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Description of Valuation of Economic Value Potential Natural Resources and Environment In Bone Bolango Regency, Gorontalo Province

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Abstract

The research describes the results of the value-benefit valuation analysis economics of natural resources and the environment. Which consists of the value of forest resource benefits (the total value of direct benefits, the total value of indirect benefits, the total value of the selected benefits, the value of existence), the value of the economic benefits of metallic and non-metallic mineral resources, the value of the economic benefits of water resources, and the potential for disasters located in the district of Bone Bolango. The method used in this research is quantitative and qualitative descriptive analysis. The results showed that the total economic value of natural resources was 2,319,253,906 per year. This value by adding up the total value of direct benefits (Rp. 392,880,000 per year), the total value of indirect benefits expressed in terms of the potential value of carbon sequestration (Rp. 1,034,261,659.3 per year), the total value of optional benefits (Rp. 224,195,580 per year) and the total value of the option benefit value of existence (Rp. 667,916,666.67 per year). The value of the economic benefits of metal mineral resources obtained is Rp. 2,541,843,750,000,000. and non-metallic (rock) mineral resources ofRp. 321,131,698,296,310. The value of the economic benefits of water resources obtained is 917,744,767.2 m3/year x Rp. 4.750/m3 = Rp. 4,359,287,644,200 per year. 10 forms of potential disasters located in the district of Bone Bolango, namely: floods, extreme waves & abrasion, earthquakes, droughts, extreme weather, landslides, forest and land fires, epidemics and disease outbreaks, tsunamis and flash floods. The potential loss (total economic value) due to the disaster is Rp. 6,701,830,000,000. The conclusion obtained is that there is a comparison of four potential natural resources in the Bone Bolango district, namely the potential value of mineral/metal mining resources of 88%, the potential of mineral resources/non-metal mining of 11.12%, the potential of forest and land resources of 11.12%. 0.67% and water resource potential of 0.15%. Most of the potential natural and environmental resources contained in this area are minerals (mining).The economic valuation of natural resources and the environment can contribute to the regional economic development of Bone Bolango district. The recommendation from this study is that there must be a balance between investment activities that utilize the potential of natural resources and environment with natural resource conservation activities and the consideration of potential disaster risks.

Keywords: Valuation, economic value, natural resources, environment

Introduction

The potential of abundant natural resources is a capital inregional development process. Optimal utilization of these natural resources will be able to bring prosperity to the area. But on the other hand, in terms of
the management of these natural resources does not considering balance, environmental sustainability and sustainability can ultimately have an impact in the form of: degradation of both quality and quantity of the natural resource itself. One form of the decline in natural resources and the environment is the increase in population increase. The contributes directly to the need for space and land. This situation will then have a further impact on the availability of natural resources and the balance of the environment.

This situation can then cause pressure on the Carrying Capacity (supporting capacity and environmental capacity). In sustainable development, it is necessary to pay attention to three aspects, namely: economic sustainability, socio-cultural sustainability, and ecological sustainability. The determining factors the progress an area from the development of facilities and infrastructure are the area, roads, office areas, public facilities, such as the procurement of transportation equipment and so on, which are encouraged to create community welfare and progress area. Development activities, which require inputs from components of natural resources and the environment as natural capital, are a transformation of processing inputs into outputs. In addition to the natural capital, development also involves various other capitals, namely; social capital, legality and finance. However, because development goals are more focused on economic needs without considering ecological interests, in the end, the sustainability of natural resources and the environment is neglected, when in fact the existence of natural resources and the environment is a precious component. (Natural resources and the environment) in the form of a valuation of the economic value of these natural resources.

One of the development programs is developing and improving the quality and access to information on natural resources and the environment. In this program, the main activities for assessing natural resources are focused on preparing environmental economic valuations and forms of damage to natural resources. The preparation of the economic valuation of natural resources and the environment aims to provide data and information from the economic aspect in making decisions on the opportunity cost of efforts to properly utilize an area from the perspective of environmental economic value. Knowing the economic valuation of natural resources and the environment can be the basis for consideration in their management and utilization following the demands of the principles of sustainable development and awareness of environmental conservation.

