JBKL
Jurnal Bisnis Kehutanan dan Lingkungan
JBKL 3(1): 18–35
ISSN 3025-4833

Institute for Advanced Science, Social and Sustainable Future
MORALITY BEFORE KNOWLEDGE

Bridging the gap between understanding and action: A participatory study on watershed conservation

Moh. Dian Zulham[1]*, Sudirman Daeng Massiri[2], Abdul Rahman[2], Hendra Pribadi[2], Arman Maiwa[2], Andi Sahri Alam[2]

[1] *Faculty of Engineering, Universitas Tadulako, Central Sulawesi, 94118, Indonesia;*
[2] *Department of Forestry, Universitas Tadulako, Central Sulawesi, 94118, Indonesia*
*Correspondence: dianzulham0@gmail.com

Received Date: June 18, 2025 Revised Date: July 27, 2025 Accepted Date: July 31, 2025

ABSTRACT

Background: Watershed conservation is crucial for maintaining environmental sustainability and ecosystem balance, particularly in Poboya Village, Mantikulore District, where rivers serve as a vital water source for downstream communities. Understanding and engaging the local community in conservation efforts is essential to ensure the long-term sustainability of watershed ecosystems. **Methods:** This study was conducted over one month (April–May 2025) in Poboya Village using a qualitative-descriptive approach. Data were collected through snowball sampling from 30 respondents using Likert-scale questionnaires, in-depth interviews, and open-ended discussions. **Results:** The research revealed that public understanding of watershed conservation is generally high (average score of 116), indicating good awareness of the concept, function, and importance of watershed ecosystems. However, the level of active community participation in conservation efforts is moderate (average score of 86). Activities such as tree planting, waste management, eco-friendly farming, and policy support are present but limited. Key barriers identified include insufficient understanding of watershed hydrology, limited participation in environmental outreach, economic dependence on damaging sectors, lack of facilities and funding, weak law enforcement, and significant challenges posed by climate change and natural disasters. **Conclusion:** Although public awareness of watershed conservation is relatively high, active participation remains moderate. Addressing this gap requires enhanced community-based education, improved infrastructure and funding, and stronger policy enforcement to increase resilience and effectiveness in watershed conservation. **Novelty of this article:** This study uniquely assesses both the level of understanding and active participation of rural communities in watershed conservation, highlighting the interplay between knowledge, behavior, and structural challenges. It also identifies climate change and economic dependency as critical threats, offering valuable insights for targeted policy and community interventions.

KEYWORDS: watershed; conservation; community.

1. Introduction

Watershed Conservation is critical to maintaining the services of hydrological ecosystems, which provide benefits such as water availability and sediment retention. This maintains ecosystem balance, supports biodiversity, agricultural productivity, and overall environmental sustainability in sensitive areas (Gwal et al., 2024). The Poboya Watershed, especially in the part located in Poboya Village, Mantikulore District, Palu City, has experienced significant environmental degradation due to Unauthorized Gold Mining activities. This activity causes erosion in the river section, which has an impact on increasing sedimentation along the river channel, especially downstream. The erosion occurred due to poor management of the watershed (Rahmi et al., 2019).

Cite This Article:
Putra, B. A., Aipassa, M. I., Ruslim, Y., & Siahaya, M. E. (2025). Bridging the gap between understanding and action: A participatory study on watershed conservation. *Jurnal Bisnis Kehutanan dan Lingkungan, 3*(1), 18-35. https://doi.org/10.61511/jbkl.v3i1.2025.2112

Watersheds face problems such as soil erosion, land degradation, and inappropriate land use. These problems cause environmental damage, deterioration of water quality, and negative impacts on surrounding communities, including migration as well as loss of soil fertility and moisture (Walia et al., 2024). Community involvement is very important in maintaining and preserving watersheds. By increasing public awareness, knowledge, and skills, a participatory approach in implementing soil and water conservation measures can be grown. This ultimately ensures sustainable land management and good environmental quality (Defar, 2024).

Negative impacts are in the form of a decrease in the quality and quantity of watershed environments caused by sediment sourced from erosion and industrial waste (pollution) caused by the existence of densely populated slum villages, besides other negative impacts are the existence of soil excavation and sand continuously so that it forms basins in the watershed which can damage the land shape and facilitate landslides, especially on the left and right of the river and riverbed to become rougher, so that it can increase the erosion and transport capacity of the river. This negative impact can change the state of rivers and watershed ecosystems (Hartati, 2018).

Thus, the above background is in line with the results of observations made by the researcher that in the upstream and downstream watersheds in Poboya village, Mantikulore District, have certain functions, the watershed section in Poboya village functions to accommodate existing water runoff and a supplier of clean water sources for Regional Water Company/*Perusahaan Daerah Air Minum* (PDAM) for community needs. The downstream part functions as a drainage water reservoir in the area around the village for agricultural land and livestock needs. Seeing the importance of the position of watersheds, in this case each often experiences problems, namely there are many plantation and mining land management activities that cause uncontrolled water due to high rainfall, resulting in an increase in flood volume and quite severe erosion in the watershed. In addition, it is also exacerbated by plastic waste that threatens the ecosystem (watershed) and water quality. Issues like this are very important to be researched about the Role of the Community in Watershed Conservation In Poboya Village, Mantikulore District is one concrete example in the form of community concern for the watershed environment.

