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ECONOMIC VALUE OF CRITICAL LAND IN SEMPAYANG VILLAGE, NORTH KALIMANTAN

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ABSTRACT

This research aims to identify the locations of vulnerable critical land areas and assess the economic value of mitigating agricultural land in critical conditions within Sempayang Village, North Kalimantan, Indonesia. The study employs Geographic Information Systems (GIS) to analyze land distribution and the Contingent Valuation Method (CVM) to estimate the economic value. A purposive sampling method was used to select 51 respondents from local farmers, with a focus on their willingness to pay for land rehabilitation. The results of this research are the largest critical land area was found in Malinau District, covering 54,108 hectares. Farmers showed a willingness to pay between Rp. 26,000 and Rp. 30,000 for land rehabilitation efforts, with a total economic value of Rp. 45,360,000 annually for non-critical land. The study underscores the importance of community and government collaboration for effective land restoration programs.

1. INTRODUCTION

The population continues to increase while the land area does not increase is a challenge for planners in planning optimal land use patterns and land management which of course still pays attention to economic, ecological, and sustainability functions (Mpanga et al., 2021; Turok & McGranahan, 2013). Land development will be very important when the function of the land will change to other functions. The higher the community's economic activity, the more land use will increase. Unfortunately, this is not followed by land cultivation as a provider of environmental services. Thus, the increase in the use of environmental services is not proportional to the maintenance of environmental quality, the benefits derived from environmental goods and services are limited because there are some limitations in the value of environmental goods and services (Freire-González et al., 2017; Geng et al., 2017). The decline in productivity is felt because productive land is getting narrower as a result of land conversion, namely rice fields, moreover the global issue of increasing degraded land which has the potential to turn into critical land. One of the causes of the process of critical land is the increase in population using land as agricultural land by not paying attention to the principles of management of critical land for soil and water (Fang et al., 2022; Mulyani & Las, 2008).

The increase in degraded land can occur due to the characteristics of the land that are vulnerable to any hazards, whether due to fire, pests, shifting cultivation, encroachment, overgrazing, or cultivation errors. Critical land occurs due to changes in land use from agricultural or forest land to non-agricultural or built-up areas so that the water absorption area is reduced which causes degraded land, drought, or critical clean water in the dry season, landslides, and floods in the rainy season (Fang et al., 2022; Gurgel et al., 2021). A combination of market, policy, and management failures, such as ambiguous property rights, distorted market prices, non-competition, and negative incentives that influence farmers' perceptions of the costs and benefits of controlling degraded land, is causing critical land to worsening (Adenle et al., 2022; Hermans & McLeman, 2021; Tesfahunegn, 2019).

Several studies have shown an increase in the function of land which causes land degradation (Indrihastuti et al., 2017; Mirzabaev et al., 2016; Tadesse et al., 2017). The increase in population and economic activity has led to an increase in the function of land conversion. Then the cost of the inefficiency of degraded land as a provider of environmental services (Börner et al., 2017; S. R. Pratiwi & Rahmawati, 2018; Santoso & Ma'ruf, 2020). For example, estimating the annual cost of degraded land in Central Asian villages, due to land use and field changes between 2001 and 2009 is about 6 billion USD, mostly due to desert degradation (4.6 billion USD), deforestation (0.3 billion USD) USD) and abandoned agricultural land (0.1 billion USD) (Mirzabaev et al., 2016).

There have been several attempts to quantify the costs of land degradation and several other studies have undertaken the valuation of environmental services, by measuring direct and indirect use values (Admasu et al., 2019; Arata et al., 2021; S. R. Pratiwi & Rahmawati, 2018). Every research shows community participation in reducing the impact of critical land or degraded land.

Land degradation is a critical issue worldwide, significantly impacting regions like Sempayang Village in North Kalimantan, Indonesia. Localized data reveals that land degradation here leads to notable reductions in agricultural productivity and exacerbates poverty among farmers. This study focuses on assessing the economic value of critical land in Sempayang Village through Geographic Information Systems (GIS) and Contingent Valuation Methods (CVM). By integrating local statistics and relevant background information, this research aims to provide actionable insights for mitigating land degradation's adverse effects.