Bone Bolango Regency is one of the regencies in Gorontalo province for a long time; this has caused development activities in this region to have developed rapidly, where many investment activities have entered and developed. The existence of this can have real consequences on the condition of natural resources and the environment. The consequences can be in the form of degradation of natural resources and a decrease in the quality of the environment's carrying capacity and carrying capacity. This impact has a significant influence on the economic aspect. The economic valuation of natural resources and the environment becomes a necessary form of activity .

Method

The method used in this research is quantitative and qualitative descriptive analysis. Data analysis by calculating the Total Economic Value (TEV) obtained from the sum of all identified benefits, namely: NET = ML + MTL + MP + ME, where ML is direct benefit, MTL is indirect benefit. direct, MP is the benefit of choice, and ME is the benefit of existence. The description of the determination of the value of the four components of these benefits, namely direct benefits / Direct Use Value is the value resulting from the direct use of natural and environmental resources such as forest products, fisheries, timber products and tourism (Fauzi, 2002). ML= ML1 + ML2, ML1 = Direct benefits, total from mining activities ML2 = Direct benefits, total from forest products and land use. Indirect benefits or functional benefits / Indirect Use Value

is the value felt indirectly on goods and services produced by natural resources and the environment (Fauzi, 2002). MTL = MTLf + MTLb ; MTLf = Indirect physical benefits of SDAL (physical benefits: water resources provider and land availability). MTLb = Indirect biological benefits of SDAL (physical benefits: forest and land productivity). According to Adrianto (2004) the measurement technique to assess these benefits is to consider productivity. Option value indicates an individual's willingness to pay to conserve natural resources and the environment (SDAL) for future use.

The option value is approached by referring to the biodiversity value of Indonesia's forests, which is US$ 1,500 / km2 / year or or US $ 15 / ha / year. As follows: MP = MPb (Biodiversity Choice Benefit) = US$ 15 per ha x Forest area. Existence Benefits (ME) / Existence Value is the benefit felt by the community from the existence of a resource after other benefits (direct benefits, indirect benefits and optional benefits). The value of the Existence Benefit by multiplying the average value (Rp) given by the respondent to the presence of resources per ha per year by the total area (forest area). formula as follows: MP = MPb (Biodiversity Choice Benefit) = US$ 15 per ha x Forest area. Existence Benefits (ME) / Existence Value is the benefit felt by the community from the existence of a resource after other benefits (direct benefits, indirect benefits and optional benefits). The value of the Existence Benefit by multiplying the average value (Rp) given by the respondent to the presence of resources per ha per year by the total area (forest area). formula as follows: MP = MPb (Biodiversity Choice Benefit) = US$ 15 per ha x Forest area. Existence Benefits (ME) / Existence Value is the benefit felt by the community from the existence of a resource after other benefits (direct benefits, indirect benefits and optional benefits). The value of the Existence Benefit by multiplying the average value (Rp) given by the respondent to the presence of resources per ha per year by the total area (forest area). formula as follows: The value of the Existence Benefit by multiplying the average value (Rp) given by the respondent to the presence of resources per ha per year by the total area (forest area). formula as follows: The value of the Existence Benefit by multiplying the average value (Rp) given by the respondent to the presence of resources per ha per year by the total area (forest area). formula as follows:

$$\text{ME} = \sum_{i=1}^{n} (ME_i)/n$$

Information :
May = Existence Benefits of respondent i
n = Number of respondents

Total Economic Value is the sum of all the benefits that have been identified, namely

NET = ML + MTL + MP + ME

Information:
NET = Total economic value (TEV) (Rp/ha/year or Rp/year)
ML = Direct benefit value (*Direct Use Value*)
MTL = indirect benefit value (*Indirect Use Value*)
MP = Value of option benefit (*Option Value*)
ME = Existence benefit value (*Existence Value*)

$$\text{NPV} = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

After the resource economic assessment is necessary to analyze natural resources and the economic environment using the Cost-Benefit Analysis (CBA) method. The analysis are several assumptions used as follows; productivity of each sector (fishery, agriculture & plantation, forestry, mining, and tourism). A fixed condition due to efforts maintain the sustainability of resources and the