Research on the role of communities in watershed conservation is very important because it can identify the level of community participation, increase understanding of the relationship between regions and downstreams, and integrate local wisdom. This can ultimately lead to effective disaster mitigation and improved people's livelihoods through sustainable practices. The formulation of the problem from the research: What is the level of public understanding of the importance of watershed conservation? What is the role of the community in watershed conservation in Poboya Village? What are the challenges faced by communities in participating in watershed conservation. The purpose of this study is to find out the level of public understanding of the importance of watershed conservation in Poboya village, Mantikulore District. Knowing the Role of the Community in Conservation/ *Daerah Aliran Sungai* (DAS) in Poboya Village, Mantikulore District. Knowing the challenges faced by communities in participating in watershed conservation. The benefits of this research are; The results of this study are expected to help identify clearly and comprehensively related to the role played by the local community in maintaining and preserving watersheds and understanding watershed conservation practices in Poboya Village, Mantikulore District. The results of this research can also be a basis for the government and the community in decision-making in terms of sustainable management and conservation strategies (watersheds) This research presents information that can contribute to increasing public awareness and understanding of the importance of conservation or ecosystem preservation (watershed).

2. Methods

This research was carried out for 2 (two) months, located in Poboya village, Mantikulore District. The tools used in this study are cameras, voice recording devices,

writing-writing tools, and laptops. The material used in this study is a questionnaire. Determination of respondents. The sampling technique in this study used the snowball sampling method, starting with a small number of initial respondents (key informants), and then asking them to Recommend or connect researchers with others who also meet the same criteria.

The data collection technique in this study is carried out through information collection by survey method or directly in the field and direct interviews with the community, both as a group and individually, the methods used in data collection as follows. Observation is direct observation at the research site, namely the conservation area (watershed) in Poboya Village, Mantikulore District. Questionnaire is a collection technique data by providing or distributing forms containing a list of questions to respondents in the hope of responding to the questions. The distribution of the questionnaire aims to find out the opinions of respondents. Interviews are a method of data collection that is carried out through direct questions and answers between interviewers and respondents, with the aim of obtaining information, opinions, experiences, or views in more depth. Documentation is the collection of data at the research site in the form of photographic images. The analysis method used in this study is a descriptive method with a scale of 1-3-5 (modification of the Likert Scale), descriptive research which is also commonly called taxonomic research, intended for the exploration and clarification of a social phenomenon by describing a number of variables that are favorable to the problem and a careful unit, the Likert scale is used to measure the role and attitude of a person or group about social events or symptoms (Sing et al., 2021).

3. Results and Discussion

3.1 Respondent characteristics

3.1.1 Age

Based on the data collected during the field trip after processing, the description of the characteristics of the respondents obtained from the results of the interview activities in question is the respondent's age, education level, occupation, land area and respondent information. Respondent age is the age of a person who is a subject or participant in a study, usually calculated in units of years from the date of birth to the time data is collected. The age of the respondents was based on the division of productive and non-productive ages. The age (25-50) years is included in the productive age category, while the age of <25 years and >50 years is included in the non-productive category. That in this activity, age is also one of the indicators of maturity of thinking, knowledge and experience that a person does not have (Adalina et al., 2015). The classification of respondents based on productive and non-productive age categories can be seen in Table 1.

Table 1. Classification of respondents by productive-non-productive age

No.	Age	Number of Respondents	Percentage (%)
1	21-48	25	83.33
2	≥ 51	5	16.67
Sum		30	100

Based on Table 1, respondents who fall into the productive age category are in vulnerable 28 - 48 years old which amounted to 25 people (83.33%), while those classified as non-productive age category ≥ 51 years old 5 people (16.67%). This data shows that in terms of age, the level of community participation in watershed conservation activities is relatively high. Therefore, it can be concluded that the majority of people involved in watershed conservation activities in Poboya Village are classified as productive age groups. According to (Aliran et al., 2022), productive age is a phase of life where a person still has the ability to work and produce something useful. Based on Table 10, respondents who are included in the productive age category are in the vulnerable category of 28 - 48 years old

which amounts to 25 people (83.33%), while those classified as non-productive age category ≥ 51 years old amount to 5 people (16.67%). This data shows that in terms of age, the level of community participation in watershed conservation activities is relatively high. Therefore, it can be concluded that the majority of people who involved in watershed conservation activities in Poboya Village is classified as a productive age group. According to (Aliran et al., 2022), productive age is a phase of life where a person still has the ability to work and produce something useful.

3.1.2 Education

Education is a conscious and planned effort to create a learning and learning atmosphere so that students actively develop their potential to have religious, self-control, personality, intelligence, noble morals, and the skills needed by themselves and society (Ujud et al., 2023). Education is all the knowledge of learning that occurs throughout life in all places and situations that have a positive influence on the growth of each individual being. For more details about the level of education of the respondents, please see the following Table 2.

