



## Economic valuation of Sumber Semen Nature Tourism Park in Rembang Regency

Shinta Nur Rahmasari<sup>a</sup>, Wonny Ahmad Ridwan<sup>b</sup>, Eka Intan Kumala Putri<sup>c</sup>

<sup>a</sup> Natural Resources and Environmental Management Study Program, Graduate School, IPB University, IPB Baranangsiang Campus, Bogor, 16128, Indonesia [+62 85726949693]

<sup>b</sup> Environmental Engineering and Management Study Program, College of Vocational Studies, IPB University, IPB Baranangsiang Campus, Bogor, 16128, Indonesia [+62 87870297113]

<sup>c</sup> Resources and Environmental Economics Department, Faculty of Economics dan Management, IPB University IPB Darmaga Campus, Bogor, 16680, Indonesia [+62 8121106500]

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### Corresponding Author:

Shinta Nur Rahmasari  
Natural Resources and  
Environmental Management  
Study Program, Graduate  
School, IPB University,  
Phone: +6285726949693  
Email:  
[shintarahmasari@apps.ipb.ac.id](mailto:shintarahmasari@apps.ipb.ac.id)

**Abstract.** *The Sumber Semen Nature Tourism Park is the only conservation area in Rembang Regency. This area is designated as a protected area by two ministries mainly because this area is the largest water catchment area in Rembang Regency, part of the North Kendeng Karst Mountains. However, some people does not realize the value of the Sumber Semen area resulting low management participation level. This study aims to identify the area potential, estimate the total economic value of the Sumber Semen area, and determine the level of community dependence. The exploration results showed 124 species of flora, six species of birds, one species of mammal, two species of herpetofauna, and butterflies. Water is utilized for tourism activities, agricultural irrigation, and household necessities. The minimum estimated carbon stock is 468.31 tons/ha. The estimated total economic value is IDR 12,486,219,121/year. The highest economic value is obtained from agricultural activities and the fulfillment of household clean water. The analysis results of economic benefits in the income sharing from total income are included in the very low category (18%). Meanwhile, the income to household expenditures is included in the low category (25%).*

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## INTRODUCTION

Nature Tourism Park is a conservation area that protects life support systems and preserves biodiversity and natural uniqueness. In addition, it can also be used for natural tourism activities while prioritizing the preservation of nature. Sumber Semen, Natural Tourism Park, is the only conservation area in Rembang Regency. This area is designated as protected by the Ministry of Energy and Mineral Resources and the Ministry of Environment and Forestry. One reason is that this area is the largest recharge area in Rembang Regency, known as the Watuputih Groundwater Basin Area. Protection of the area is also stated in Presidential Decree No. 26 of 2011 concerning the Designation of Groundwater Basin as a conservation/protection area. Unfortunately, Sumber Semen Nature Tourism Park is not included in the list of ten leading tourist attractions in Rembang Regency based on the results of interviews in 2020 with the Rembang Regency Tourism Office. The community is unaware of the value of Sumber Semen Natural Tourism Park, causing a low willingness to participate in managing the area. Often, there are disturbances to Sumber Semen Natural Tourism Park from

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the community in the form of the irresponsible use of mass tourism activities. Tourism activities should be able to provide economic benefits to the community and the region if carried out responsibly (Ekayani and Nuva 2012). There are many challenges in sustainable management, mainly to maintain ecological functions but can provide optimal economic benefits for the community so that social conditions can be conducive and maintained. All three dimensions intersect in area management (Hijrianti and Mardiana 2014).

Management of the area must be based on the principle of sustainability: ecological, economic, sociocultural, infrastructure, and institutional dimensions (Aminudin et al. 2014). All dimensions can be aligned by involving the community in managing Sumber Semen Natural Tourism Park. It might encourage the improvement of community welfare indirectly. The economic benefits of the community may motivate the community to be willing to conserve and utilize natural resources sustainably. According to Sunkar and Rachmawati (2013) community participation is essential to sustainably managing conservation areas. So it is necessary to formulate the management of the Sumber Semen Natural Tourism Park area, which refers to sustainability and is long-term oriented to be sustainable.

