

The Impact of Ecotourism Development: Livelihood Structure as well as Adaptation and Mitigation of Climate Change in the Rural Household

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Abstract. Ecotourism is a tourism activity that relies on natural and environmental conditions as a tourist destination. The presence of ecotourism can affect the livelihood conditions of rural households around the tourism area. In addition, ecotourism can also be an activity for climate change adaptation and mitigation. and mitigation of climate change. The purpose of this research is to analyze the change in the livelihood structure of rural households due to the presence of ecotourism and how climate change adaptation and mitigation activities are carried out by households in ecotourism areas. This research uses mixed methods. The results showed that the development of ecotourism development causes changes in social, human, physical, and financial livelihood capital. This research also found a new livelihood structure on the non-farm, namely tourism. Ecotourism activities can also be an adaptation and mitigation of climate change which can also be an activity to preserve ecotourism areas so that they are more sustainable ecotourism areas to make them more sustainable

Keywords: Adaptation, Climate Change, Ecotourism, Mitigation, Livelihood Structure

1 Introduction

The implementation of natural resource management in Indonesia is very diverse. One of the management carried out at this time is community-based ecotourism management. Ecotourism is an activity carried out to achieve environmental and community welfare. Ecotourism has an important role in the development of an area in Indonesia. [14] Regarding guidelines for the development of ecotourism in the region explains that local governments are encouraged to develop ecotourism in each region. [10] Ecotourism is a sector that contributes to accelerating the achievement of points 12 and 15 of the sustainable development goals (SDGs). Issues related to the environment, supporting community democracy and increasing the livelihoods of local communities and becoming a sector that improves the management and conservation of natural resources are designs for ecotourism management.

The existence of tourism can affect the socio-economic conditions of the surrounding community. [2] The benefits for local communities when there is ecotourism are employment, revenue generation, entrepreneurial opportunities, and sociocultural revitalization. Tourism activities based on the environment and nature must be maintained because currently there are disasters caused by the phenomenon of climate change and climate variability. In addition to playing a role in the community's economy, ecotourism activities can also be used as climate change adaptation and mitigation activities as well as activities to protect the environment around the ecotourism area. The existence of ecotourism can play a role as the adaptation and mitigation of climate change [1]. This research aims to determine household responses to climate change and climate variability in ecotourism areas and changes in livelihoods that occur in ecotourism areas.

The threats of climate change can occur in several areas, especially Batulayang Village, Cisarua, Bogor Regency. Therefore, to minimize the impact and reduce the causes of climate change, the community must adapt and mitigate the impact of climate change. The types of tourism offered are also tours that are used to introduce nature and protect the environment such as nature education tours, tree planting, and *Saba Desa* which are used to introduce environmental conditions. The natural beauty presented by Batulayang Village is a special attraction for tourists. This is one of the ecotourism area's climate change adaptation and mitigation activities. In addition, Batulayang Tourism Village is one of the tourist villages managed by the surrounding community, and an increase in the community's economy because several inns and MSMEs are managed by the surrounding community. In addition, managers and workers in the tourism sector are also indigenous to Batulayang Village.

2 Literature Review

Climate change and climate variability occur in several regions in Indonesia. Climate and weather are important components for the community, especially for those who work as farmers and rural communities that depend on ecotourism areas. Climate change and climate variability are two different concepts. Climate variability is the variation of weather within a season or from year to year. [11] Climate variability indicates the existence of weather and rainfall cycles that shift and become uncertain. This causes an increase or decrease in rainfall during the rainy season or extreme drought during the dry season. Climate variability can cause a number of risks for households working in the environmental sector.

The phenomenon of climate change and climate variability causes disasters that can disrupt community activities. (S. Salim et al., 2018) explains that climate change has diverse and multidimensional impacts because it can affect the environment, economy, fisheries, and even the development of a country. [8] Climate change can contribute to humanitarian crises where the impacts and hazards of climate change can interact with the level of vulnerability of the community. Therefore, adaptation and mitigation responses are needed to adjust and reduce the impacts that will occur. [8] Adaptation is the process of adjusting to climate change and its impacts to moderate damage or take advantage of beneficial opportunities.