Table 2. Respondent categories by education level

No.	Education	Number of Respondents	Percentage (%)
1	Elementary/Equivalent	0	0.00
2	Junior High School/Equivalent	10	33.33
3	High School/Equivalent	19	63.33
4	Bachelor's degree	1	3.33
Sum		30	100

Based on Table 2, it shows that out of 30 respondents, the last education of the community in Poboya Village is dominated at the high school education level, which is 19 people with a percentage (63.33%). Furthermore, at the junior high school education level, there are 10 people with a percentage (33.33%) and finally at the S1 education level, only 1 person with a percentage (3.33%). It is known that education is very important in knowing the extent of public understanding related to increasing productivity, especially in the ability to a person in absorbing and understanding the knowledge or information given. So that education can affect the level of a person's role, especially at the level of understanding.

3.1.3 Work

Work is a routine carried out by the community in Poboya Village to meet the needs of daily life. Based on the results of the research, the respondents' job categories can be seen in Table 3.

Table 3. Respondent Job Categories

No.	Job Type	Number of Respondents	Percentage (%)
1	Market Trader	5	16.66
2	Food Stalls	3	10.00
3	Motorcycle/car workshop	4	13.33
4	Builder	2	6.67
5	Lecturer	1	3.33
6		2	6.67
7	Honorary Village Office	7	23.33
8	Rice Farmers	2	6.67
9	Vegetable Farmer	1	3.33
10	Oil palm farmer	1	3.33
11	IRT	2	6.67
Sum		30	100

Based on the results of the study in Table 12, it shows that out of a total of 30 respondents, the characteristics of the type of work of respondents in Poboya Village are divided into five groups. First, Market Traders 5 people or 16.66%, Food Stalls 3 people or 10.00%, motorcycle/car repair shops 4 people or 13.33%, Builders 2 people or 6.67%, Lecturers 1 person or 3.33%, Teachers 2 people or 6.67%, Honorary Village Offices 7 people or 23.33%, Rice Farmers 2 people or 6.67%, Vegetable Farmers 1 person or 3.33%,

Oil Palm Head Smallholders 1 person or 3.33%, IRT 2 people or 6.67%. The people of Poboya Village who participate in watershed conservation activities all have background back of diverse work. A basic job is the main activity that a person does to earn income and meet his or her life needs. If a person has more than one job, then the job that consumes the most time is considered the main job. If the time spent is the same, then the job with the largest income is considered to be main occupation.

3.2 Utilization of the Poboya Village sub-watershed

The Sub-Watershed (Sub-Watershed) in Poboya Village, Mantikulore District, is an integral part of the hydrological system that has important ecological and socio-economic functions for the local community. This sub-watershed is located in an area with a varied topography, consisting of highlands, hills, and river channels that flow to the downstream part of Palu City. The existence of Sub-Watersheds in this area is not only a watershed, but also intensively used by the community for various purposes, including agriculture, settlements, economic activities, and mining activities.

3.2.1 Utilization of goods in sub-watershed

Sub-watersheds provide goods (such as water, forest products, agricultural products) and services (such as water flow management, flood control, and recreation services) that can be used by the surrounding community (Fatmala et al., 2023). As shown in Table 4.

Table 4. Category of goods from watersheds

No.	Description Utilization	Description	Sum Respond	Percentage (%)
1	Agriculture	Use of land and water sources of Sub-Watershed for food crop cultivation activities such as rice and corn	2	6.7
2	Plantation	Utilization of Sub-watershed areas for the cultivation of commodities annuals such as cocoa, coconut, and cloves	6	20.0
3	Farm	Use of land around the Sub-Watershed as grazing areas or cages livestock	3	10.0
4	Fishing	Utilization of water bodies for fish farming activities through ponds or small streams	3	10.0
5	Household Necessities	The use of river water for domestic needs such as bathing, washing, cooking, and drink	7	23.3
6	Social and Recreational Activities	Use of border districts rivers as a place to gather and socialize	4	13.3
7	Extraction of Natural Materials	Exploitation of natural resources such as rocks, sand, and soil from rivers for construction purposes	3	10.0
8	Settlement	Land use in the Sub Watershed area for development residence or settlement	2	6.7

The results of the study on 30 respondents showed that the people of Poboya Village use the Sub-Watershed (Watershed) area for various activities that are directly related to their daily needs, both economically and socially. The most dominant type of utilization is for household needs at 23.3%, Reflect high dependence on the availability of water sources

from watersheds for basic needs such as bathing, washing, cooking, and clean water consumption.

The use of Sub-Watersheds for plantations occupies the second position with a percentage of 20.0%. This activity includes the cultivation of annual crops such as cocoa, coconut, and cloves. This shows that the area around the watershed is intensively used to support people's livelihoods, especially in the plantation agriculture sector. Meanwhile, livestock and fisheries accounted for 10.0% and 10.0%, respectively, which indicates the existence of land and water bodies that still support livestock and freshwater fish cultivation activities on a household or community scale.

The use for social and recreational activities (13.3%) indicates that the river border area is also used as a social space by the community, such as a place to gather, interact, or simply recreation. On the other hand, the extraction of natural materials (10.0%) reflects the exploitation of resources in the form of sand, stone, or soil from rivers for construction needs. This activity has the potential to put pressure on the physical stability of the river and cause environmental impacts if not managed wisely.

