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Resilience of Communities Surrounding Forest Areas to Climate Change in the Aik Bual Community Forest, Central Lombok

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A B S T R A C T

This research aims to identify vulnerabilities, adaptation and mitigation strategies, and the level of resilience of the people of HKm Aik Bual to climate change. This study uses a descriptive approach with mixed methods. The analysis includes climate, economic, environmental, and community resilience aspects to climate change. The results show that communities are vulnerable to fluctuations in rainfall, temperature, and pest attacks on high-value commodities. Despite the implementation of agroforestry and the use of NTFPs, the level of resilience is in the medium category (score of 300/500), mainly due to high economic dependence and low institutional participation. These findings emphasize the need for capacity building, economic diversification, and awig-awig revitalization to build sustainable climate resilience in social forestry areas.

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INTRODUCTION

Climate change is now one of the most pressing global issues, with a widespread impact on many areas of life. The impact is not only limited to environmental aspects, but also extends to various important sectors of life, such as agriculture, health, economy, and social (Dong et al., 2024). The continuous increase in the average temperature of the earth's surface clarifies the symptoms of climate change in various regions, including Indonesia, which ultimately disrupts the balance of ecosystems. Phenomena such as uncertain rainfall patterns, extreme rainfall intensity, and increased air temperature trigger various serious problems, one of which is the increasing frequency of crop failures due to the spread of pests and plant diseases that are increasingly difficult to control. In addition, climate change also has a direct impact on human health, especially through the expansion of disease spread areas affected by climatic conditions. These developments show that the global climate is increasingly unstable, bringing greater risks to both the environment and human life, especially for people who depend on natural resources to meet their daily needs.

Changes in rainfall patterns and shifts in wind direction caused by climate change have triggered an increase in the frequency and intensity of natural disasters such as floods, erosions, landslides, and storms (Bolan et al., 2024). This condition is further exacerbated by the destruction of forests, which are supposed to be our natural protectors. Forests have an important role in absorbing carbon dioxide, preventing erosion, reducing flood risk, and providing clean water (Opoku et al., 2024). Unfortunately, human activities such as illegal logging, forest burning, and the conversion of forest land into agricultural land or settlements are actually damaging these ecosystems, exacerbating the impacts of climate change and threatening the environmental balance that is essential to our lives. The importance of forests in supporting people's lives and welfare makes sustainable forest management a top priority (Wati et al., 2022).

One approach to sustainable forest management is through the Community Forest (HKm) program, where communities are given permission to legally manage forest areas for 35 years with the option of extension in accordance with applicable regulations. One of the Community Forests (HKm) that is located in West Nusa Tenggara is the Aik Bual Community Forest (HKm), which is located in Aik Bual Village, Kopang District, Central Lombok Regency with a management area of 94.45 hectares. Cultivated land in this area is managed by farmers by considering the potential and characteristics of the land, as well as by combining annual crops, fruits, and food crops. The HKm program is designed to empower communities around forests while preserving forests, with a balance between increasing community income and environmental sustainability. Based on the Regulation of the Minister of Environment and Forestry (LHK) Number 9 of 2021, HKm is an important policy that allows local communities to manage forests in a sustainable manner, which is expected to improve their welfare without neglecting the role of forests as an environmental buffer.

The land that is granted use permits through the Community Forest (HKm) scheme is managed by the community in the Aik Bual Forest Area by implementing an agroforestry system. This system involves the integration of different types of vegetation, plant structure, vegetation species under the stand, and different plant densities (Markum et al., 2013). The diversity in the implementation of the agroforestry system provides a diversity of income and a diversity of plant species in the area. According to Markum et al., (2021), well-managed agroforestry practices can increase people's income while significantly increasing the value of carbon stocks. One of the most profitable agroforestry patterns is the mixed agroforestry pattern, which includes a variety of MPTS (Multiple Purpose Tree Species) crops such as durian, mangosteen, avocado, jackfruit, rambutan, palm, coffee, and chocolate (Fikry et al., 2024; Wahyuningsih et al., 2021). This diversity of plants has been shown to contribute high income to farming communities under the HKm scheme. However, it is important to note that these plants are also quite sensitive to climate change. Plants require certain conditions in terms of temperature, humidity, sunlight intensity, and nutrients for optimal growth, flowering, and fertilization phases. A mismatch in these factors can result in production failure and threaten farmers' incomes.