[18] The adaptation strategies carried out by farmers when climate change occurs include stopping planting, changing types, looking for better seeds in the face of climate change, renting smaller agricultural land, and diversifying their livelihoods, for example, motorcycle taxis transporting potatoes. In addition, There are 3 patterns of adaptation carried out by farming communities, namely economic adaptation, ecological adaptation, and social adaptation [15]. Adaptation strategies are grouped into 3 types in dealing with the impacts of climate change, namely in the form of physical, social and economic strategies. Physical strategies are carried out so that the physical impacts can be handled and the function of infrastructure facilities can be maintained.[4]

The intensity of climate change impacts must also be reduced by mitigating climate change. Adaptation and mitigation are interconnected activities. The whole of the mitigation strategy carried out by all parties is to reduce greenhouse gas emissions. In ecotourism, mitigation must be carried out by those who do business in it because tourism is a collection of several small and large-scale businesses. Mitigation can be achieved by reducing energy use such as changing habits for mobilization, increasing energy efficiency, increasing the use of renewable energy, sustainable destination planning management, choice of tour operator and tour product packaging, and other changes in tourism business practices. [17]

Households can utilize the assets or capital they have to survive or find a livelihood strategy that they will do when facing a crisis. [3] The survival strategy of households can be formed from the ability of each household to access the livelihood assets they have. Livelihood capital is a very important component to deal with the crisis faced by households. [18] Livelihood capital owned by farmer households is a component in determining the adaptation strategy of farmer households in the face of climate change. This is because farmers are entities that are vulnerable to climate change. In addition, livelihood capital can also change when the community is faced with pressure and crisis. [10] When ecotourism is managed by SEAPAC (a private company) there are differences in livelihood capital owned by the community around ecotourism.

Livelihood systems can come from two different madhabs. There are two types of madhabs of thought in livelihood system studies, namely the Bogor Madhabs and the Western Madhabs. The Bogor madhabs were born from Sajogyo and IPB social scientists. Meanwhile, the Western madhabs are the madhabs born from Western scientists such as Chambers and Conway, de Haan, Bebbington and Batterbury, Sconnes, and Eliis. The focus of attention in the Bogor and Western madhabs concepts is different from each other. The Bogor madhabs focus on social change through agrarian change, resulting in occupational variation. Meanwhile, the Western madhabs are more focused on the symptoms of ecosystem change. Livelihood strategies in the Bogor madhabs refer to the agricultural sector in a broad sense. [5]

3 Methodology

This research uses mixed methods with an exploratory sequential mixed-method research design. The mixed method is a method that integrates qualitative and quantitative approaches. The qualitative approach will be analyzed using an interactive design. Interactive design is broadly carried out with 3 stages, namely data collection, verification, and data presentation. The 3 stages are an interactive model of qualitative data analysis. Meanwhile, quantitative data will be analyzed using the Spearman rank correlation test, Chi-square test and Wilcoxon signed rank test. This research was conducted in Batulayang Village, Cisarua District, Bogor Regency. Batulayang Village is also designated as one of the sustainable villages. Batulayang village has an area of 2.26 Km² with a total population of 10.110 people. Batulayang Village is designated as one of the sustainable villages because of its excellent tourism and environmental management. Batulayang Village is a sustainable tourism village in Bogor Regency.

The data used in this research are primary data and secondary data. This research obtained primary data through survey methods, in-depth interviews, and field observations. This primary data includes questionnaires filled out by respondents and the results of in-depth interviews with informants at the research location using an interview guide. Respondents were selected through purposive sampling, namely deliberately taking 30 respondents of managers and tourism workers (tourism actors) and 30 respondents who were not managers and tourism workers (not tourism actors) who lived in Batulayang Village so that the total respondents taken in this study were 60 respondents.

