 3.2 Environmental knowledge of communities around Situ Bagendit

The results of the questionnaire show that the community has learned about environmental education from school and parent. This shows that the community already has basic knowledge of the importance of the environment. From the results of the knowledge obtained, the community implement the activities in conserving the local environment. People only keep the environment clean and collect domestic waste into a trash to be burnt. What the community is doing is not right, because burning domestic waste may cause other negative effects. The implication of burning domestic waste in the open place, contributed to the high concentration of CO and CO<sub>2</sub> in the atmosphere (Daffi et al 2020). More over burning of plastic bags released chemicals into the air, causing serious lung damage and other long-term health problems to the residents living close to such areas

(Verma et al. 2016). Any combustion process including plastic waste, will produce dioxins which has carcinogenicity effect to human (Lavric et al. 2004).

Another affective attitude that almost all respondents (93%) stated that they continue to play an active role in preserving the Bagendit Situ. This shows that the community around Situ Bagendit has an awareness of the importance of environmental sustainability. This behavior reflects the attitude written by Keraf (2002), namely the attitude of compassion and care for nature where people have the awareness to pay attention to the condition of the surrounding environment and try to protect it.

The behaviour of people in caring the environment is based on their knowledge (Notoatmojo 2003). The existence of sufficient knowledge from individuals or community groups is expected to lead to positive behavior. 50% of respondents stated that they applied the knowledge from school in caring environment. It showed that the community already had basic knowledge of the importance of the environment. From the results of the interview, it was found that the environmental knowledge possessed by the community around Situ Bagendit is only limited to maintaining environmental cleanliness and waste management. This knowledge is generally obtained from formal education such as elementary school and the family environment. In addition, the community has an awareness of the influence of the human activities around the Situ Bagendit. This shows that the surrounding community has applied the principle of respect for nature because people are aware of their dependence on their environment (Keraf, 2002).

### 3.3 Community Activities Around Situ Bagendit

The data from the questionnaire shows that the surrounding community visited Bagendit Situ occasionally. This is recorded by the number of respondents that 46% of respondents rarely visited Situ Bagendit. People who answered that they rarely visited Situ Bagendit because their daily activities or their livelihood did not utilize Situ Bagendit. The community whose daily activities involve the waters of Situ Bagendit is 6% and usually activities in the morning (41%) and in the afternoon (36%). People make a living as fishermen and floating shop traders so that most activities are carried out in the morning towards daylight. The duration of activities at Situ Bagendit mostly takes less than 3 hours.

Activities around Situ Bagendit are broadly divided into several fields, namely agriculture, fisheries, tourism, and trade. Farming activities on the shores of Situ Bagendit are mostly carried out by residents of Sukamukti and Sukaratu villages. The local community manages rice fields and vegetable gardens when the water recedes. This is because the land used is the edge of Situ Bagendit. The water source used comes from the Ciojan river which also empties into Situ Bagendit. The fertilizer used is NPK fertilizer which is obtained from the government or fertilizer sellers for free.

Many agricultural lands are found in the Sukamukti and Sukaratu areas because they utilize the Ciojan river flow as a source of irrigation. This certainly affects the waters of Situ Bagendit because the flow of the Ciojan river empties into Situ Bagendit. The land is used as rice fields and secondary crops with the use of fertilizers generally using NPK fertilizer. The use of this type of NPK fertilizer if it is not in accordance with the required dose it will not be absorbed by plants and eventually settles in agricultural land or is carried by water flows to rivers. Fertilizer carried can affect the water content of Situ Bagendit. In addition, community farming activities are carried out during the dry season so that land clearing is available on the edge of Situ Bagendit. This behavior can cause the sediment in the soil layer to be carried away when it rains and the water level rises. This can cause changes in the chemical content of the Bagendit Situ waters. According to Kumurur (1998), the utilization of the function of the space around the waters into plantation areas and fields can greatly affect the increase in water phosphate levels, because it can be a determining factor for the entry of pollutant materials.