Farmers' dependence on forest resources is very high, so production failures can have a major impact on their incomes. Research conducted by Khairunnisa et al., (2024) shows that communities around forest areas are highly dependent on forest resources, with a level of dependency that reaches 80% to 100%. This condition indicates that changes or disruptions in forest product production will have a significant impact on them. For farmers who are completely dependent on forest products for their livelihoods, disruptions to forest product production can threaten their survival. In this situation, people's resilience to climate change is very important. However, how effectively they can adapt and mitigate climate change depends on a variety of factors. These factors include social, institutional, economic, physiological conditions as well as access to resources that can support their adaptation efforts.

The purpose of this study is to identify forms of vulnerability to climate change in the communities around the Aik Bual community forest, analyze how the community adapts and mitigate climate change, and analyze the level of community resilience to climate change in the Aik Bual Community Forest, Central Lombok.

THEORETICAL REVIEW

Global Warming

Global warming is an increase in average temperatures in the Earth's atmosphere, oceans, and land area due to the capture of solar heat radiation by greenhouse gases (Poletti et al., 2024). These gases, such as carbon dioxide (CO_2), naturally exist in the atmosphere, but human activities such as fossil fuel use and land-use change have increased their concentrations, reinforcing the greenhouse effect. This process is similar to a greenhouse, where heat is trapped and cannot be released, causing the earth's temperature to continue to rise (Long et al., 2024).

This increase in temperature has an impact on wind and ocean wave patterns, changing marine ecosystems directly or indirectly (Teske et al., 2024).

Climate Change and Its Impacts

Climate change is a shift in long-term weather patterns caused by natural factors such as volcanic eruptions and variations in sunlight, as well as human activities such as deforestation and greenhouse gas emissions (Degroot et al., 2022; Malpeli et al., 2024). In Indonesia, climate change is causing hotter dry seasons, late rainfall, and extreme rainfall that triggers flooding and crop failure (Clech et al., 2024; Suhadi et al., 2023). Piers et al., (2024) predict a temperature increase of 2.1–3.9°C in 2000–2100, which will have an impact on evaporation, agricultural productivity, and increased pests (Soermarno et al., 2019).

Community Resilience

Resilience is the ability of individuals or communities to face, overcome, and rise from difficulties (Angeles, 2024; Reivich, K and Shatté, 2002). Seven key abilities make up resilience: emotion regulation, impulse control, optimism, causal analysis, empathy, self-efficacy, and achievement. Social support, spirituality, and positive emotions also strengthen resilience. In the context of farmers around the Sesaot forest, resilience includes cognitive and psychomotor abilities supported by economic, social, and institutional conditions to adapt to climate change (Reivich & Shatté, 2002).

Community Shared Forest Management (PHBM)

PHBM was introduced in 1999 in response to the failure of conventional forest management. This program integrates communities in sustainable forest management with the principles of democracy, transparency, equality, and cooperation (Minister of Environment and Forestry Regulation No. 83 of 2016). The goal is to improve community welfare while maintaining forest sustainability through active involvement in planning and decision-making (Budi & Mardiana, 2022; Febrian & Triadi, 2024).

Social Forestry

Social Forestry (PS) is a sustainable forest management system by local communities or customary law communities in state forest areas or customary forests (PP No. 23 of 2021). The forms include Village Forests, Community Forests, People's Plantation Forests, Customary Forests, and Forestry Partnerships. PS aims to improve welfare, environmental balance, and socio-cultural dynamics (Syahiib et al., 2024). This concept was born from the failure of an exploitative approach to forests and has been developing since 1968 (Abimanyu, 2023), adopted by Indonesia in the 1970s as part of forestry reform (Haryani & Rijanta, 2019).

Community Forest (HKm)

Community Forest (HKm) is a government program that provides communities with legal access to manage state forests to improve welfare, create jobs, and reduce poverty (Minister of Environment and Forestry Regulation No.