4 Result and Discussion

4.1 Overview

Batulayang Village has a natural tourist recreation area. The temperature in Batulayang Village ranges from 18 to 24 °Celsius, and Batulayang Village is directly adjacent to a protected forest area, so the nature in Batulayang Village is still very beautiful and maintained. In addition, the shape of the area in Batu Layang Village is dominated by a choppy to hilly shape of 60% of the total area and the other 40% is flat to choppy. Batulayang Village not only has natural attractions to support tourism in Batulayang Village, but also has cultural or artists, as well as hotels/lodging, guest houses/cottages, WIS/bungalows for rent, restaurants/dining houses, and villas that are not rented out. The facilities provided are used to meet the needs of tourists when traveling to Batulayang Village. Ownership of inns, guesthouses, bungalows, and restaurants is on average owned by individuals who are not only natives of Batulayang Village. Further details on a number of tourist industry and workers who are accommodated in the tourist industry are provided in Table 1.

Table 1. Number of tourist industries in Batulayang Village and the number of workers accommodated in the industry

Type of Industry	Quantity (n)	Number of workers who accommodated in the Industry (Person)
Hotels/lodging	7	120
Guest house/cottages	13	80
Villas	76	450
Restaurant/dining houses	8	96

The tourism industry in Batulayang Village is dominated by villas for rent. The observation results also show that there are many types of villas in the Batulayang village area. The tourism industry in Batulayang Village absorbs a lot of labor that can contribute to household income. Besides having many tourist industries, Batulayang Village also cannot be separated from the threat of climate change. The air temperature in Batulayang Village, Cisarua District, Bogor Regency, according to the village profile data, ranges from 18-24 degrees Celsius. Meanwhile, the climate in Batulayang Village is the same as other regions in Indonesia, namely, rainy and dry. These climatic conditions have an influence on ecotourism management in Batulayang Village. The climatic conditions of a tourist area can affect tourist visits and the condition of the flora and fauna in the ecotourism area. In addition, the phenomenon that occurs can affect the amount of maintenance costs for existing attractions.

The increase in rainfall intensity in Batulayang Village made the river overflow and caused flooding and landslides at several points. Flooding is caused by continuous rain so that river water in the area overflows and causes damage to the infrastructure supporting residents' economic activities such as roads that become quickly potholed and damaged, and damaged water systems. This phenomenon creates a household response, especially households that have jobs that often interact with nature such as farmers, tourism workers, ranchers, and others. Adaptation activities carried out include working together to repair roads, adding cleaning equipment, improving infiltration areas, and repairing landslide areas. In addition, the community also increases the cost of fuel oil, and utilizes savings to repair and provide consumption when repairing roads. This adaptation is very important especially for people who work in the field of ecotourism because visitors will definitely see access to tourist sites. Sometimes, tourism managers also contribute to making donations to repair disaster-affected areas.

Mitigation activities that run in Batulayang Tourism Village are also very diverse and are used as tourist attractions such as tree planting, and waste management. In addition, reducing plastic waste and disposable tools is also one way not to damage the environment so that disasters due to climate change can be reduced. Adaptation and mitigation activities can reduce the impact caused by floods and landslides. This is in accordance with the informant's statement regarding the benefits obtained when carrying out mitigation and adaptation responses

"...Reducing in the long term, within 5 years the benefits will be felt..." (E, Batulayang Village, 45 years old, 16/11/2022).

Batulayang Village has educational tourism which can also be a response to the phenomenon of climate change. Educational tourism, which is also used for climate change mitigation and adaptation activities, has been carried out since 2012 before the tourism village was established by the village head. In that year, women who were members of the ecovillage, especially Greenping, planted trees together with other members and tourists. Tree planting aims to prevent landslides and to make the soil loose. In addition, planting is also done to maintain a beautiful environment and replace old trees. In addition, the types of plants planted are also dicotyledonous plants that have woody stems.

4.1 Livelihood Assets

Ecotourism development that occurs in Batulayang Village makes changes to the ownership of household livelihood capital. In addition, there is a change in the allocation of household livelihood capital in Batulayang Village due to the presence of tourism. Testing using the Wilcoxon Signed Rank Test shows that there are changes in physical capital, social capital, financial capital, and human capital. Testing is based on the 2014-2022 time period. This is because Batulayang Tourism Village which has ecotourism was authorized by the village head in 2014 and was then inaugurated by the Bogor Regent in 2022. During this period, there was a lot of development and employment in the tourism sector.