environment. The type of utilization of natural resources and the environment is fixed and converted into a unit area, cost benefit analysis through the condition of natural resources and the environment at the initial condition and at the present condition, loss of direct benefits, indirect benefits, option benefits and existence benefits due to forest conversion of natural resources and the environment into loss costs for natural resource management. The analysis period is 10 years, ecologically this period is used based on the estimated time of achieving the establishment of an ecological natural resource system, the discount rate) used is 15%. The use of a 15% discount rate on the basis that the discount rate for economic analysis in resource utilization is 8% to 15% (Gittinger, 2008), 15% was chosen because in economic analysis there is no definite value for the discount rate, so the discount rate the highest. The policy evaluation criteria used is the Net Present Value (NPV).

NPV = *Net Present Value* (net benefit value now)
Bi = Direct benefits obtained at time t (Rp)
ci = Direct costs incurred at time t (Rp)
t = Assessment period (10 years)
r = *Discount rate*

Decision criteria, a program is feasible to develop from an economic perspective if the NPV value > 0.

Results and Discussion

Benefits of Forest Resources (Identification of Forest Economic Benefits)

Based on the identification results in the field, the direct benefits of terrestrial forests can be calculated are in the form of forest utilization by local communities as agricultural and plantation land. Average nthe direct benefit value of terrestrial forests per year in Gorontalo Regency (based on data obtained from BPS in 2018, from 2013 – 2017) is Rp. 3,388,303. Based on Gorontalo Regency BPS data in 2018, in Gorontalo Regency there are several commodities produced from plantation land including both food crop commodities (seasonal) in the form of lowland rice, upland rice, corn, soybeans, sweet potatoes, peanuts, and green beans as well as other crops. horticulture in the form of vegetables and fruits. The value of direct forest benefits obtained from agricultural and plantation products in Table 1.

Direct Benefit (ML) / Direct Use Value

There are five types of forest products used by the people of Bone Bolango Regency, namely rattan, resin resin, honey, palm sugar and orchids. The total extraction that is used directly by the community in Table 1.

Table 1. Types and total direct harvesting of forest products per year

No	Direct Use Value	Respondent Sample	Pick Up Frequency /year	Amount of Retrieval	Total Amount of Withdrawal (unit/year)
1	Rattan	1	12	150	1800
		2	12	200	2400
		3	12	130	1560
		4	12	250	3000
		5	12	170	2040
		Number of Pickups (kg)			**10800 Kg/Year**
2	Resin	1	12	60	720
		2	12	100	1200
		3	12	80	960
		4	12	130	1560
		5	12	90	1080
		6	12	100	1200
		Amount of Retrieval			**6720 Kg/Year**

3	Honey	1	12	20	240
		2	12	30	360
		3	12	30	360
		Amount of Retrieval			**960 Liters/Year**
4	Palm sugar	1	12	30	360
		2	12	30	360
		Amount of Retrieval			**720 kg/Year**
5	Orchid	1	12	20	240
		Number of Takes			**240 Bunches/Year**

The result of direct use value calculation using the market price method against some forest product commodities used in the community around the Bonebolango forest in Table 2 below.

Table 2 Direct use value calculation results by the market price method

No	Types of Forest Products	Total Withdrawal (unit/year)	Market Price/unit (Rp)	Type of Economic Value (Rp/Year)
1	Rattan	10,800 kg	3,200	34,560,000
2	Resin	6,720 kg	36,000	241,920,000
3	Honey	960 ltr	110,000	105.600.000
4	Palm sugar	720 kg	15,000	10,800,000
5	Orchid	240 bunch	25,000	6,000,000
Total number				**Rp. 392.880000**

Based on the data in table 2 above, the total direct use-value of the Bonebolango forest is Rp. 392.880.000/year. The most widely used forest product is resin gum with an economic value of Rp. 241,930,000/year. Some people in the forest area of Bonebolango take resin sap to be used as furniture, fuel and sold. Furthermore, the forest product by the community is honey with an economic value of Rp. 105.600.000/year. People use honey for consumption, namely as medicine and some are sold.