An economic assessment of natural resources and the environment must illustrate the area's importance in reducing environmental losses due to development (Anjani and Harini 2016). Economic value is the form most easily understood by the community in describing the perceived benefits. So it is crucial to evaluate the Sumber Semen Natural Tourism Park area economically to increase public awareness of the existence of Sumber Semen. This formulation is expected to encourage local economic growth, equitable distribution of social welfare, and preserve the area. This study aims to identify the potential of Sumber Semen Natural Tourism Park, estimate the total economic value of the Sumber Semen area and determine the level of community dependence on Sumber Semen Natural Tourism Park. This research is expected to benefit stakeholders in managing and making decisions related to Sumber Semen.

## **METHODS**

### **Research Location**

The research was carried out at the Sumber Semen Nature Tourism Park. Administratively, it is located in Gading Village, Sale District, Rembang Regency, Central Java, and 39 km from Rembang downtown. Natural Resources Conservation Center Central Java Province manages Sumber Semen Nature Tourism Park with an area of 17.1 hectares.

### **Data Collection**

Identifying the potential of Sumber Semen Nature Tourism Park is done by exploring biodiversity and field observations. Both are efforts to collect data by identifying the types of flora and fauna in Sumber Semen Nature Tourism Park to get a list of biodiversity types (Suryani and Owbel 2019). Estimating economic value combines field observations, identification of market prices, interviews, and literature studies. An interview with a questionnaire guide was used to determine community dependence. Respondents were selected using the Simple Random Sampling (SRS) Method, a sampling method in which each member of the population is given the same opportunity to be chosen as a sample. Data collection on community dependence was carried out in Gading Village and Tahunan Village. According to Alwi (2015), the respondents should be 2% of the population to ensure consistent and accurate representation (Table 1).

Table 1 Number of respondents

<b>Study</b>	<b>Respondent</b>	<b>Source</b>
Tourist activities	85 visitors (last 5 years)	BKSDA Central Java Prov (2015)
	37 Gading Village Communities	BPS (2019)
	37 Tahunan Village Communities	BPS (2019)
Household clean water	163 Customer PDAM Banyumili	Interview PDAM Banyumili

Study	Respondent	Source
Agricultural Irrigation	37 Gading Village Communities	BPS (2019)
	37 Tahunan Village Communities	BPS (2019)
Existence value (willingness to pay)	85 visitors (last 5 years)	BKSDA Central Java Prov. (2015)
Level of community dependence	37 Gading Village Communities	BPS (2019)
	37 Tahunan Village Communities	BPS (2019)

## Data Analysis

### Descriptive Analysis

Descriptive analysis transforms raw data into something easier to understand as a form of concise information. Combined the results of field observations, interviews, and literature studies, presenting them with new information that can represent the conditions of the research location. Descriptive analysis was carried out to describe the data without intending to make general conclusions. This analysis is expected to make the results of this study easier to understand.

### Benefit Transfer

According to the Ecosystem Valuation Organization (Choirunnisa and Grafitiani 2022), the benefits transfer method estimates the economic value of biodiversity by transferring available information from similar studies that already exist in other locations. The values used are the research results by Mukhamadun et al. (2008) in Kampar District. This research was chosen because it was conducted in a Nature Tourism Park (TWA) with a lowland forest ecosystem type that was quite suitable for the conditions of Sumber Semen Nature Tourism Park. For the calculation results to be more actual values, adjustments are needed to the year of study and the district/city minimum wage rate (Choirunnisa and Grafitiani 2022):

$$V_{2022} = V_{2008} (1 + i)^t$$

$$N = V \times M \times \left( \frac{\text{the district/city minimum wage rate current research}}{\text{the district/city minimum wage rate of reference research}} \right)$$