The developments that occurred included the construction of villas, boarding houses, and public facilities such as mosques and toilets. In the test, there are 3 things to interpret the test results, namely, negative difference, positive difference, and similarity of values. The negative difference in the test shows that there is a decrease in the score on household livelihood capital ownership. Meanwhile, a positive difference indicates that there is an increase in the score of household livelihood capital ownership. In addition, the similarity of values shows that there is no change in the score of household livelihood capital ownership. The establishment of Batulayang Tourism Village led to the development of homestays, boarding houses, villas, and other tourist support buildings. This is what makes changes to household physical capital, especially for those who are tied to tourism. In addition, the development of ecotourism in Batulayang Tourism Village was also followed by an increase in training obtained by tour managers. The training obtained included training to become a tour guide, cooking training, climate change socialization, and other training.

Table 2. Changes in livelihood capital in 2022 Batulayang Village households with Wilcoxon Signed Rank Test Analysis

Livelihood assets		N
Natural capital after-Natural capital Before	Negative Ranks	2 ^a
	Positive ranks	1 ^b
	Ties	57 ^c
	Total	60
Physical capital after-Physical capital Before	Negative Ranks	3 ^d
	Positive ranks	16 ^e
	Ties	41 ^f
	Total	60
Human capital after-Human capital Before	Negative Ranks	2 ^g
	Positive ranks	18 ^h
	Ties	40 ⁱ
	Total	60
Financial capital after-Financial capital Before	Negative Ranks	2 ^j
	Positive ranks	18 ^k
	Ties	40 ^l
	Total	60
Social capital after-Social capital Before	Negative Ranks	0 ^m
	Positive ranks	26 ⁿ
	Ties	34 ^o
	Total	60

Table 2 shows that the most changes occurred in the ownership of physical capital, human capital, social capital, and financial capital. The changes that occurred were due to the addition of equipment for tourism workers and the development of villas, lodges, and homestays. For non-tourism workers, it was due to the addition of equipment to support their work, as well as changes in the work they do. Meanwhile, the cause of many social capitals experiencing positive changes is due to the development of communities in the village. Some households opened boarding houses, homestays, and villas to increase household income. In addition, there are some households working as villa guards who earn income from tourism activities. This can contribute to increasing household income and at the same time can be the main source of income. When viewed from the ownership of social capital, ecotourism development also created a new communities such as cooperatives, tourist village communities, *greenping*, ecovillage communities, religious communities, and others. This formation is based on the vision and mission of Batulayang village to protect the environment with ecotourism management based on a beautiful, healthy, natural environment still preserved from damage.

".... first in terms of community knowledge will increase, with the number of tourists who come. at least we are not servants or anything, but we interact well with tourists with higher education, one of them is me, I used to be unable to do this because my formal education was very far below, but now thank God for the formation of this tourist village we can complete what is suitable for us, so that the economy rises, and knowledge increases. Both, it is very clear that the economy has increased, so our goal for the tourist village is to increase the community's economy in terms of tourism. Then in an increasing mindset, the economy increases, insights increase...." (A, Batulayang Village, 45 years old, 9/11/2022)

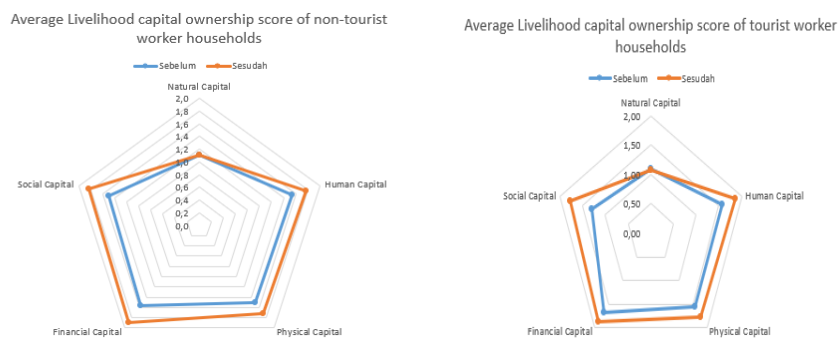


Fig. 1. Average livelihood capital score of tourist and non tourist workers households