The community uses rattan as a furniture material such as a primary material for making chairs and household utensils, besides that people use rattan for sale, where the economic value of rattan in one year is Rp. 34.56 million. The following commodity used by the community is palm sugar. Palm sugar is obtained from the tap water of palm tree sap in the Bonebolango forest area and then processed into palm sugar, then the community uses it for consumption and sale. The economic value of palm sugar in a year is Rp. 10,800,000.

Orchid commodities used by people who are taken from the forest for planting in the yard, other it can be sold if the condition of the orchid is seen as good or has a selling value or have aesthetic value that is seen promising. The economic value of orchids is Rp. 6,000,000/year.

b. **Indirect Benefit Value (ML) / Direct Use Value**

Utilization of forest potential is not directly by calculating the potential for carbon sequestration in the forest area of Bonebolango Regency. The calculation of the estimated potential for carbon sequestration in rupiah in the forest area of the Bonebolango Regency is presented in Table 3 below.

Table 5.3 Carbon sequestration potential (CO2) in the forest area of Bonebolango Regency

Forest Area Area (Ha)	Carbon Sequestration Potential (tons/ha)	Selling price of Carbon (CO2)/Ha (US$)	Exchange Rate /1 Dollar/ 20 June 2020 (Rp)	Total Indirect Benefits (Rp)
28,374.64	8717.97	5	14,243	19,580,573,337,775

Total	**19,580,573,337,775**

The ability of forests to absorb carbon can be divided into 3 types according to the statement by Born and Pearce (1994) in Widada (2004), primary natural forests, secondary forests and open forests can store carbon of 283 tons, 194 tons per hectare and 115 tons, respectively. per hectare. The survey conducted as a whole is in upland forest. Based on the survey results conducted at the study site, there are 2 types of forest: primary forest, secondary forest, shrubs, and open forest. According to Barlow (Wahyun and Kafiar, 2017), primary forest has a higher abundance and composition of tree species than secondary forest. There is no disturbance from human activities. Meanwhile, secondary forest is a forest that can regenerate naturally to provide conservation services like primary forests but cannot provide conservation services like primary forests. The forest area that became the data collection area was categorized as primary forest, secondary forest, shrubs and open forest which has a total area of 28,374.64 Ha and the ability to absorb carbon of8717.97tons/ha. The carbon value is $30 US. Meanwhile, according to Fahri (2002) in Alif (2005), the price of carbon still varies, which is between $1 US to $ 30 US per tonne of carbon. To avoid overestimating, this study uses the assumption of a price of $5 US per tonne in accordance with Alam (2009). Based on the calculation results (exchange rate of $ as of June 20, 2020, 1 US = Rp. 14,243, -), the value of potential carbon sequestration in the forest area of the Bonebolango Regency is Rp. Rp. 19,580,573,337,775.

Most of the state of forest vegetation in the Bone bolango district as natural and functions as an absorber carbon. The issue of carbon trading has a positive impact because it provides opportunities for us to still benefit from forest without cutting down trees. It fits with Alam et al (2007) statement that forests provide critical environmental services for carbon sequestration, so that it can reduce global warming. Trading This carbon creates opportunities to sell forests without cutting trees so that development sustainability can be realized. Value calculation carbon sequestration by determining the selling price of carbon in the international market.

Option Benefits (MP) / Option Value

Benefits of deep forest conservation options this study is calculated based on the benefits of biodiversity from the forest's importance. According to Regulation Minister of Environment of the Republic of Indonesia No. 15 of 2012 concerning valuation guidelines forest ecosystem economy, Value benefits forest biodiversity is US$ 9.45/ha/year if the forest exists are ecologically important and are kept relatively natural.The total forest area calculated is 28,374.64 Ha. Based on the forest area data, the option value (biodiversity benefits) calculation result is Rp. 3,819,122,977/year (exchange rate of US$ 1 = Rp. 14,243). The calculation of the benefits of forest choice in Bone Bolango District is presented in Table 4.