Description:

V : Reference research biodiversity value (IDR/ha/year)

I : Interest rate (%)

T : Time (years)

N : Biodiversity value of Sumber Semen Nature Tourism Park (IDR/year)

M : Area (ha)

### Total Economic Value (TEV)

Used to determine respondents' willingness to pay (WTP) for environmental services from Sumber Semen Nature Tourism Park. The analysis in determining the amount of WTP was carried out referring to the research of Priambodo (2014), namely making a hypothetical market, getting a quote for the amount of WTP, and estimating the average WTP value.

$$EWTP = \frac{\sum_{i=1}^n WTP_i}{n}$$

$$TWTP = \sum_{i=1}^n WTP_i \left( \frac{ni}{N} \right) P$$

Description:

EWTP : Estimated average WTP value (IDR)

WTP-i : Value WTP –i (IDR)

N : Number of respondents who gave a value

N : Total respondents

P : Total population

The total economic value (TEV) of Sumber Semen Nature Tourism Park area is calculated according to the formula (Hasibuan 2014):

$$TEV = DUV + IUV + OV + EV$$

Description:

TEV : Total Economic Value (IDR/year)

DUV : Direct Use Value (IDR/year)

IUV : Indirect Use Value (IDR/year)

OV : Option Value (IDR/year)

EV : Existence Value (IDR/year)

### ***Economic Benefit Analysis (Sharing and Covering)***

Economic benefits can indicate community dependence on the Sumber Semen area. The economic dependence can be analyzed using share income from Sumber Semen Nature Tourism Park and total income in one month. Covering household expenses is how the contribution of Sumber Semen Nature Tourism Park can cover the household needs of the surrounding community (Istiqomah et al. 2019). The following equation can calculate both:

$$S = \frac{\pi}{\pi t} \times 100\%$$

$$I = \frac{\pi}{B} \times 100\%$$

Description:

S : Share income from Sumber Semen Nature Tourism Park to total income (%)

$\pi$  : Income from Sumber Semen Nature Tourism Park (IDR/month)

$\pi t$  : Total income from household (IDR/month)

I : Covering household expenses (%)

B : Household expenses (IDR/month)

## **RESULTS AND DISCUSSION**

### **The Potential of Sumber Semen Nature Tourism Park**

The potential referred to in this research is the potential for biodiversity, consisting of the diversity of flora and fauna, water resources, and the physical potential for using environmental services. Sumber Semen Nature Tourism Park, which is directly adjacent to community settlements, has the potential to change dynamically. The easy access to the area and surrounding environment, especially the limestone mine upstream, may cause deterioration of environmental quality. The exploration of flora diversity identified as many as 124 species from 58 flora families found in the Sumber Semen Nature Tourism Park area. Several types of woody flora, such as Jati (*Tectona grandis*) and two types of Mahoni (*Swietenia mahagoni* and *Swietenia macrophylla*), are found in groups in the eastern part of Sumber Semen Nature Tourism Park and form a plantation forest. Its existence shows that the Sumber Semen Nature Tourism Park area was once an ecotourism area managed by Perhutani. Jati and Mahoni are commercial types with durability class II, with high commercial value (Candiana et al. 2019). Although there are plantation forests within the Sumber Semen

Nature Tourism Park Area, the natural forest area is more expansive. In addition, there are ornamental plants with high commercial value, including orchids (*Rhyncostylis retusa* and *Cymbidium sp.*) and ferns. This condition shows the high flora diversity in Sumber Semen Nature Tourism Park.