P.88/Menhut-II/2014). Communities grow timber and non-timber crops such as MPTS, taro, and ferns through agroforestry systems (Haryani & Rijanta, 2019). HKm emphasizes the active participation of communities in decision-making, forest product utilization, and ecosystem restoration (Maryudi et al., 2020; Purnomo et al., 2022). Its success depends on clarity of rights, institutional capacity, and policy support (Tacconi et al., 2020).

Community Dependence on Forests

Communities around forests are highly dependent on forests as a source of food, building materials, medicine, and income (Maryudi et al., 2020; Wattie & Sukendah, 2023). Limited land and economic access drive this dependency, especially for smallholder farmers with less than 0.1 hectares of land (Ningsih et al., 2022). Forests also have strong social, cultural, and spiritual values (Wattie & Sukendah, 2023). Their income comes from farming (rice fields, livestock) and non-farming (handicrafts, trade). Providing access to forest management can build a sense of ownership and encourage conservation (Yakin et al., 2019).

METHODOLOGY

Research Methods

This study uses a descriptive approach with *mixed methods* to understand community resilience to climate change in the Aik Bual Community Forest (HKm), Central Lombok. This approach was chosen to describe factual conditions thoroughly without variable manipulation (Efendi et al., 2012; Sugiyono, 2012). Qualitative data was collected through in-depth observation and interviews to understand behaviors, social structures, and institutions, while quantitative data was used to measure farmers' incomes, production of non-timber forest products (NTFPs), and vulnerability to crop failure.

Location, Time, and Data Source

The research was carried out in January-April 2025 at HKm Aik Bual, Aik Bual Village, Kopang District, Central Lombok Regency.

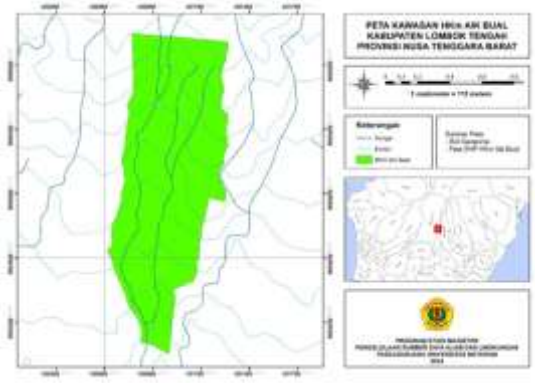

Figure 1. Map of the research location

The types of data used include qualitative (narratives about behavioral, social, and institutional) and quantitative (income, production, and

vulnerability figures). The data source consists of primary data collected directly from the location and secondary data from documents such as forest use permits, area maps, and farmer group records (Ronny, 2007).

Sampling and Data Methods

The research population consisted of 260 members of farmer groups who had forest use permits. Using the Slovin formula and a margin of error of 10%, the number of samples was determined as many as 73 respondents. The simple random sampling technique is used because populations are considered homogeneous in forest access and utilization patterns (Creswell & Creswell, 2018; Daniel, 1999). In addition, the sampling plots were made randomly on the respondents' land with dimensions of 20x20 m (trees), 10x10 m (poles), and 5x5 m (piles). Data collection techniques include observation, structured interviews, measurements, and documentation to support data triangulation and improve validity (Neuman, 2014).

Variables and Data Analysis

The research variables included climate data (temperature, rainfall, humidity), plant type, adaptation strategies (crop management, social protection), and resilience aspects: psychological (emotion regulation, optimism, self-efficacy), economic (variety of livelihoods, income), socio-institutional (participation), and environment (plant density, diversity index, carbon reserves). Data analysis was carried out descriptively to identify vulnerabilities and adaptation strategies, and used scoring based on the Likert scale to assess the level of resilience of the community.

Carbon Stock Measurement

Carbon stocks are calculated through above-ground biomass (AGB) using allometric equations specific to plant types such as coffee, durian, mahogany, and sengon (Manuri et al., 2016). The carbon content is calculated using the formula C = BK × 47%, then converted to tons per hectare. This calculation is done per plot and standardized per hectare to assess the contribution of the environment to durability.