Fisheries activities in Situ Bagendit include fishing that is not carried out freely but follows written and unwritten rules. Fishermen who catch fish in the waters of Situ Bagendit

only use nets of a certain size that are not too small. In addition, the local government, namely UPT Situ Bagendit, forbade fishing activities using poison, bombs, and electricity. This prohibition is caused because this method of fishing has proven to be destructive to aquatic ecosystems (Sala et al., 2011). In addition, there is a public belief that if you catch tilapia or tilapia with red spots, it cannot be brought ashore and must be returned to Situ.

In addition to nets, fishermen also use fishing techniques using bunbuns or clumps of wood placed in the waters with the intention of being fish traps. The fish found in Situ Bagendit are tilapia (*Oreochromis niloticus*) and tilapia (*Oreochromis mossambicus*). The community still uses the traditional method of catching fish, namely bunbun fish traps, fishing nets, and fishing. The use of bunbuns is found in the waters of Situ Bagendit because of its easy installation, does not require special care, and saves the use of labor (Nurfiarini and Purnomo, 2009). The existence of this bunbun also provides a breeding ground for fish, but because the material uses bamboo, weathering can occur so that it can cause silting of the waters.

Fishing using nets is also found in the waters of Situ Bagendit but does not run throughout the year but only at certain times. Catching using nets is intended to catch fish of a certain size so that smaller fish (juvenile) are not caught. This behavior shows the attitude of responsibility put forward by Keraf (2002) where the community has a responsibility for the survival of living things in the vicinity.

The existence of floating net system fish ponds can also affect the waters they use. The results of fish excretion that are concentrated at one point can increase the concentration of phosphate, nitrate, and ammonia in the water. This phenomenon also occurs in Lake Tondano where the presence of floating nets that mushroom and utilize the waters of Lake Tondano contributes to nutrients due to the decomposition of feed residues which causes an increase in the concentration of phosphate, nitrate, and ammonia so that the water quality of Lake Tondano decreases (Kumurur, 2002).

The community around Situ Bagendit knows that if you catch fish that have red spots or fins, they must be returned to the waters. This feature is characteristic of tilapia (*O. niloticus*) and tilapia (*O. mossambicus*) during the breeding season where the pectoral, dorsal, and caudal fins turn reddish (FAO, 2019a; FAO, 2019b). The existence of these restrictions and prohibitions is a form of ecological intelligence of the community who utilize the waters of Situ Bagendit to maintain the survival of the fish found in Situ Bagendit so that this source of livelihood can be used sustainably and the community can take advantage of the existence of Situ Bagendit for daily life and earn a living. In addition, the Department of Fisheries and Livestock of Garut Regency also maintains the fish population in Situ Bagendit by breeding twice a year.

### *3.4 Environmental problems experienced by surrounding Communities*

The community around Situ Bagendit said that the condition of Situ Bagendit is now not as clean as it used to be. In addition, the depth of Situ Bagendit has experienced silting up to only about 2 meters. This is in accordance with the results of research from Syahinsyah (2019) which states that the average depth of the waters of Situ Bagendit is only 1.5 to 2 meters deep. Although the use of Situ Bagendit in various fields has a positive impact on the surrounding community, the environmental conditions of Situ Bagendit have decreased due to the use of the Situ area by the surrounding community. The decline in water quality caused by the activities of the surrounding community is a common cultural eutrophication around the lake which is used as a tourist area and the surrounding land is used by the surrounding community (Kumurur, 1998; Soemarwoto, 2003).

This eutrophication process can be caused by human activities around the waters including the results of the use of chemical fertilizers in irrigated rice fields and vegetable fields, changes in land use around the lake, and uncontrolled growth of aquatic plants (Kumurur, 1998; Murtiono and Wuryanta, 2016). This cause can be found around Situ Bagendit where the community interacts with Situ Bagendit in various fields such as

agriculture, fisheries, tourism, and settlements. Although the community responds to environmental problems by trying to show good behavior in interacting with the environment, there is still a lack of knowledge about the influence of community behavior on the environment, causing many activities that can damage the environment carried out by the community.