In contrast to the flora condition, which tends to be less affected by high direct and indirect interactions from the community, the condition and presence of fauna allow for significant changes in a relatively short time as a response of fauna to a condition in their habitat. Environmental changes often lead to environmental damage due to people exploiting the environment at a level that exceeds the carrying capacity of the environment so that it can increase or decrease wildlife populations. The research of Kuswanda and Barus (2018) also states that the wider the community's plantations or rice fields will affect the wildlife habitat, narrowing its space for movement. The results of regional exports have identified six species of birds from 6 different families, including the *Elang Bido* (*Spilornis cheela*) and *Punai* (*Treron vernans*). Several types of butterflies, two herds of *Monyet Ekor Panjang* (*Macaca fascicularis*), and two types of herpetofauna, namely *Sanca Kembang* (*Python reticulatus*) and *Biawak* (*Varanus salvator*). Exploration results illustrate that food availability for long-tailed monkeys is still quite good. In addition, the many flowering plants identified in the Sumber Semen area invite many butterflies to live and breed.

Another potential is a natural pond from three underground springs in the Sumber Semen Nature Tourism Park. All three are in the saturated water zone category, located 150 meters above sea level. Since the flow pattern (hydrological system) that develops in this zone is a parallel irrigation pattern controlled by geological structures, most of these springs are perennial or flow throughout the year, and a small part is seasonal (KLHK 2017). Utilization of water resources is only carried out for tourism activities, irrigation of rice fields, and clean water providers managed by *Perusahaan Daerah Air Minum* (PDAM) Rembang Regency. The length of the irrigation channel that flows through the seven villages is 32,520.91 meters, with varying water discharge flowing into each rice field area. The utilization permit owned by the PDAM of Rembang Regency is 140 liters/second with the collection point at the Jakinah River body, which is at the outermost boundary of the Sumber Semen Nature Tourism Park using a water pump with a capacity of 80 liters/second. Based on interview results from PDAM, 2021 data states the water taken from the Jakinah River is used to meet 8,142 customers, with service areas covering Rembang District, Lasem District, Pancur District, and Sale District. The number of customers is the largest that the production unit meets for its clean water needs.

The potential for environmental services produced by Semen Source Natural Tourism Park is utilized for tourism activities and carbon availability. The number of visits after the improvement of visitor facilities in 2018 and the Covid-19 pandemic is shown in Figure 1. Following a decree from the Rembang Regent to close tourist sites temporarily, there were no tourist visits from April to December 2020. In mid-2021, Sumber Semen Nature Tourism Park reopened to the public. The number of visits gradually increases while still implementing health protocols while traveling. Community empowerment is again actively carried out in tourism activities and is expected to increase participation and action in sustainable area management. In line with Hasanah et al. (2019), community participation in decision-making for tourism development around their place will increase their sense of care and appreciation for the area they have and care for the surrounding environment.

It was considered the Sumber Semen area has existed for a long time and was designated as a nature conservation area. Both have built suitable conditions for providing forest carbon stocks in an optimal amount. The estimated carbon stock value in Sumber Semen Nature Tourism Park is the minimum value that may be calculated. In total, it can be calculated not only from the stand-alone. Forest biomass has a potential carbon content. Almost 50% of forest vegetation biomass is composed of carbon elements. Stand carbon stock increased along with the increase in stem diameter. The results of the study estimate that the amount of carbon stock contained in the Sumber Semen Nature Tourism Park is 468.31 tons/ha. Manafe et al. (2016) stated that the tree trunk's diameter is one of the essential factors determining the size of a tree's carbon stock. The larger the diameter of the stand, the greater the carbon content. At the same time, the greater the density, the greater the carbon content. The estimated value of biomass and carbon stock in a stand can continue to increase if

there is no logging activity, forest fires, or vegetation removal due to vegetation growth, both in diameter and height of the stand. The amount of carbon depends on the diversity and density of plants, soil fertility, and how it is managed (Hairiah and Rahayu 2007).