Table 4 Calculation of the benefits of forest choice in Bone Bolango Regency

Value of Biodiversity Benefits (US$/Year)	Exchange Rate /1 Dollar/ 20 June 2020 (Rp)	Forest Area (Ha)	Total Option Benefits (Rp)
9.45	14,243	28,374.64	3,819,122,977
Total			**Rp. 3,819,122,977**

Existence Benefits (ME) / Existence Value

Based on the results of interviews with local communities, it is known that most of the people around the Bone Bolango forest are not willing to pay if at any time they are asked or asked if they are willing to participate in maintaining the sustainability of the surrounding forest ecosystem, because for the people around the forest, most of it is damaged and not much. provide results that can be taken or used in everyday life. A small part of the community is also willing to pay in the range of Rp. 100,000 - Rp. 250,000 and most of them are willing to pay Rp. 50,000. The total willingness to pay from the majority of the community (the number of respondents is 100 people) is Rp. 5,000,000/year with an average of Rp.

416,667.28,374.64Ha. The value of the Existence Benefit is obtained by multiplying the average value (Rp 416,667) given by the respondent to the presence of resources per ha per year by the total forest area, so that the total direct benefit value is Rp. 667,916,666, 67/ha/year. The calculation of the value of the existence of forests in the Bonebolango district is presented in Table 5 below.

Table 5 Calculation of the value of forest existence in the Bone Bolango District

Number of Respondents	Willingness to Pay (Rp)
100 people	50,000 - 200,000
Amount Total willingness to pay (Rp)	5,000,000
Average willingness to pay (Rp)	416,667
Forest area (ha)	28,374.64
Total Existence Value (Rp)	Average payment x Forest area = 11,822,776,124.88

The people willing to pay are generally those who have education levels ranging from elementary, junior high and high school and have a reasonably adequate income, and who still interact directly with the Bone Bolango forest such as taking rattan, resin resin, honey and palm sugar. Regarding knowledge about the benefits of forests as a source of water, preventing erosion and other natural disasters, almost all of the people around the Bone Bolango forest know about the benefits, most of them are reluctant or even unwilling to pay. The community still thinks that what is said to be using it is taking forest products directly. At the same time, it is not necessary to consider the value for indirect benefits.

Total Economic Value (NET) / Total Economic Value / TEV

Economic Value The total forest area of Bone Bolango district is **Rp.** 2,319,253.906/year. This Total Economic Value is obtained by adding up the total value of Direct Benefits of Rp. 392.880.000/year, the total Indirect Benefit Value (Potential value of carbon sequestration in Rupiah) is Rp.1,034,261,659,3/year, the total Value of Option Benefits is Rp. 224,195,580/year and the total Value of Existence or Existence is Rp. 667,916,666.67/year. These details are presented in Table 6 below.

Table 6 Calculation of the total economic value of forest area in Bone Bolango District

Benefit Value	Total (Rp)
Immediate benefit value	392,880,000
Indirect benefit value	19,580,573,337,775
Optional Benefit Value	3,819,122,977
Value of Existence/Existence	11,822,776,124.88
Total economic value	**19,596,608,116,877**

The results of this calculation clearly show that the economic value of the forest in the Bone Bolango district from the indirect use value is much greater than the direct use-value. This is because there are not many direct use values or forest products that can be taken and utilized by the community around the forest. Wirahadikusumah (2003) argues that forest products are also clearly a diverse potential economic resource which in the forest area is able to produce timber, non-timber forest products and intangible forest products such as soil protection, conservation of water resources and various tourism products. The description above reveals that forests, forestry and forest products are actually resources that have the potential to create goods, services and economic activities that are very beneficial to society. The total economic value indicates that natural resources, especially forests and biodiversity in the Bone Bolango

district, require higher appreciation and can be used as basic quantitative information to determine various policy options in the context of managing forest resources in this region.

Mineral Yield Benefits

Metal Mineral Benefits

Metal mineral resources in Bone Bolango Regency consist of 3 types of metals, namely gold, silver, and copper. Based on the data on the amount of metal potential in Bone Bolango Regency, the total number of direct economic benefits of minerals is obtained which is presented in Table 7.