Figure 1 shows that changes in scores occur in the ownership of human capital, socio-financial and physical capital in the households of tourism actors and non-tourists. changes that occur tend to increase in each livelihood capital owned. The existence of tourism opportunities encourages people to be able to utilize tourism as a source of income or a potential new source of income for households in Batulayang Village. Changes in livelihood capital ownership occur in households around the Batulayang Village ecotourism area. Ownership of natural capital is calculated from the number of livestock owned and the area of land owned by households. Some households use livestock and land for tourism activities so that household income depends on the number of tourists present to utilize the land and livestock owned by the household. In addition, ownership of physical capital also varies because the current occupation of rural households is not only in agriculture. In addition, ownership of financial capital and human capital has also increased and changed due to new job opportunities in the field of ecotourism. This also occurs in the ownership of household social capital.

4.2 Livelihood Structure

Livelihood structure is a combination of rural household income which is then classified into 3 namely on-farm, off-farm, and non-farm. On-farm income is income from agricultural products. Meanwhile, off-farm income is income collected from results outside agriculture, such as farm labor, fertilizer sales, and others. Non-farm income is income collected from work other than agricultural work such as teachers, parking attendants, traders, and others. [6]

The presence of tourism today can change the structure of household income because it can be used as a new source of income for households. Changes in the livelihood structure in this study are seen from the contribution of household income sources in the study period, namely 2014 to 2022. Based on in-depth interviews conducted, changes that occur due to new sources of income that appear in Batulayang Village, namely in the tourism sector, the presence of tourism raises new income for households. Field observations and in-depth interviews show that tourism activities can contribute to increasing the composition of household income both directly and indirectly.

Table 3. Number of households income after ecotourism development

Household income after ecotourism development	Tourism actors		Non Torusim actors	
	n	%	n	%
(< Rp13.810.667)	2	6,7	2	6,7
(Rp13.810.667 - Rp52.663.333)	18	60,0	17	56,7
(>Rp52.663.333)	10	33,3	11	36,7
Total	30	100,0	30	100,0

Table 3 shows that the households of tourism actors and non-tourists are dominated by the medium income group in the range of Rp13,810,667.00 - Rp52,663,333.00. The contribution of household income comes from 3 sectors of livelihood, namely the on-farm, off-farm, and non-farm sectors [6]. Changes in the income of tourist households and non-tourist households have changed since the 2014-2022 period. Changes in income are due to the increasing number of jobs that are present in Batulayang Village after the legalization of Batulayang Village as a tourist village. In addition, income changes were also due to the addition of new labor in households in Batulayang Village. Some tourism workers also get a fixed salary when working at one of the tourist attractions in Batulayang Village.