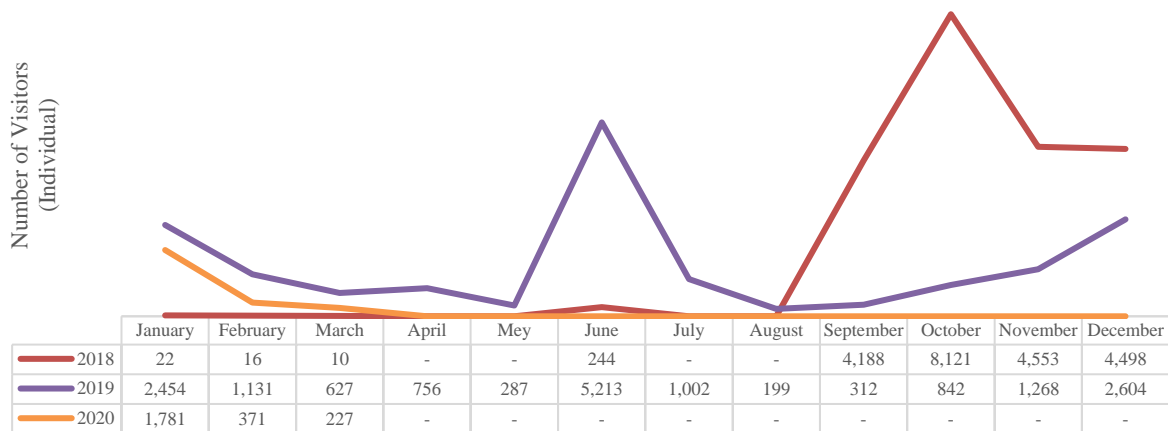


Figure 1 Number of visitor Sumber Semen Nature Tourism Park

**Estimated Total Economic Value of Sumber Semen Nature Tourism Park**

Direct use value from tourism activities is calculated from entrance tickets and total revenue from Sumber Semen Nature Tourism Park in the past year. The entrance ticket is Non-Tax State Revenue (PNBP) of IDR 7,500 on national holidays and weekends and IDR 5,000 on weekdays. The total number of visitors in one year (2019) was 16,695 visits. The year 2019 is used because it can represent the number of visitors to Sumber Semen Nature Tourism Park before the 2020 Covid pandemic occurred. The closure was due to the procurement and improvement of visitor infrastructure in 2018. Sumber Semen Nature Tourism Park revenues are calculated from tour guide activities, stall income, parking services, and photographers, which are accumulated in the calculation year. Based on the results of interviews, people who have income from Nature Tourism Park Sumber Semen have an average income of IDR 506,667/month.

The direct use value of tourism activities is estimated at IDR 131,292,500. Other direct use values are obtained from using water used for agricultural irrigation and meeting household clean water needs. Agricultural irrigation from springs in Sumber Semen Nature Tourism Park can irrigate approximately 449.24 ha of rice fields from seven villages. Only 14.38% of water is used for agricultural irrigation by rice fields in Gading Village, or the equivalent of 64.61 hectares. The rest is used by rice fields not directly adjacent to Sumber Semen Nature Tourism Park. The value of the contribution of water to farming is very high. Following research by Syaukat and Siwi (2009), estimates the value of water rent in hectares/year ranges from IDR 1,210,896 – 2,309,545. It follows field data obtained for two planting periods (one year). The required irrigation costs are IDR 1,819,697/ha. The direct economic value of agricultural irrigation can be calculated from the area of the paddy fields, which are fed by water from Sumber Semen Nature Tourism Park, and the cost of irrigation needed for one hectare/year. The estimated direct-use value of agricultural irrigation is IDR 817,484,170. The household clean water needs were fulfilled for 8,142 PDAM Banyumili, Rembang Regency customers. This number represents the most significant number of customers whose needs are met by a clean water production unit in Rembang Regency. The total need for clean water is 2,226,353 m<sup>3</sup>. Based on data for July 2022, PDAM Banyumili has set a price/m<sup>3</sup> of IDR 3,150 for each customer. So the estimated direct use value of clean water is IDR 7,013,011,950. The total direct use value from Sumber Semen Nature Tourism Park is IDR 7,961,788,620.