Table 7 The Direct Economic Benefit Value of Metallic Minerals in Bone Bolango Regency

Mineral	Total Potential (tons)	Price/ton	Amount (Rp)
Gold	3,375.00	753,000,000,000	2,541,375,000,000,000
Silver	25.00	7,950,000,000	198,750,000,000
Copper	3,375.00	80,000,000	270,000,000,000
Total			**2,541,843,750,000,000**

Based on the calculation of the potential amount of metallic minerals at unit prices, the direct economic benefit of mineral resources in the form of metals is Rp. 2,541,843,750,000,000.

Benefits of Non-Metallic Minerals

The non-metallic mineral inferred resources of Bone Bolango Regency consist of several rock types, namely Andesite, Basalt, Limestone, Dacite, Granite, Sand, Stone & Sirtu, and Marble. Based on the data on the number of potential non-metals in Bone Bolango Regency, the total number of direct economic benefits of minerals is obtained in Table 8.

Table 8 The Value of Direct Economic Benefits of Non-Metal Minerals in Bone Bolango Regency

Mineral	Total Potential (Tons/Year)	Unit price (Rp/Ton)	Amount (Rp)
andesite	312,500,000	160,000	50,000,000,000,000
Basal	1,000,000,000	250,000	250,000,000,000,000
Limestone	227,000,000	65,000	14,755,000,000,000
Dasit	25,000,000	115,000	2,875,000,000,000
Granite	12,500,000	120,000	1,500,000,000,000
Sand, Stone & Sirtu	25,000,000	80,000	2,000,000,000,000,000
Marble	18,870	90,000	1,698,296,310
Total (Rp)			**321,131,698,296,310**

Based on the calculation results of the number of potential non-metallic minerals with unit prices, the direct economic benefits of mineral resources in the form of non-metals (rocks) are Rp. 321,131,698,296,310.

Based on the calculation of the value of the benefits of metallic and non-metallic minerals, the total economic value of the direct benefits of mineral products namely:

Total Direct Benefit Economic Value = Value of benefits of metallic minerals + Value of benefits of non-metallic minerals = Rp. 2,541,843,750,000,000 + Rp. 321,131,698,296,310 = Rp. 2,862,975,448,296,310. Thus, the value of the mineral yield of Bone Bolango Regency is RP. 2,862,975,448,296,310.

Economic Benefits of Water Resources

Bone Bolango district forest has a forest ecological function that contributes as a water provider and water regulator. Based on BPS data from Bone Bolango Regency (2020), the number of clean water

customers in Bone Bolango Regency in 2019 was 74,152 customers, with the volume of water distributed being 1,020,951 m3. where the price of per cubic water in 2019 is Rp. 4.750/m3. Besides, in Bone Bolango Regency in 2019, 112 industrial units of drinking water and mineral water with a total production value of Rp. 1,074,112,000. Based on these data, the value of the economic benefits of water resources is obtained as presented in Table 5.9.

Table 9 Economic Benefits of Water Resources managed by PDAM Bone Bolango District

Water Management Unit	Quantity	Total Benefits (Rp)
PDA	1,020,951 m3	4,849,517,250
Drinking-Water And Mineral Water Industry	112 units	1,074,112,000
Amount		**4,849,517,250**

Based on the results of the calculation between the amount of water distributed and the price of water/m3, the economic benefits of water resources in Bone Bolango Regency are Rp. 4,849,517,250. Meanwhile, the water potential in Bone Bolango Regency is estimated using the reference to the Regulation of the Minister of the Environment No. 17 of 2009 AboutGuidelines for Determining Environmental Carrying Capacity in Regional Spatial Planning.The average rainfall data in Bone Bolango Regency for the last 10 years (2010-2019) in Table 10.