Durability Level Classification

The level of community resilience was assessed based on a maximum total score of 500, with criteria: very high (>400–500), high (>300–400), medium (>200–300), low (>100–200), and very low (<100). This score describes the ability of communities to respond to climate change, which is influenced by knowledge, participation, social capital, and institutional involvement (Markum et al., 2025).

RESULTS AND DISCUSSION

The Aik Bual Community Forest (HKm) is located in Aik Bual Village, Kopang District, Central Lombok Regency, the result of the expansion of Wajageseng Village in 2008 which consists of seven hamlets. Geographically, this area is bordered by Mount Rinjani National Park to the north, Wajageseng

Village to the south, Setiling Village to the west, and North Jenggik Village to the east. Managed by Tastura I Aik Bukak Resort under the Tastura Forest Management Unit Center, HKm Aik Bual has high ecological and social value. Its strategic location between conservation areas, settlements, and agriculture makes it an important element in maintaining environmental balance and supporting sustainable development through the sustainable use of forest resources.

The study involving 73 respondents showed that the majority of people are in productive age (46–60 years) with a proportion of 62%, which indicates great potential in adopting land management innovations (Goma et al., 2021). However, the level of acceptance of innovation tends to decline with age (Setiyowati et al., 2022), so an approach that considers generational diversity is needed. Low levels of education are a significant challenge, with 41% of respondents never having formal education and 45% only completing elementary school, which limits understanding of climate change issues and the application of modern technology (Sandra, 2015). In addition, 78% of respondents managed less than 1 hectare of land, a condition that limits productivity and income, according to the findings of Markum et al., (2021) that land area greatly affects the welfare of farmers.

In response to these limitations, 45% of respondents do side jobs as farmers, taking advantage of the availability of natural feed on cultivated land, while 21% are still fully dependent on the agricultural sector. This diversification of livelihoods is an important adaptation strategy in the midst of climate uncertainty. The number of family dependents also affects economic vulnerability, with 26% of respondents caring for four, which increases financial pressures especially when land productivity declines (Harahap, 2021). Therefore, people's resilience to climate change is strongly influenced by age, education, land area, and family burden, which demands an integrated approach through institutional strengthening, training, and innovation in inclusive resource management.

Forms of Community Vulnerability Due to Climate Change

Climate Vulnerability

Climate change has created multidimensional vulnerabilities in the Aik Bual Community Forest (HKm), Central Lombok, which can be seen from extreme fluctuations in rainfall, rising temperatures, and sunlight intensity during the 2023–2025 period. Erratic rainfall from an average increase from 146.27 mm (2023) to 154.75 mm (2024), but plummeted drastically to 75.75 mm/month in early 2025, with a peak of 454.50 mm/month disrupting the traditional agricultural calendar and threatening food security and the availability of clean water (Purwanto et al., 2022). This pattern is consistent with the IPCC's (2022) projections of increasing rainfall intensity in the tropics, which actually increases community dependence on non-timber forest products (NTFPs) when agricultural production is disrupted by climate anomalies (Amalia et al., 2015). The increase in temperature from 26.45°C (2023) to 26.99°C (2024) (BMKG, 2024) causes stress on crops, decreases crop yields (Baeti et al.,

2022), expands the spread of pests and diseases (Idayati, 2013), and supports the transmission of vector diseases such as malaria and dengue fever (Kusumo et al., 2023). The increase in humidity from 83.25% to 84.08% creates an ideal environment for pathogens, which can reduce productivity by up to 40% (Khudori, 2011; Markum et al., 2025), although forest cover still plays an important role in maintaining the microclimate and preventing fires (Nurjannah et al., 2017).

The increased sunlight intensity from 229.38 hours/month (2023) to 261.30 hours/month (2024), with an extreme value of 395 cd, has a double impact: it supports photosynthesis but has the potential to cause photo-oxidative stress and increase soil evaporation, exacerbating drought (Kusumo et al., 2023). These light fluctuations explain up to 60% of the variability of the primary productivity of the net tropical forest (Piers et al., 2024), so that the Aik Bual community developed a shade system in agroforestry to optimize the canopy architecture based on local knowledge (Andini et al., 2018). Although high intensity can create micro "heat islands" that interfere with thermal comfort, its potential also opens up opportunities for the development of solar energy as a strategy for economic diversification and increased energy security. Faced with the complexity of these vulnerabilities, HKm Aik Bual must be placed as the center of adaptation and mitigation strategies, not only as a source of income, but also as an ecosystem fortress and disaster buffer through a participatory and holistic ecosystem-based approach (Deswarman et al., 2024).