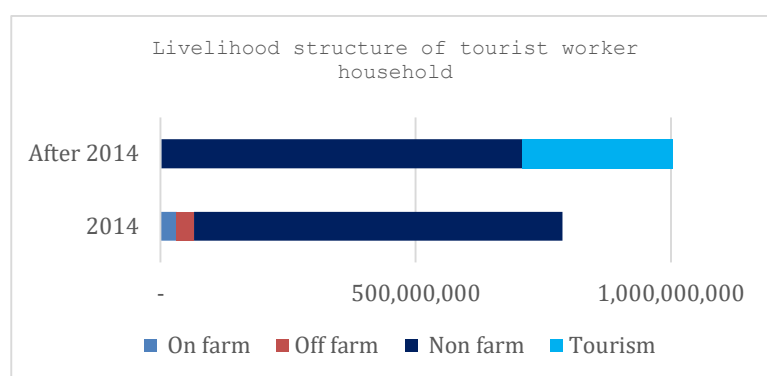


Fig. 2. Livelihood structure of tourist workers household

Figure 2 shows that the dominant type of work that occurs is non-farm. Meanwhile, the most on-farm and off-farm work was done in 2014, before the ratification of Batulayang tourism village. The total on farm income structure decreased from Rp31,636,000.00 to Rp1,550,000.00 or around 95%. This is due to the large number of agricultural land conversions that are converted into villas or inns for tourism purposes and the use of land for tourism purposes such as camping ground. Meanwhile, off farm income also decreased from Rp 34,100,000.00 to Rp 0.00 due to new jobs and increased work opportunities such as becoming a tour guide, tour worker, villa guard, and other tourist jobs.

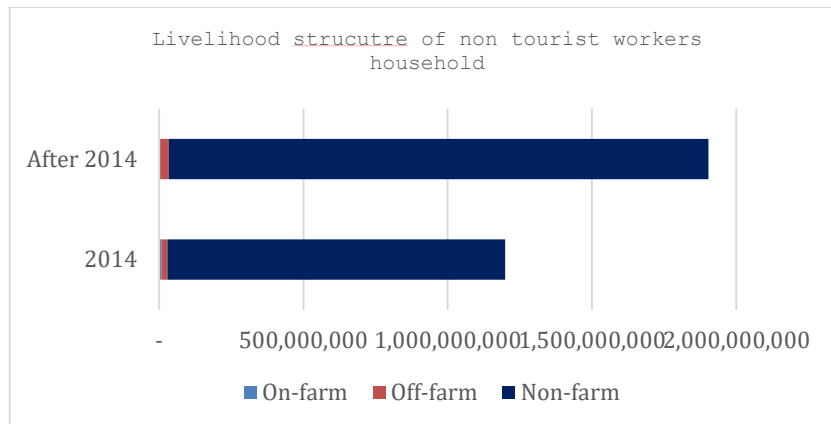


Fig. 3. Livelihood structure of non tourist workers household

Figure 3 shows that the jobs of the non-tourist workers households are also dominated by non-farm jobs. The on-farm income structure also decreased by IDR 4,550,000, this is because the land owned was sold and some was used to build villas. However, the off farm income structure has increased due to an increase in wages received by farm laborers, or workers in other agricultural fields. Meanwhile, the structure of non-farm livelihoods also increased due to an increase in income when opening a stall, an increase in work wages when compared to before 2014, and the presence of tourists visiting making some stalls more crowded.

4.2 Adaptation and Mitigation of Climate Change

Climate change is seen as a change in weather that becomes unstable and is seen from rainfall and temperature. People are considered not to understand the concept of climate change, but on the other hand they are aware and feel the impact caused by climate change [13]. The people who feel the impact of climate change the most are those who depend on natural conditions.

Table 4. Number and percentage of physical adaptation strategies of respondent households in Batulayang Village 2022

Physical adaptation strategy	Non-Tourist workers		Tourist Workers	
	Quantity	Percentage	Quantity	Percentage
>= 4 Strategy	15	50	20	67
0-3 Strategy	15	50	10	33
Total	30	100	30	100

Table 4 shows that there are differences in the level of adaptation strategies of respondent households related to tourism and those not related to tourism. The percentage of households that carry out physical adaptation strategies in the high category is 67%. This is due to the needs of tourism, namely proper access for tourists. Adaptations carried out include carrying out mutual cooperation activities, road repairs, and cleaning water absorption channels.

Table 5. Number and percentage of economic adaptation strategies of respondent households in Batulayang Village 2022

Economic adaptation strategy	Non-Tourist workers		Tourist Workers	
	Quantity	Percentage	Quantity	Percentage
>= 4 Strategy	10	33	12	40
0-3 Strategy	20	67	18	60
Total	30	100	30	100

Table 5 show that there are more economic strategies with low levels than high levels, this is because some households do not utilize their savings for contributions or help with repairs. The financial support provided by tourism managers is sometimes enough to repair roads damaged by floods and landslides.