The indirect use value from forest carbon stocks is estimated at 468.31 tons/ha. Carbon prices refer to research by Kepel et al. (2017) and Imran et al. (2022), which divide the price of carbon into two. The economic value of carbon is calculated based on prices prevailing in the voluntary market and the mandatory market (clean development mechanism). The voluntary market is a carbon market formed to reduce greenhouse gas

emissions without obligation and protect the environment. Meanwhile, markets must be formed because of policies that require reductions and restrictions on the amount of greenhouse gas emissions produced by companies and the government (Imran et al. 2022). The economic value used is global market data in 2010, each worth IDR 81,000/tCO<sub>2</sub>e and IDR 211,680/tCO<sub>2</sub>e. So, it is necessary to adjust for inflation that will occur in Indonesia in 2022 so that each is worth IDR 134,469/tCO<sub>2</sub>e for the free market and IDR 351,412/tCO<sub>2</sub>e for the mandatory market. The indirect use value of carbon in Sumber Semen Nature Tourism Park on the free market is IDR 62,973,177 and IDR 164,569,754 on the mandatory market. Carbon pricing in the form of an emissions trading system (Emissions Trading Systems/ETS) or introducing carbon taxes can stimulate clean technology and market innovation and encourage new, low-carbon economic growth (Sutartib and Purwana 2021).

The Option value from biodiversity is analyzed using benefit transfer which refers to the research results of Mukhamadun et al. (2008) in Kampar District. The value used in the calculation is the economic value of trees, firewood, ornamental plants, animals, fruits, honey, rattan, fish, and medicinal plants calculated in hectare units, amounting to IDR 4,894,462/ha/year. The calculation results show that the value of research biodiversity in 2022 is IDR 9,372,629/ha/year. This value is calculated by considering the interest rate of 4.75% (2022) and the difference in research years. Then the value is transferred by considering the area and the amount of the local district/city minimum wage rate. In 2022 minimum wage rate for Rembang Regency is IDR 1,874,322.05, and the minimum wage rate for Kampar Regency is IDR 3,047,470.58. The calculation results show that the biodiversity value of Sumber Semen Nature Tourism Park is equivalent to IDR 98,573,961/year.

The existence value of the regional ecosystem is estimated using Willingness to Pay (WTP). The average WTP is IDR 1,383,182. Several things, such as region of origin, occupation, and education, significantly influence the value of the WTP given to each individual. Pramestyan's research (2021) states that a low level of education will increase the risk of low economic life, so the willingness to give value to natural resources is also relatively low. After estimating the average WTP value, the total WTP value is calculated from Sumber Semen Nature Tourism Park visitors. This calculation uses data on the number of visitors in 2013, totaling 3,921 visitors/year as visitor population data (BKSDA Central Java Province 2015). This data is used because, at the beginning of the research, the data visitor data in 2013 was available publicly. The total WTP value, which becomes the value of Sumber Semen Nature Tourism Park, is IDR 4,261,286,786/year. The complete estimate of the total economic value of Sumber Semen Nature Tourism Park is presented in Table 2.

Table 2 Total Economic Value of Sumber Semen Nature Tourism Park

<b>Total Economic Value</b>	<b>IDR/Year</b>
Direct Use Value	
Tourist Activities	131,292,500
Agricultural Irrigation	817,484,170
Household Clean Water	7,013,011,950
Indirect Use Value	
Carbon Stock	164,569,754
Option Value	
Biodiversity	98,573,961
Existence Value	
Ecosystem	4,261,286,786
Total	12,486,219,121

The biggest contributor to the economic value of Sumber Semen Nature Tourism Park is obtained from the utilization of water resources. As much as 63.97% of the total economic value is obtained from agricultural irrigation and fulfilling household clean water needs. Forest land cover will significantly affect the availability

of groundwater and surface water (Budi 2017). This proves that forest sustainability has a direct effect on maintaining the hydrological function of forest areas. However, it differs from the public perception, which states that very few benefits are received from Sumber Semen Nature Tourism Park. The community's low awareness about the area's value causes it. For the community, the fulfillment of water needs so far has yet to contribute to the condition of the area's ecosystem, even though it can maintain the hydrological function of springs. So far, the fulfillment of water needs has not been considered an economic benefit from Sumber Semen Nature Tourism Park.