The utilization for residential land of 6.7% shows the existence of settlements that have developed around the Sub-Watershed. Existence Settlement at near the border river risk cause environmental degradation if not followed by spatial planning that pays attention to the carrying capacity and ecological function of watershed areas. The utilization for agricultural activities was recorded the lowest, at 6.7%. Thing get caused by the limitation of flat land suitable for intensive agriculture or the shift in community business patterns towards plantations and other sectors that are more adaptive to topographic conditions of the area.

3.2.2 Utilization of services in sub-watersheds

The data obtained show that the use of Sub-Watersheds by communities is very diverse and reflects a high dependence on the ecological function of watersheds. It is necessary to carry out integrated management efforts that involve the community in planning, supervising, and implementing conservation activities. Strengthening community capacity, counseling on the ecological impact of unsustainable utilization activities.

Table 5. Watershed service category

No.	Service Categories	Type of Service	Description/Usage
1	Provision Services	Clean water	The river is used for drinking and bathing
		Agricultural products	Rice fields near the river are irrigated from the river flow
		Fish	Residents catch fish in the river
		Wood	Wood from the trees by the river
		Sand and rocks	Residents take sand and stones for buildings
2	Arrangement Services	Reduce flooding	Forests near rivers absorb rainwater and reduce flooding
		Keeps the water flow stable	Water continues to flow despite the dry season
		Holding the soil from landslides	Tree roots prevent landslides on slopes
		Filtering water Naturally	Soil and plants filter wastewater before it enters the river
3	Support Services	Fertilize the soil	The soil around the river becomes fertile due to mud deposits
		Becoming a place where animals and plants live	Many fish, birds, and plants grow around the river
		Help Plant pollination	Insects help flowers grow fruit

3.3 The role of communities in watershed conservation

3.3.1 Community-based watershed conservation activities

The people of Poboya Village have shown active participation in environmental conservation activities through tree planting programs, especially in the sub-watershed area and along the riverbanks. Planting in areas with steep slopes is carried out in areas with steep slopes that have a high level of vulnerability to soil erosion, so as to improve soil stability and reduce the rate of land degradation. Planting along the riverbank aims to form a natural buffer zone that plays an important role in maintaining the stability of river banks and reducing the potential for sedimentation that can damage aquatic ecosystems. This activity reflects the community's collective awareness of the importance of natural resource conservation and sustainable environmental management.

This activity is carried out through cooperation withh: Surrounding Communities, Local Non-Governmental Organizations (NGOs), Village Government. Tree planting provides various significant benefits, both from an ecological and socio-economic perspective. Ecologically, the existence of tree vegetation is able to prevent landslides and erosion, especially in the rainy season, through the role of plant roots in strengthening soil structure. In addition, trees increase the absorption of rainwater into the soil, which directly contributes to reducing the risk of flooding and increasing groundwater reserves that are urgently needed by the community during the dry season. From an economic aspect, the trees planted, especially fruits and wood, have the potential to provide long-term benefits for people's welfare. In addition, this activity also encourages the growth of collective awareness of the importance of preserving the environment as part of the shared responsibility in sustainable natural resource management.

The implementation of tree planting activities in the Poboya Village area faces a number of challenges that require handling. One of the main obstacles is the lack of consistently availability of quality tree seedlings, which has an impact on the effectiveness of land rehabilitation programs. In addition, difficulties in irrigation, especially in the dry season, are obstacles in ensuring the survival of the seedlings that have been planted. This activity also requires technical assistance and ongoing training so that the community has adequate knowledge and skills in vegetation management. Another challenge is the existence of mining activities, both legal and illegal, around the Poboya area, which can cause environmental degradation and disrupt conservation efforts. Therefore, cross-sector collaboration is needed to overcome these problems to support the success and sustainability of the reforestation program. Conclusion the participation of the people of Poboya Village in tree planting activities is a clear example of local efforts in participatory sub-watershed management. These efforts not only contribute to the reduction of the risk of disasters such as erosion andflood.

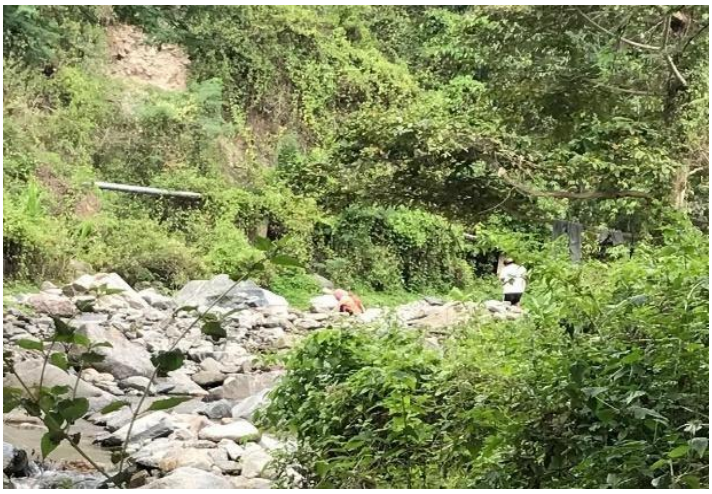

Fig. 1. Tree planting around watersheds

The community in Poboya Village has started to implement a more economical and efficient water consumption pattern in response to the limitation of water resources, especially in the dry season. This efficiency effort is carried out by using water wisely as needed, such as when bathing, washing, and watering plants, to avoid waste. People use rainwater by storing it in containers such as drums or reservoirs as water reserves for domestic purposes when the dry season arrives. Not only that, the use of used washing water has also been implemented, especially for watering plants and cleaning the yard, as a form of reusing household wastewater that is still feasible. These practices reflect public awareness of the importance of sustainable water management in the face of the challenges of climate change and limited natural resources.