Economic Vulnerability

Aik Bual Community Forest Communities who depend on forest products face economic vulnerability due to climate change, as their livelihoods are highly dependent on natural resources that are vulnerable to environmental fluctuations such as changes in rainfall patterns, rising temperatures, and climate uncertainty that disrupt crop growth and productivity, increasing the risk of crop failure and reducing production yields which directly impact the decline in farmers' incomes. Leading commodities such as coffee, durian, cocoa, mangosteen, and avocados experience significant productivity declines because critical phases of growth such as flowering and fertilization are highly sensitive to erratic weather changes (Wulandari & Suryatmojo, 2021), where temperature and humidity fluctuations cause flower drops, fruit failure, spoilage, as well as increased pest and disease attacks such as caterpillars and pathogenic fungi(Kusumaningtyas & Agustina, 2020).

Table 1. Types of plants that are vulnerable to the impacts of climate change

Plant Type	Forms of Vulnerability	Economic Value
Durian (Durio zibethinus)	Flowers and fruits fall off, rotten fruits, attacked by caterpillars	Tall
Manggis (Garcinia mangostana)	Flowers and fruit falling, rotten fruit	Tall
Avocado (Persea americana)	Flowers and fruit falling, rotten fruit	Tall
Rambutan (Nephelium	Flowers and fruit fall	Keep

Plant Type	Forms of Vulnerability	Economic Value
lappaceum)		
Cocoa (Theobroma cacao)	Rotten fruit	Keep
Coffee (Coffea spp.)	Black rotten fruit	Tall
Duku (Lansium parasiticum)	Flowers and fruit fall	Keep
Sirsak (Annona muricata)	Flowers and fruit fall	Keep
Mango (Mangifera indica)	Flowers and fruit fall	Keep
Pomelo (Citrus maxima)	Flowers and fruit fall	Keep
Guava (Psidium guajava)	Flowers and fruits fall off, fruit attacked by caterpillars	Low

Source: Primary Data (2025, processed)

The long-term resilience of these high-economic value crops is increasingly questioned amid unstable climate pressures, while narrow economic dependencies exacerbate vulnerability, leaving them without strong adaptation strategies and inclusive policy support.

Environmental Vulnerability

Climate change has created a microclimate that supports the development of pests and diseases in the Aik Bual Community Forest, with temperatures rising from 26.45°C (2023) to 26.99°C (2024) and humidity increasing by 84.08%, creating ideal conditions for the life cycle of fruit flies (Bactrocera dorsalis), caterpillars, and pathogens such as bacteria and fungi. These warm and humid conditions accelerate pest reproduction, prolong the attack season, and interfere with plant recovery time, so that mainstay commodities such as durian, mangosteen, avocado, and coffee experience an increase in the frequency of attacks that cause flower and fruit drops, rot, and caterpillar contamination in fruits, which directly reduces the quality and quantity of crops (Suryadi et al., 2022).

Table 2. Types of pest and disease attacks on some types of plants

Plant Type	Attacked By	Attack Form	Economic Value	Vulnerability Level
Durian (Durio zibethinus)	Fruit flies / Caterpillars	Flowers and fruits fall off, rotten fruits, there are caterpillars inside	Tall	Vulnerable
Manggis (Garcinia mangostana)	Bacteria	Flowers and fruits fall off, rotting fruits	Tall	Vulnerable
Avocado (Persea americana)	Bacteria	Flowers and fruits fall off, rotting fruits	Tall	Vulnerable