Table 10 Total Rainfall in Bone Bolango Regency 2010-2019

Rainfall (mm)										
Month	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
January	100.0	248.0	109.0	109.0	146.0	120.0	96.0	183.9	183.0	74.5
February	45.0	202.0	130.0	130.0	15.0	68.0	170.0	174.5	148.0	45.9
March	38.0	269.0	67.0	67.0	107.5	15.0	0.0	127.1	238.0	83.0
April	153.0	194.0	159.0	159.0	124.0	23.0	118.0	89.7	192.0	330.7
May	378.0	97.0	116.0	116.0	135.8	188.0	208.0	85.2	122.0	51.4
June	263.0	136.0	205.0	205.0	112.0	176.5	277.0	219.7	132.0	119.1
July	172.0	40.0	244.0	244.0	45.0	0.0	162.0	145.5	83.0	25.6
August	277.0	19.0	107.0	107.0	54.0	0.0	37.0	135.3	91.0	6.7
September	302.0	104.0	46.0	46.0	6.0	0.0	167.0	121.4	9.0	0.0
October	250.0	81.0	154.0	154.0	72.0	45.4	303.0	65.0	152.0	129.9
November	84.0	66.0	412.0	412.0	321.0	154.0	189.0	105.4	194.0	8.2
December	250.0	142.0	27.0	27.0	266.0	55.0	155.0	86.0	247.0	173.8
Amount	**2,312.0**	**1,598.0**	**1,776.0**	**1,776.0**	**1,404.3**	**844.9**	**1,882.0**	**1,538.4**	**1,791.0**	**1,048.8**
Average	**1,597,1**									

Source: BPS Bone Bolango Regency, 2011-2020

Based on the calculation results of the potential availability of water in Bone Bolango Regency and the price of water per cubic in 2019 of Rp. 4,750/m3, then the economic benefits of water resources in Bone Bolango Regency are917,744,767.2 m3/year xRp. 4.750/m3 = Rp. 4,359,287,644,200 per year.

Potential Disaster Threat

Based on the results of disaster risk analysis by BPBD of Gorontalo Province in 2015, in Bone Bolango Regency, 10 types of disasters can occur. Based on the history of disaster events and regional characteristics of Bone Bolango Regency. The types of disasters that have the potential to occur in the Bone Bolango Regency area along with the extent and hazard class of each type of disaster in Table 5.11.

Table 11 Types of disasters that have the potential to occur in the Bone Bolango Regency according to area and hazard class

No.	Disaster Type	Danger	
		Area (Ha)	Class
1	Flood	12,961	Currently
2	Extreme Waves & Abrasion	1,294	Tall
3	Earthquake	190,321	Tall
4	Drought	190,321	Tall
5	Extreme weather	57,245	Currently
6	Landslide	149,272	Tall
7	Forest & Land Fires	146,670	Tall
8	Epidemics & Disease Outbreaks	1.272	Low
9	Tsunami	2,929	Tall
10	Flash floods	4.085	Tall

Source: Document of Disaster Risk Assessment (KRB) of Gorontalo Province 2016-2020

The potential population exposed to disasters is obtained from the socio-cultural component which is determined based on the parameters of population density and population of vulnerable groups (gender ratio, vulnerable age group, poor population and disabled population).

The potential population exposed to various types of disaster threats in Bone Bolango Regency is presented in Table 12.

Table 12 Potential of Population Affected by Disasters in Bone Bolango Regency

No.	Disaster Type	Exposed Population (Soul)	Vulnerable Population Group (Soul)			Class
			KUR	Poor Resident	Disabled Resident	
1	Flood	92.127	13318	22366	575	Tall
2	Extreme Waves & Abrasion	10,945	1580	2655	92	Tall
3	Earthquake	152,988	22102	37118	1100	Tall
4	Drought	152,988	22102	37118	1100	Tall
5	Extreme weather	148,171	21407	35949	1060	Tall
6	Landslide	31.115	4489	7538	273	Tall
7	Forest & Land Fires	0	0	0	0	-
8	Epidemics & Disease Outbreaks	22,730	3285	5520	138	Tall

9	Tsunami	3.305	478	804	24	Tall
10	Flash floods	6,730	969	1631	54	Tall

Source: Document of Disaster Risk Assessment (KRB) of Gorontalo Province 2016-2020
Note: KUR = Vulnerable Age Group

Potential losses due to disasters from a loss index grouped into two indices, namely rupiah losses (physical and economic) and environmental damage. The physical component is obtained based on the parameters of houses, public facilities and critical facilities that have the potential to be affected by disasters, the economic component is based on the parameters of productive land and GRDP. In contrast, the environmental component is obtained based on land cover parameters (protected forest, natural forest, mangroves/mangroves, swamps, and shrubs). scrub). Potential rupiah losses (physical and economic) and environmental damage due to various types of disaster threats and the presence of exposed residents in Bone Bolango Regency are presented in Table 13.