Domestic waste management in Poboya Village is carried out through a community-based approach that emphasizes the active participation of residents in maintaining cleanliness and environmental sustainability. One of the main steps implemented is the separation of organic and inorganic waste to facilitate the recycling and further processing process. Organic kitchen waste is used to make compost, which is then used as a natural fertilizer for plants, thus supporting environmentally friendly agricultural practices. In addition, household liquid waste management is carried out by building sewers that do not flow directly into the river, but are drained through a simple filtration system or well to reduce water body pollution. Some residents have also begun to reduce the use of harmful chemicals, such as detergents and synthetic pesticides, in an effort to reduce the negative impact on soil and water quality. This approach reflects the community's collective awareness of the importance of sustainable and environmentally friendly waste management.

This activity is carried out in collaboration with: Counseling from the Kelurahan government, support from local Non-Governmental Organizations (NGOs), the community. Domestic water and waste management in Poboya Village still faces a number of challenges that need serious attention. One of the main obstacles is the limited supporting infrastructure, such as an uneven rainwater storage system and liquid waste disposal that does not fully meet sanitation standards. In addition, not all residents have sufficient understanding and awareness of the importance of waste separation and the long-term impact of household chemical use on the environment. The lack of household-scale waste treatment facilities, such as infiltration wells, also hinders the optimization of organic and liquid waste management. On the other hand, social challenges such as lack of technical assistance and limited economic resources also affect the effectiveness of implementing sustainable water and waste management practices. Therefore, collaborative efforts are needed between the government, the community, and related parties to overcome these obstacles comprehensively.

Conclusion the wise behavior of the people of Poboya Village in managing domestic water and waste reflects concern for environmental sustainability. By implementing efficient water consumption, responsible waste management, and maintaining the cleanliness of the river, communities have made a tangible contribution to maintaining the ecological function of the sub-watersheds in their areas. This activity also strengthens the spirit of mutual cooperation and community resilience in facing water crises or environmental disasters in the future.

Agroforestry farming practices in Poboya Village are a form of innovation in integrated land management that combines elements of agriculture and forestry in one production system. This approach not only aims to increase agricultural yields, but also to strengthen the ecological function of the land through the presence of tree vegetation that plays a role in soil and water conservation, as well as increasing soil fertility naturally. In the agroforestry system, agricultural crops such as vegetables and tubers are cultivated side by side with fruit trees or perennials, thereby creating production diversification and increasing the economic resilience of the community. In addition to providing economic benefits, this system also contributes to climate change mitigation through carbon sequestration and increased biodiversity. However, the implementation of agroforestry

requires careful planning, adequate technical knowledge, and support from various parties to ensure its long-term success and sustainability.

Fig. 2. Watershed water and waste management

Many farmers in Poboya Village have started to implement the agroforestry system, which is an integrated agricultural approach that combines food crops with annual trees. The application of this system provides various environmental conservation benefits, including helping to hold the soil from being prone to landslides, increasing micromoisture around agricultural land, and increasing the capacity of the soil to absorb and store water. In addition to ecological benefits, agroforestry systems also provide economic benefits through diversification of agricultural products, which can increase farmers' income in a sustainable manner. This planting pattern also contributes to reducing pressure on protected forest areas around Poboya, because

The community's needs for natural resources have largely been met from their own agroforestry farmland. The implementation of the agroforestry system in Poboya Village faces various challenges that affect Effectiveness and its sustainability. One of the main obstacles is the limited knowledge and technical skills of farmers in managing the interaction between food crops and annual trees optimally. In addition, the availability of quality tree seedlings that are in accordance with local conditions is still inadequate consistently. Climate factors, such as prolonged dry seasons, can also inhibit plant growth in agroforestry systems. Another challenge is the economic pressure that makes some farmers reluctant to invest in the long term, as annual tree yields can only be harvested after a few years. In addition, the risk of disturbances from mining activities and land use changes also threaten the sustainability of agroforestry in this region. Therefore, supportive technical, financial, and policy support is needed to overcome these barriers and ensure the successful implementation of the agroforestry system in a sustainable manner.