2. RESEARCH METHODS

This study utilizes a combination of Geographic Information Systems (GIS) and Contingent Valuation Methods (CVM) to assess the economic value of critical land. A purposive sampling method was employed to select 51 respondents, ensuring a representative sample of local farmers. The questionnaire, meticulously designed, aimed to gauge respondents' willingness to pay (WTP) for land rehabilitation initiatives. The GIS analysis involved a detailed, step-by-step process, including data collection, spatial analysis, and mapping of degraded land. A flowchart illustrating the GIS analysis process enhances the clarity and reproducibility of the methodology. This sampling method is used with several considerations, namely providing criteria for the intended respondent (Sonnenberg et al., 2012).

In the non-demand curve approach, there is a contingency valuation method. This method determines consumer preferences for the utilization of natural resources and the environment by expressing the willingness to pay (WTP) which is expressed in terms of money. The measurement of WTP is usually related to environmental quality and degradation by calculating the costs incurred by individuals to reduce the negative impact on the environment due to restoration activities (Ebert, 2008; Feng et al., 2021; Sørensen, 2012).

Critical land disasters have a negative impact on farmers. The amount of loss to farmers is known from changes in agricultural productivity (Sarr et al., 2021). The loss uses the following formula (Kolapo et al., 2022; Soeparmoko, 2006):

$$\Delta Q_x = f\ (A \times \Delta P_t)$$

Where as:
Δ : Symbol Of Change
Q_x : Agricultural Production
A : Critical Area
P_t : Agricultural Land Productivity per Hectare

The steps taken to determine the level of loss per farmer include: 1) Calculating the decline in agricultural production; 2) Calculating the area of agricultural land for each farmer; 3) Calculating the average loss of agricultural production.

3. RESULTS AND DISCUSSION

Identification of Distribution of Critical Land

A spatial analysis using secondary data was conducted to assess the distribution of critical land in North Kalimantan Province. This analysis identified five classes of land criticality: Not Critical, Somewhat Critical, Potentially Critical, Critical, and Very Critical. The focus was on the Critical and Very Critical classes to map the distribution of critical land across districts and cities in North Kalimantan Province. The spatial data used included: 1) Administrative Map of North Kalimantan Province; 2) Road Network Map of North Kalimantan Province; 3) Map of the North Kalimantan Province River Network; 4) Topographic Map of North Kalimantan Province.

Interpretation of images and field observations revealed that Sempayang Village has 702,46 hectares of critical land, as detailed in Table 1.

Table 1. Recapitulation of the Distribution of Critical Land Areas

Location	Wide (Ha)
Bulungan	41,39
Malinau	541,08
Nunukan	119,99
Tana Tidung	0,00
Tarakan	0,00
Total	702,46

Source: BPS Kalimantan Utara (2022)

The spatial analysis indicates that North Kalimantan Province has a total of 702,46 hectares of critical dry land agriculture. The largest affected area is in Malinau District, with 54,108 hectares. Table 2 shows the distribution of critical land across sub-districts in Malinau Regency.

Table 2. Distribution of Critical Land per District

District	Wide (Ha)
Bahau Hulu	0,00
Kayan Hilir	17,98
Kayan Hulu	172,06
Kayan Selatan	19,64
Malinau Barat	42,47
Malinau Kota	0,00
Malinau Selatan	0,00
Malinau Utara	15,20
Mentarang	27,99
Mentarang Hulu	0,00
Pujungan	107,65
Sungai Boh	138,09
Total	541,08

Source: Processed data (2022)

The prevalence of critical land is primarily due to nutrient deficiency, compounded by the dominance of loam/clay soils, which are challenging to cultivate. Additionally, previous agricultural activities were abandoned without proper soil management. The lack of information on critical land mitigation and soil improvement also exacerbates the problem (Löbmann et al., 2022; Xu et al., 2019).

Estimation of the Economic Value of Critically Affected Agricultural Land

Data analysis revealed the maximum average Willingness to Pay (WTP) for land rehabilitation initiatives among the respondents, providing a basis for estimating the total economic value of the affected land. The majority of farmers showed a WTP value ranging from Rp. 26,000 to Rp. 30,000 (33.3%). Maximum average PAP that can be used as a new price for environmental recovery efforts due to critical land (Faccioli et al., 2020). The new price is at least higher than the current price, because respondents have understood the importance of economic and environmental values (Admasu et al., 2021; S. Pratiwi et al., 2018). Table 3 summarizes the WTP distribution among farmers.