Plant Type	Attacked By	Attack Form	Economic Value	Vulnerability Level
Rambutan (Nephelium lappaceum)	Fruit flies	Flowers and fruit fall	Keep	Vulnerable
Cocoa (Theobroma cacao)	Bacteria	Rotting fruit	Keep	Vulnerable
Coffee (Coffea spp.)	Mold (Fruit rust)	The fruit rots and turns black	Tall	Vulnerable
Duku (Lansium parasiticum)	Bacteria	Flowers and fruit fall	Keep	Quite Vulnerable
Sirsak (Annona muricata)	Bacteria	Flowers and fruit fall	Keep	Quite Vulnerable
Mangga (Mangifera indica)	Fruit flies	Flowers and fruit fall	Keep	Quite Vulnerable
Jeruk Bali (Citrus maxima)	Fruit flies	Flowers and fruit fall	Low	Quite Vulnerable
Jambu Biji (Psidium guajava)	Fruit flies	Flowers and fruits fall off, fruit attacked by caterpillars	Low	Quite Vulnerable

Source: Primary Data (2025, processed)

Repeated attacks cause stress on plants, inhibit growth and regeneration, and weaken the resilience of the ecosystem as a whole, even opening up opportunities for invasion of new pest species. The impact is systemic, as the loss of fruits and flowers reduces the source of feed for frugivvorous animals such as birds and bats, which can break natural pollination chains and disrupt the ecological balance.

How Communities Adapt and Mitigate Themselves to Climate Change

The Community Forest Community (HKm) of Aik Bual, Central Lombok, faces climate change by implementing an ecosystem-based and socio-economic adaptation strategy, dominated by the implementation of agroforestry systems. The agroforestry patterns applied, such as mixed, durian-dominant, and coffee-dominant, allow for optimal limited land utilization, increase productivity, and strengthen ecological resilience by maintaining soil moisture, reducing erosion, and increasing fertility (Ningsih et al., 2022; Prasetyo, 2022). Agroforestry systems integrate woody crops such as mahogany and sengon with agricultural crops and fruits such as coffee, durian, and palm, which not only diversifies income (Ayuniza et al., 2020), but also reduces photo-oxidative stress through shade arrangements based on local knowledge. The integration of traditional knowledge and modern technologies, such as seasonal-based planting and organic fertilizing, further strengthens the sustainability of agroforestry practices (Kamaludin, 2019), making it a holistic adaptive solution to climate fluctuations.

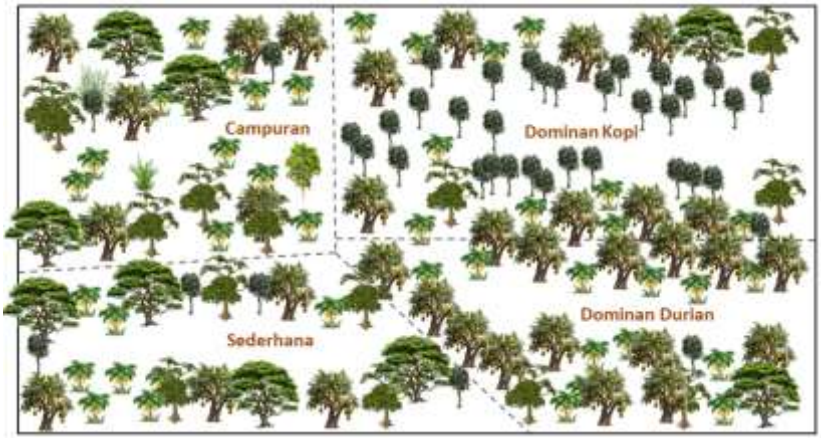

Figure 2. Agroforestry Patterns Used in HKm Aik Bual

The use of Non-Timber Forest Products (NTFs) such as palm, coffee, durian, and bamboo is the main pillar of the community's economy, considering that timber harvesting is prohibited in protected forest areas. Palm oil, which can be processed into ant sugar, is an adaptive solution because it can be harvested daily and has high economic value. The use of NTFPs not only serves as an economic adaptation strategy, but also as a form of climate change mitigation, characterized by an increase in stand density from 110 stems/ha (2015) to 365 stems/ha (2016), which significantly increases carbon storage. This effort is strengthened through participation in the REDD+-based Environmental Service Payment (PES) program through the Plan Vivo scheme (2016–2019), which provides financial incentives for forest conservation. Although the program has stalled, the community's commitment remains strong, showing that their motivation is not solely economic, but also based on a collective awareness of the importance of forests for climate balance.