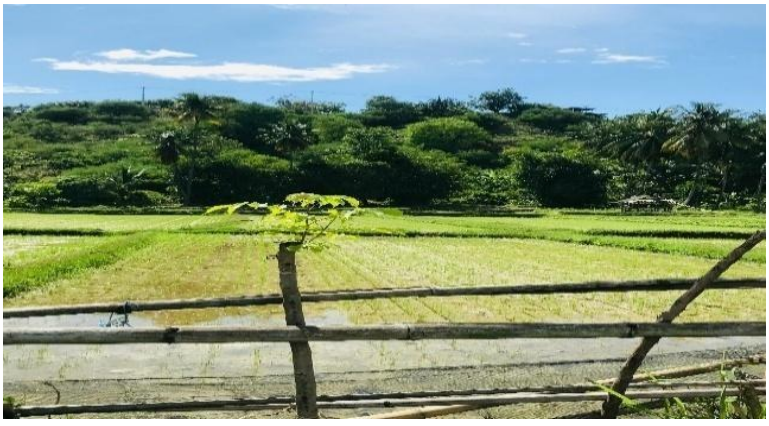

Fig. 3. Watershed agroforestry agriculture

Conclusion Farmers in Poboya Village play an important role in maintaining watershed sustainability through the application of conservation techniques such as terrace,

agroforestry, and reducing the use of hazardous chemicals. These measures not only maintain agricultural land productivity, but also protect water resources that are very important to the people of Palu City as a whole.

Compliance with conservation policy support for the prohibition of illegal logging in the Poboya Village Community in stages show awareness and compliance with illegal logging bans imposed to protect protected forest areas and watersheds. With socialization from the government and support from environmental organizations, residents are increasingly understanding the long-term impact of illegal logging on floods, droughts, and habitat destruction. Public awareness of the importance of waste management and river cleanliness has shown a significant increase, in line with the intensification of education carried out by the government and non-governmental organizations. The community began to actively manage household waste independently, including through waste sorting, composting, and reducing the use of detergents and the disposal of domestic waste that pollutes water. In addition, the participation of residents in environmental service activities to maintain the cleanliness of the riverbanks also shows a collective concern for the preservation of aquatic ecosystems. These efforts reflect growing adherence to the principles of sustainable environmental management.

The challenges in improving compliance with conservation policies are still complex and diverse. One of the main obstacles is the lack of public understanding of the content and objectives of conservation policies, thus causing resistance or indifference to the applicable rules. On the other hand, the limited resources and capacity of government institutions in socializing, monitoring, and law enforcement also hinder the effectiveness of the implementation of these policies. In addition, economic pressure and the need for land for settlements and agricultural activities often encourage people to engage in activities that are contrary to conservation principles, such as illegal logging, forest encroachment, or poaching of protected animals. Weak coordination between relevant agencies and lack of incentives for communities to engage in conservation efforts also magnify the challenges in creating sustainable compliance with conservation policies. Conclusion The Poboya Village community plays an active and strategic role in supporting watershed management policies. Through compliance with illegal logging bans, awareness in management waste, and participation in conservation programs, communities show that they are not only the beneficiaries of the watershed, but also the custodians of its sustainability.

Fig. 4. Community support for the river stream

The people of Poboya Village show active involvement in vegetation conservation efforts through various community-based initiatives. One of the main steps taken is the revegetation of critical land around forest areas that have been degraded due to anthropogenic activities. In addition, the community also develops conservation gardens planted with various types of local plants, such as traditional medicinal plants, regional fruit trees, and shade plants that have ecological and economic functions. This activity is complemented by the care of vegetation that has grown before, including through clearing

the land from invasive weeds and regular pruning of plants to strengthen growth and maintain the balance of the local ecosystem. These efforts reflect the community's commitment to supporting environmental conservation in a sustainable manner.

The implementation of vegetation conservation activities in Poboya Village still faces a number of challenges that need serious attention. One of the main obstacles is the limited funding which has an impact on the lack of optimal long-term care of the vegetation that has been planted. In addition, the lack of availability of experts in the field of forestry and plant conservation also hinders the effectiveness of the implementation of conservation techniques that are in accordance with the conditions of the local ecosystem. Land use conflicts are also quite complex problems, especially when conservation needs clash with the economic interests of the community, such as the conversion of land for agriculture or settlements. Other threats that are no less significant come from mining activities, both legal and illegal, as well as the clearing of new land that causes damage to natural vegetation. In addition, the absence of a systematic monitoring and evaluation system makes it difficult to assess the success rate of conservation programs objectively and sustainably. Vegetation conservation initiatives carried out by the people of Poboya Village show that the participatory approach has a significant impact on maintaining the sustainability of the local ecosystem. These activities not only strengthen environmental resilience to climate change and natural disasters, but also build collective awareness of the importance of maintaining biodiversity and long-term quality of life.

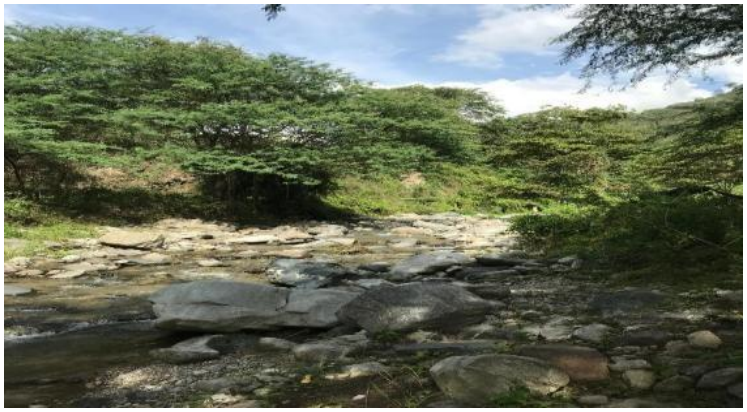

Fig. 5. Maintaining vegetation preservation

In encouraging optimal participation in its management efforts. This emphasizes the importance of developing more structured guidelines and increasing the active role of the community in dealing with watershed-related problems (Bekele et al., 2023). Such as a major river or lake. As can be seen in Table 6.