### *3.5 Ethics, attitudes, and the impact of the surrounding community against Situ Bagendit*

From the results of interviews conducted in five villages around Situ Bagendit, it is known that the community has applied the principles of respect for nature and responsibility for nature proposed by Keraf (2002). This principle is shown by the active attitude of the community in preserving the Bagendit Situ such as not throwing garbage in the Bagendit Situ environment and not making a household waste water disposal route that empties into the Situ. This is also because Situ Bagendit according to the community can be a source of livelihood so that its existence is well maintained by the community. This attitude of protecting the environment can be seen in the behavior of people who do not litter. Local residents usually collect the resulting waste and then burn it in their yards. In addition, in the construction of houses, the community already has a septic tank in their respective home.

Then, the results of field observations found that the surface of the Bagendit lake was dominated by the lotus plant (*Nelumbo nucifera*). This plant covers most of the surface of the Bagendit waters and spreads from the edge to the middle of the waters. This is due to the habitus of this lotus plant which has roots that grow at the bottom of aquatic sediments with leaves and flowers on the surface with leaf stalks that can grow up to 200 cm (Kew, 2019) so that this plant can grow in waters that have a depth of up to 200 cm. 2 meters. The lotus plant which the local community calls the lotus plant is consumed by the seeds of the surrounding community. Consumption of this lotus flower seed is a natural thing to do by the community around the waters that are the habitat of the *N. nucifera* plant because of its nutritional content (Mukherjee, 2009). Besides being consumed, the lotus plant has the ability as a bioremediator because it can reduce the levels of pollutants and heavy metals from the waters (Gallego et al., 1996; Kanabkaew and Puetpaiboon, 2004). Heavy metal groups including arsenic, lead, and cadmium can be absorbed from the waters through the rhizofiltration process (Anawar et al., 2008; Mishra, 2009). Several studies also state that *N. nucifera* has been successfully used in overcoming the eutrophication process because of its ability to assimilate phosphorus and nitrogen which are mostly contained in the waters caused by high agricultural activities around these waters (Othman, 2004). This agricultural activity is also found around Situ Bagendit so that the appearance of this lotus plant can be caused by the occurrence of cultural eutrophication due to community activities around Situ Bagendit.s. The drainage canal is also made in such a way that it does not end up in Situ Bagendit.

## **4. Conclusions**

The study concludes that community activities around Situ Bagendit, including agriculture, fisheries, settlement, and tourism, significantly impact the lake's environmental condition. These activities, while vital for the local economy and livelihoods, contribute to changes in the lake's ecosystem. Agricultural practices around the lake, for instance, often involve the use of fertilizers and pesticides that can lead to runoff, increasing nutrient levels in the water. Similarly, waste from settlements and tourism activities adds to the organic and chemical load, putting additional stress on the lake's natural processes. Although the local community shows a degree of environmental awareness and has made efforts to protect Situ Bagendit, the lack of comprehensive knowledge on the environmental consequences of their activities limits the effectiveness of these efforts.

This limited understanding of environmental impacts has led to a decline in Situ Bagendit's water quality, manifesting in a process known as cultural eutrophication. This phenomenon occurs when excessive nutrients, primarily nitrogen and phosphorus, accumulate in the water, spurring rapid algae growth. Over time, this process can deplete oxygen levels in the lake, harm aquatic life, and reduce water clarity, thereby pushing the lake into a hypereutrophic trophic state. This status indicates an advanced level of nutrient enrichment that compromises the lake's ecological balance. Addressing these issues requires not only awareness but also targeted environmental education and sustainable practices to prevent further deterioration of Situ Bagendit.

### Author Contribution

All author contributed fully to the writing of this article.

### Ethical Review Board Statement

Not applicable.

### Informed Consent Statement

Not applicable.

### Data Availability Statement

Not applicable.

### Conflicts of Interest

The author declare no conflict of interest.

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