Diversification of livelihoods, such as livestock farming (45% of respondents), traders, or honorary teachers, is an important strategy to reduce dependence on the agricultural and forestry sectors that are vulnerable to climate change. This diversification increases the economic resilience of the community, in accordance with the findings of Nurhidayati et al. (2020) that the variation of income sources is the main mechanism for increasing resilience. Institutional strengthening through the establishment of the Aik Bual Forest Farmers Group (KTH) with a clear organizational structure is the foundation for collective, transparent, and participatory forest management. KTH is responsible for planning, SMART-based forest patrols, and management of PES funds, as well as being a forum for the revitalization of customary norms such as awig-awig, which emphasizes collective responsibility for conservation, such as the obligation to plant trees during marriage.

The cooperative formed on the initiative of the Chairman of KTH is a strategic forum to strengthen a sustainability-based economy, by focusing marketing on low-carbon products such as ant sugar and organic coffee. Cooperatives reduce dependence on middlemen, increase the added value of products, and allocate profits back to conservation, creating a positive cycle

between the economy and ecology. The success of this model is supported by multi-stakeholder collaborations with NGOs such as FFI and Gaia-dB, as well as academic institutions that provide technical assistance, training, and scientific research. This collaboration strengthens community capacity and makes HKm Aik Bual a learning site and a real model of how strong institutions, knowledge integration, and strategic partnerships can protect forests while improving welfare amid climate change challenges (Tjilen et al., 2023).

The Level of Community Resilience to Climate Change

The results of the data analysis showed that the level of resilience of the community around the Aik Bual community forest area, Central Lombok, was at moderate criteria with a total score of 300 out of a maximum score range of 0–500 (Table 3). This score puts communities at a level of resilience that is not yet optimal, even though it already has several aspects that support resilience to climate change.

Table 3. Assessment of Community Resilience to Climate Change

Component	Leaning Components	Value Range	Value
Aspects Psychological	▪ Emotion regulation	0-20	15
	▪ Impulse control	0-20	20
	▪ Optimism	0-20	10
	▪ Empathy	0-20	20
	▪ Thinking style	0-20	15
	▪ Self-efficacy	0-20	20
	▪ Improvement of positive aspects	0-20	15
	Total score (1)	0-140	115
Aspects economics	▪ Variety of livelihoods of farmers	0-40	20
	▪ Sources of family income	0-40	20
	▪ Income from forests	0-60	30
	▪ Out-of-forest income	0-60	20
	Total score (2)	0-200	90
Aspects Social and Institutional	▪ Participation in plant cultivation	0-20	10
	▪ Participation in disaster management	0-20	10
	▪ Participation in social protection	0-20	10
	▪ Participation in institutions	0-20	10
	Total scores (3)	0-80	40
Aspects Milieu	▪ Plant density at the research site	0-20	15
	▪ Types of plants at the research site	0-20	10
	▪ Shanon winer diversity index at the research site	0-20	15
	▪ Estimated carbon reserves	0-20	15

Component	Leaning Components	Value Range	Value
	stored in stands at the research site		
	Total scores (4)	0-80	55
	Total score range	0-500	300

Source: Primary Data (2025, processed)

In the psychological aspect, the community showed a relatively good level of resilience with a total score of 115 from the range of 0–140. They have the ability to control emotions, impulses, and self-efficacy that is quite high. However, optimism and improvement of positive aspects still need to be increased so that people are better prepared to face the challenges of climate change in the future. In the economic aspect, the community obtained a total score of 90 out of the range of 0–200, indicating that this aspect is one of the main points of vulnerability. Community income is still heavily dependent on forest resources and does not have adequate livelihood diversity. This makes them vulnerable to economic disruption due to fluctuations in forest products affected by climate change.

In the social and institutional aspects, the community only obtained a score of 40 out of the range of 0–80. Community participation in various social activities such as plant cultivation, disaster management, social protection, and institutions is still relatively low. Active involvement in local groups or institutions is essential to improve coordination and collective response to the threat of climate change. Meanwhile, in the environmental aspect, the community obtained a score of 55 from the range of 0–80. The biodiversity index, vegetation density, and potential carbon stocks in forest areas show fairly good conditions. However, environmental management needs to be further improved so that the function of forest ecosystems is maintained and able to be a buffer against the impacts of climate change.