Table 6. Indicators of understanding watershed conservation

Yes	Indicator Description	Categories of Comprehension			Total Score	Category
		BC	CM	CE		
1	Understand that watersheds are areas that are bounded by topography (such as mountains and hills) that drain rainwater to a certain point	40	30	12	82	Keep
2	Know the parts of the watershed, such as , middle, and downstream, as well as their respective roles in the hydrological and ecosystem cycles	66	25	3	94	Keep
3	Understand how natural factors (rainfall, soil type, vegetation) and human factors (deforestation, urbanization, agriculture) affect watershed conditions	60	42	4	106	Keep

4	Explain the consequences of watershed degradation, such as flooding, soil erosion, drought, and loss Biodiversity	35	54	5	94	Keep
5	Know watershed conservation strategies, such as reforestation, terraced construction, water management and environmental policies that are support watershed sustainability	120	12	2	134	Tall
∑ Total Score				510		
Average (∑ / 5)				102	Keep	

The results of the study regarding the understanding of Watersheds (DAS), that the majority of respondents have a fairly good understanding of the basic concept of watersheds and their role in ecosystems. The understanding of the topographic area shows that out of the total score 82 shows a moderate understanding of the watershed as an area bounded by topography. This is in line with the explanation (Naharuddin, 2018), which states that watersheds are an important unit in water resource management, where rainwater flows towards a specific point, such as rivers or lakes understanding of parts of the watershed, such as upstream, middle, and downstream, as well as showed a moderate score (94), which reflects awareness of the role of each part in the hydrological cycle. According to (Razak et al., 2025), this understanding is important for sustainable management of water resources. The third and fourth indicators show moderate understanding (106 and 94), indicating that there is still an opportunity to improve knowledge of the factors that affect watershed conditions and the consequences of watershed degradation, such as flooding and soil erosion.

Understanding of watershed conservation strategies shows a high understanding (134) on watershed conservation strategies, which shows awareness of the importance of conservation actions such as reforestation and water management management. This is in line with research conducted by (Widyantara, 2016), which emphasizes that conservation strategies are very important to maintain the sustainability of watersheds. The average score of 116 indicates that the understanding of watersheds among respondents is in the high category, although it still needs to be improved.

3.3.2 The role of communities in watershed conservation

The role of society in various aspects of life is essential to achieve common goals, including efforts to preserve the environment and sustainable development. The community has a strategic role in watershed conservation efforts through various actions, such as preservation, conservation, and rehabilitation. This role can be realized through direct involvement in activities such as tree planting, environmentally friendly household waste management, and active participation in counseling or training on natural resource management. (Widyantara, 2016), as can be seen in Table 7.

Table 7. Indicators of the role of the community in watershed conservation

Yes	Indicator Description	Role Categories			Total Score	Category
		SB	KB	TB		
1	The community is active in tree planting activities in the area and along the riverbanks to prevent erosion and increase water infiltration.	25	66	3	94	Keep
2	The community implements wise water consumption patterns, manages domestic waste well, and maintains the cleanliness of rivers and other water sources.	40	60	2	102	Keep
3	Farmers use soil and water conservation techniques, such as terraces, agroforestry, and reduce the use of harmful chemicals that can contaminate the watershed.	15	72	3	90	Keep

4	The community engages in environmental counseling, training, or campaigns to raise awareness about the importance of watershed conservation.	-	39	17	56	Low
5	Communities support and comply with policies related to watershed management, such as prohibitions on illegal logging, waste disposal, and support government or organizational conservation initiatives milieu.	25	63	4	92	Keep
∑ Total Score				434		
Average (∑ / 5)				86	Keep	

The results of the assessment on the role of the community in watershed management showed that community participation in various conservation activities was at a moderate level. The role of tree planting activities with a score of 94, shows that the community is actively involved in tree planting activities around rivers and riverbanks to prevent erosion and increase water absorption. This is in line with research by (Fuad et al., 2023), which emphasizes the importance of reforestation to maintain environmental quality and prevent ecosystem damage.The role of wise water consumption patterns shows that the community has implemented wise ways of consuming water and treating domestic waste well, with a score of 102. According to (Allu et al., 2023), good waste management is essential to maintain the cleanliness of rivers and other water sources. The role on soil and water conservation techniques shows that even if farmers apply soil and water conservation techniques, a score of 90 indicates that there are still challenges in implementing more environmentally friendly techniques, such as agroforestry and reduced use of hazardous chemicals. Community participation in environmental outreach and campaigns, which is reflected in the role on environmental outreach and campaigns scores low (56), shows the need to increase mutual awareness of the importance of watershed conservation. This is in line with research by (Pakaya et al., 2025), that environmental education and counseling are essential to encourage community engagement. The role of policies related to watershed management shows that the community supports watershed management policies with a score of 92, which shows awareness of the importance of regulations to maintain environmental sustainability. The average score of 86 shows that the role of the community in watershed management is in the medium category, with the potential to increase through education and participation more active.