Table 6. Number and percentage of mitigation of tourist destination strategies of respondent households in Batulayang Village 2022

Mitigation of tourist destination strategy	Non-Tourist workers		Tourist Workers	
	Quantity	Percentage	Quantity	Percentage
>= 4 Strategy	14	47	21	70
0-3 Strategy	16	53	9	30
Total	30	100	30	100

Table 6 shows that mitigation strategies implemented by tourism-bound households are higher than those of non-tourism-bound households. This is because some mitigation activities are carried out more with tourists, such as planting trees, processing waste into products, and closing nature tours when the weather is bad. However, there are some households that are not tied to tourism that have higher mitigation strategies because they join environmentalist communities such as greenpink, ecovillage, sapu nyere, sapu jagat, and others.

Table 7. Number and percentage of mitigation of accommodation strategies of respondent households in Batulayang Village 2022

Mitigation of Accommodation Strategy	Non-Tourist workers		Tourist Workers	
	Quantity	Percentage	Quantity	Percentage
>= 4 Strategy	17	57	24	80
0-3 Strategy	13	43	6	20
Total	30	100	30	100

Table 7 show that mitigation strategies undertaken by tourism-bound households are higher than those of non-tourism-bound households due to the commitment of tourism workers to protect the environment. This is evidenced by the reduction in the use of disposable utensils for catering, reducing the use of plastics, and the utilization of sunlight during the morning to evening hours, among others.

4.3 Climate Change Adaptation and Mitigation as an Ecotourism Sustainability strategy

Ecotourism cannot be separated from environmental conditions. Threats that arise and can damage ecotourism include climate change. Climate change is seen as a change in weather that becomes unstable and is seen from rainfall and temperature. The community is considered not to understand the concept of climate change, but on the other hand they are aware and feel the impact caused by climate change [13]. The people who feel the impact of climate change the most are people who depend on natural conditions.

Informants said that climate change is a phenomenon of changes in weather and seasons. This shows that informants have felt the impact of climate change. [7] 72% of respondents from the study, namely students studying in Jakarta and Yogyakarta, believe that currently there has been climate change. Based on the opinions of informants and previous research, it currently shows climate change based on what informants feel. [18]The phenomenon of climate change that occurs in the Dieng Plateau is understood by the community as a local phenomenon that occurs. This is also what the research informants feel, they understand the phenomenon of climate change as a local phenomenon that occurs where there is an increase in rainy days, an increase in temperature, seasonal changes, and weather changes that occur in Batulayang Village.

The contribution of ecotourism to household income is quite large in Batulayang Village. Therefore, the sustainability of ecotourism in Batulayang Village needs to be considered. Seeing the research results that tourism is a source of household income in Batulayang Village, the sustainability of tourism must be considered. Research shows that Batulayang Village has diverse sources of income from various sectors. Land as household capital is not only used as a means of agricultural production but can be used as another source of income in the tourism sector such as renting camping grounds and other educational tours. This is also the case with livestock owned by some households. In addition, the physical capital owned by households is also very diverse due to diverse occupations, especially in the tourism sector, which requires tools to support tourism.

The diversity of sources of income that arise certainly cannot be separated from the threat of climate variability and change that occurs in Batulayang Village. Given that tourism in Batulayang Village depends on environmental conditions. Therefore, activities to reduce the risk of these phenomena such as adaptation and mitigation activities must still be carried out. According to the results of in-depth interviews, tourism activities in Batulayang Village are supported by the environment and nature that are still maintained without damage. One of the threats that can interfere with tourism activities in Batulayang Village is climate change and climate variability.

The results of in-depth interviews and field observations show that tourism activities are inseparable from disaster events caused by the phenomenon of climate change and climate variability. Therefore, tourism activities and their management require strategies to be able to support environmental conservation in ecotourism areas. One of the activities to preserve tourism is to carry out climate change adaptation and mitigation strategies. Households in Batulayang Village have carried out several climate change adaptation and mitigation activities. Therefore, it is necessary to maintain the activities that have been carried out by expanding the range of participation from the surrounding community because the environmental benefits are not only felt for tourism actors but also households that are not tourism actors.

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