Table 4. Obtaining a Community Resilience Score to Climate Change

Durability Criteria	Score Acquisition Criteria	Information
Keep	>200 - 300	The public is quite knowledgeable about climate change, stating that there have been losses and problems due to climate change. However, it is not accompanied by a responsive attitude to deal with it immediately. Climate change has an impact on several components, including the economic aspect

Source: Primary Data (2025, processed)

Based on Table 4, with the criteria of moderate resilience, it can be concluded that the community already has a good enough knowledge of climate change and is aware that the change has caused losses as well as various problems, especially in the economic aspect. However, this knowledge has not been followed by proactive and organized efforts to address these impacts. Thus,

it is necessary to strengthen community capacity through training, strengthen local institutions, diversify livelihoods, and increase participation in natural resource management so that community resilience to climate change can increase significantly.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that the Aik Bual Community Forest (HKm) community in Central Lombok experiences several forms of vulnerability due to climate change, including climate, economic, and environmental vulnerability. The fluctuation in rainfall, which from 154.75 mm/month (2024) to 75.75 mm/month in early 2025, has had an impact on the disruption of the agricultural calendar and a decrease in the productivity of high-value commodities such as coffee, durian, mangosteen, and avocados, which have been damaged by flower falls, rotten fruits, and pest attacks such as fruit flies and rusty fungi. Economically, 78% of respondents manage less than 1 hectare of land, 41% have never had formal education, and communities are still heavily dependent on forest products, making them vulnerable to climate change. In response to this, the community has developed ecosystem-based adaptation strategies, such as the implementation of agroforestry systems (mixed, durian-dominant, and coffee-dominant) that increase ecological resilience and land productivity, as well as the use of palm oil as a source of daily income with high economic value. Mitigation efforts are also carried out through an increase in stand density from 110 stems/ha (2015) to 365 stems/ha (2016), which contributes to carbon storage, as well as participation in the awig-awig customary norm that requires the planting of trees during marriage, reflecting the common awareness of local communities in forest conservation. Diversification of livelihoods such as livestock farming and institutional strengthening through Forest Farmers Groups (KTH) also increase economic and social resilience. However, the results of the assessment showed that the level of community resilience was in the moderate category with a total score of 300 out of 500, mainly due to weak economic aspects (score 90) and social-institutional participation. Although the public has sufficient knowledge about climate change and its impacts, the response has not been fully proactive and organized. Therefore, it is necessary to strengthen sustainable capacity through training, revitalization of awig-awig as an instrument of customary-based resource management, inclusive policy support, and strengthening partnerships with NGOs and academic institutions so that HKm Aik Bual can become a model of resilient community resilience in the midst of the climate crisis.

Based on the findings of the study, it is recommended that researchers further develop GIS-based spatial studies, examine land cover dynamics and long-term productivity, and examine the role of gender, the younger generation, and the effectiveness of awig-awig in climate adaptation. The community is advised to strengthen economic diversification through the development of NTF-based businesses such as palm sugar, optimize agroforestry with climate-tolerant crops, revive awig-awig as an instrument of sustainable forest management, and increase participation in KTH, cooperatives, and village forums. Governments and stakeholders need to

provide regular training on ecosystem-based adaptation, facilitate access to capital, markets, and infrastructure such as irrigation and production roads, provide conservation incentives in the form of seeds, tools, or financial support, and integrate the findings of this research into regional development planning based on climate change mitigation and adaptation.

FURTHER STUDY

Future research on the Aik Bual Community Forest (HKm) should focus on a more detailed assessment of socio-economic resilience strategies, particularly in addressing the economic vulnerabilities caused by small land ownership and low levels of formal education. Further studies are also needed to evaluate the long-term effectiveness of ecosystem-based adaptation measures, such as agroforestry diversification and customary regulations (awig-awig), in sustaining productivity and ecological balance under changing climate conditions.

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