Table 13 Potential Losses of Rupiah and Environmental Damage Due to Disaster Threats in Bone Bolango District

No.	**Disaster Type**	**Loss of Rupiah (Billion Rp.)**				**Environmental Damage (Ha)**	
		Physical	Economy	Total	Class	Large	Class
1	Flood	188,60	67.90	256.50	Tall	24.0	Low
2	Extreme Waves & Abrasion	323.78	5.19	320.36	Tall	69.5	Tall
3	Earthquake	1,119.50	230.60	1350.00	Tall	-	-
4	Drought	-	277,20	277,20	Currently	117700.0	Tall
5	Extreme weather	689,80	154.40	844.20	Tall	-	-
6	Landslide	175.50	62.60	238.10	Tall	112417.5	Tall
7	Forest & Land Fires	-	12.40	12.40	Currently	78347.5	Tall
8	Epidemics & Disease Outbreaks	-	-	-	-	-	-
9	Tsunami	-	-	-	-	-	-
10	Flash floods	45,40	2.4	47.8	Tall	2237.5	Tall
Amount		**2,542.58**	**812.69**	**3,346.56**	**Tall**	**310796.0**	**Tall**

Based on the results of the calculations in Table 5.12 above, the potential loss due to disasters in Bone Bolango Regency is IDR 2,542,580,000,000 + IDR 812,690,000,000 + IDR 3,346,560,000,000 = IDR. 6,701,830,000,000.

Discussion

The results of the study that have been described indicate that the total economic value of Natural and Environmental Resources (SDAL) in Bone Bolango district consists of forest and land resource potential, mineral resource potential/metal mining, mineral resource potential/non-metal mining, and potential water resources, amounting to Rp. 2,886,931,344,057,390. While the Total Economic Net Value of SDAL is Rp. 2,139,531,722,410,190. Setiyowati et al (2016) revealed thatThe total economic value indicates that natural resources and the environment (SDAL) require a higher appreciation and become the basis for quantitative information to determine various policy options, both fiscal and monetary policies, structural adjustments and stabilization efforts, because they have an impact on sectors that depend on natural resources. Suppose the four potential natural resources. In that case, the comparison shows that the potential value of mineral resources/metal mining is 88%. The potential for mineral resources/non-metal

mining is 11.12%, and the potential for forest and land resources is 11.12%. 0.67% and water resource potential of 0.15%. This fact shows that most of the natural resources potential found in this area are mineral resources (mining).

The use of natural resources services without considering the sustainable availability of natural resources can hurt the existence of natural resources itself. In line with what was stated by Pimm et al., (1995); Simon and Wildavsky (1995), human activities can contribute to the rate of biodiversity loss and threaten the stability and sustainability of ecosystems, including the provision of goods and services for human welfare itself. According to Wirahadikusumah (2003), forest products are a diverse potential economic resource in the forest area capable of producing timber, non-timber forest products, and intangible forest products such as soil protection and water resource conservation and various tourism products (benefits). not directly SDAL).

Conclusion

Natural resources and the environment have strategic values, including economic values, social values and conservation values.The total net economic value of the natural resources and environment (SDAL) economy in Bone Bolango district is Rp. 2,139,531,722,410,190.Comparison of four potential natural resources in the Bone Bolango district, namely the potential value of mineral resources/metal mining of 88%, potential of mineral resources/non-metal mining of 11.12%, potential of forest and land resources of 0.67% and potential water resources of 0.15%. Most of the natural resources potential contained in this area is mostly mineral resources (mining). The total potential loss due to disasters in Bone Bolango Regency is Rp. 6,701,830,000,000. This study recommends that there must be a balance between investment activities that utilize the potential of natural resources and environment with natural resource conservation activities and the consideration of potential disaster risks.

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BPS Bone Bolango Regency, 2018, Bone Bolango Regency in Figures 2018.

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