Table 3. Willingness To Pay Farmers' Community

WTP (Rp)	Sum Res.	Percentage Res.
0	1	1,9%
Rp.5.000 - Rp.10.000	8	15,7%
Rp.11.000 - Rp.15.000	5	9,8%
Rp.16.000 - Rp.20.000	4	7,8%
Rp.21.000 - Rp.25.000	15	29,4%
Rp.26.000 - Rp.30.000	17	33,3%
>Rp.31.000	1	1,9%
Total	51	100%

Source: Processed data (2022)

The majority of farmers have WTP values ranging from Rp.26.000 - Rp.30.000, which is 33.3%. Of the total respondents, there were those who had a WTP score of 0 (not willing to pay for land improvement efforts). This is because the costs incurred are considered expensive, respondents chose to donate their energy in efforts to mitigate critical land (Lerner & Rottman, 2021; Tyllianakis & Ferrini, 2021). So far, farmers have assumed that mitigating critical land is only the government's job (Ghanian et al., 2020).

Land resources have a big role in supporting agricultural development. The land is a habitat for the growth and development of various vegetation as a provider of various food sources so it is very important to do conservation, this is done in order to reduce disasters, be it floods, erosion, and drought (Snapp, 2017). One of the negative impacts of the critical land disaster is a decrease in farmer productivity (Sarr et al., 2021; Zhu et al., 2021). The majority of farmers experienced a decline in productivity ranging from Rp. 0 to Rp. 1,000,000 (39.2%), followed by declines between Rp. 4,100,000 and Rp. 5,000,000 (25.5%). Table 4 details the decline in production among respondents.

Table 4. Recapitulation of Decrease in Land Production

Production Decline	Sum Res.	Percentage Res.
Rp.0 - Rp.1.000.000	20	39,2%
Rp.1.100.000 - Rp.2.000.000	5	9,8%
Rp.2.100.000 - Rp.3.000.000	10	19,6%
Rp.4.100.000 - Rp.5.000.000	13	25,5%
>Rp.5.100.000	3	5,9%
Total	51	100%

Source: Processed data (2022)

Farmers' losses due to critical land were primarily between 11-15% (31.4%) and 0-5% (29.4%). Table 5 presents the percentage loss rate among farmers.

Table 5. Farmer Loss Rate

Product derivation (%)	Sum Res.	Percentage Res.
0 -5	15	29,4%
6 - 10	10	19,6%
11 - 15	16	31,4%
16 - 20	10	19,6%
Total	51	100%

Source: Processed data (2022)

From the calculation results obtained a Consumer Surplus (CS) value of Rp. 2.520.000 per individual per year or a consumer surplus per individual per production time of Rp. 210.000, - where farmers can produce 1-2 times a month or approximately 18 times a year. a year. The surplus obtained by farmers shows that the profits obtained by farmers in one harvest/production. This means that the agricultural sector in Malinau District provides benefits that are greater and greater than the costs they have to incur in order to enjoy the harvest. (Akinyi et al., 2022).

To obtain total Economic Value or Economic Total (ET), the surplus value per individual per year is:

ET = Consumer Surplus x Number of Harvests
= Rp.2.520.000 x 18
= Rp.45.360.000,-

So that the total economic value of the dry land agriculture sector in Malinau Regency is obtained Rp.45.360.000,-, with a total harvest period of 18 times a year. While the Total Expenditure (TE):

TE = Expenditure per Harvest x Number of Harvests
= Rp.350.450 x 18
= Rp.6.308.100,-

So that the total expenditure at one harvest / production in Malinau Regency is Rp.6.308.100,-.

4. CONCLUSION

The study concludes that addressing land degradation is crucial for improving economic outcomes in Sempayang Village. Based on the results of the GIS analysis, the area with the largest critical land area is Malinau District. Almost all areas in Malinau District are vulnerable to being affected by critical land. The majority of respondents were able to pay between Rp. 26.000 - Rp. 30.000, which was 33.3%. The total economic value of farmers on their land that is not critically affected is Rp 45.360.000. Based on the findings, it is recommended that local authorities and policymakers implement targeted land rehabilitation programs, supported by community contributions and government funding. Specific actions include promoting sustainable agricultural practices, enhancing soil conservation techniques, and investing in reforestation projects. Additionally, this study highlights the need for further research on the long-term economic benefits of land rehabilitation and the potential for scaling successful interventions across North Kalimantan. Future studies should also consider incorporating more extensive sample sizes and diverse respondent groups to validate and expand upon these findings.

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