### **Level of Community Dependence on Sumber Semen Nature Tourism Park**

The community's dependence on its area is based on how economic benefits are obtained and affect the fulfillment of the needs of life. The economic benefits are estimated through the share of income from Sumber Semen Nature Tourism Park (tourism activities), the total direct income to the community, and household expenditures. It is crucial to count the benefit to describe success in sustainable management. Yoeti (2008) states that the success of tourism development in an area can be seen from the significant influence of money tourists spend on the local economy. Research data shows that a few people use Sumber Semen Nature Tourism Park as a source of income (from tourism activities). This is influenced by the unequal access of the community to the area, especially for tourism activities. The varying number of visitors is also the primary reason for the low participation of the local community. At the peak season, the needs of tourists can be met by approximately 5–10 traders. While in the low season, in one week, no more than 50 visitors come to Sumber Semen Nature Tourism Park.

Some people who have received Sumber Semen Nature Tourism Park come from the services of tour guides, selling food and drinks, selling souvenirs, photo services, and parking. This condition causes the income from Sumber Semen Nature Tourism Park to have a share of 18%, categorized as very low. Share is the contribution of tourism income from Sumber Semen Nature Tourism Park to total household income. Household income can come from more than one source of income, and the more diverse the types of work, the higher the level of acceptance (Hartono 2011). Not many activities can be carried out by the surrounding community at Sumber Semen Nature Tourism Park to increase household income. The average household income from Sumber Semen Nature Tourism Park from tourism activities is IDR 506,667, while the average total income for the surrounding community is IDR 2,860,000 in one month. The economic value obtained by the community contributes little to the total household income in one month to meet household needs.

Household needs in this study are routine monthly expenditures, including food, clothing, education costs, electricity, transportation, credit/internet, and others. The analysis results of covering income for household expenditures around the Sumber Semen Nature Tourism Park show a low category (25%). The number of tourism receipts from Sumber Semen Nature Tourism Park cannot meet household expenditures for the surrounding community. However, the average household income is almost the same as the average household expenditure. The average total income is IDR 2,860,000, with total household expenditures on average of IDR 2,016,667.

The surrounding community has benefited economically from Sumber Semen Nature Tourism Park, although it cannot meet household needs. It is causing the community's low dependence on the existence of the Sumber Semen Nature Tourism Park area. However, the community's contribution to preserving the area is maintained and maintained. This is related to the indirect benefits provided by Sumber Semen Nature Tourism Park for the survival of the community in the form of water and fresh air. In contrast to Hasanah et al. (2019), which state that positive and high-value perceptions are related to community dependence on the area, the community around Sumber Semen Nature Tourism Park still has positive perceptions and values towards the Sumber Semen area even though the level of dependence is deficient. According to Neil et al. (2016), people's dependence on forest resources has a good perception of the area around their residence.



## CONCLUSION

The results of the exploration of flora diversity identify as many as 124 species from 58 families. The diversity of fauna identified six species of birds, one mammal, two herpetofauna, and butterflies. Water is utilized for tourism activities, agricultural irrigation, and meeting household clean water needs. The minimum estimated carbon stock is 468.31 tons/ha. The estimated total economic value of Sumber Semen Natural Tourism Park is IDR 12,486,219,121/year. The highest economic value (63.97) is obtained from water used for agricultural activities and household clean water needs. The analysis results of economic benefits in the form of share income from total income are included in the very low category (18%). Meanwhile, covering income for household expenditure is in a low category (25%). This means that the income from Sumber Semen Nature Tourism Park does not significantly contribute to meeting the surrounding community's needs.

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