3.4 Challenges faced by communities in participating in watershed conservation

Communities are faced with various challenges, including limited understanding of the relationship between upstream and downstream areas, low levels of participation in soil and water conservation activities, and the need to apply conservation techniques that not only function in disaster risk mitigation, but are also able to have a positive impact on improving economic welfare (Indrawati et al., 2022). As can be seen in Table 8.

Table 8. Indicators of challenges faced by the community in participating in watershed conservation

Yes	Indicator Description	Challenge Categories			Total Score	Category
		BC	CM	CE		
1	There are still many people who do not understand the importance of watershed conservation and its impact on daily life.	40	30	12	82	Keep
2	Limited funds and facilities are often obstacles to implementing conservation programs, such as reforestation and waste management.	60	42	4	106	Keep
3	Many communities depend on agriculture, plantations, and industries that can negatively impact watersheds, making it	50	39	7	96	Keep

	difficult to find a balance between the economies and the environment.					
4	Lack of oversight and weak enforcement of environmental violations, such as illegal logging and water pollution, make watershed conservation difficult done	55	45	4	104	Keep
5	Extreme weather changes, droughts, and natural disasters such as floods and landslides can hinder efforts	70	36	4	110	Tall

The results of the assessment of challenges in Watershed Conservation/*Daerah Aliran Sungai* (DAS) show that various challenges are faced by communities and related parties. The challenge on the importance of watershed conservation with a score of 82, shows that many people still do not understand the importance of watershed conservation and its impact in daily life. According to research by (J. Therik, 2021), the level of public awareness about the importance of conservation has a major influence on the success of environmental programs. Challenges on budget and facility limitations, with a score of 106, are a major obstacle in carrying out conservation programs such as reforestation and waste management. This is in line with the results of research (Susanto, E, 2023) showing the importance of sufficient financial support for the success of various environmental initiatives. Challenges about industries that negatively impact watersheds show that many communities depend on the agricultural, plantation, and industrial sectors, with the economy and environmental protection are complex challenges. Challenges on oversight and weak law enforcement indicate that there is a lack of oversight and weak enforcement of environmental violations, such as illegal logging and water source pollution, with a score of 104. Pointing out that law enforcement needs to be improved to support watershed conservation, Challenges on extreme weather and natural disasters, with a score of 110, major challenges that could hinder conservation efforts that have been undertaken. Research by (Irwan, S, 2016), shows that climate change can worsen environmental conditions and affect the success of conservation programs. An average score of 99 indicates that challenges in watershed conservation are in the moderate category, with some aspects requiring more attention.

4. Conclusions

The level of public understanding of the concept, function, and conservation of watersheds in general is moderate. This is evidenced by the final score which shows that most respondents lack understanding of watershed as a hydrological area that includes sections, middle, and downstream, as well as knowing the natural and anthropogenic factors that affect watershed conditions. They also lack a clear understanding of the impacts of watershed degradation such as floods, droughts, and soil erosion, as well as conservation strategies such as reforestation and water system management. The active role of the community in activities watershed conservation is in the medium category. Respondents indicated involvement in tree planting activities, domestic waste management, the use of environmentally friendly agricultural techniques, and support for watershed management policies. However, participation in environmental counseling or training activities is still moderate, which indicates the need to improve community-based education programs. The results of the study identified five main obstacles in watershed conservation. Among them, the low public understanding of the importance of watershed conservation is still a fundamental problem, although in general the level of knowledge is quite good. In addition, limited funds and facilities, dependence on economic sectors that damage watersheds, and weak law enforcement are moderate obstacles. The most significant constraints come from climate change and natural disasters, which are categorized as high, as they directly affect the success of conservation efforts.

Acknowledgement
The authors express their gratitude to the reviewers for their valuable and constructive feedback on this article.

Author Contribution
All authors contributed equalily to the conceptualization, methodology, analysis, and writing of this review. They collaboratively reviewed and approved the final manuscript for submission.

Funding
This research did not receive funding from anywhere.

Ethical Review Board Statement
Not available.

Informed Consent Statement
Not available.

Data Availability Statement
Not available.

Conflicts of Interest
The authors declare no conflict of interest.

References
Adalina, Y., Nurrochman, D. R., Darusman, D., & Sundawati, L. (2015). Socio economic conditions of communities around Mount Halimun Salak National Park. *J Pengelolaan Hut Konserv Alam*, *12*(2), 105-118. https://doi.org/10.20886/jphka.2015.12.1.1 05-118

Alfandi, D., Qurniati, R., & Febryano, I. G. (2019). Community participation in mangrove management. *Jurnal Sylva Lestari*, *7*(1), 30-41. https://doi.org/10.23960/jsl1730-41

Allu, A., Ahmad, M. S., & Nurdiansyah N., W. (2023). Evaluation of Residential Scale Domestic Wastewater Treatment Plants in East Luwu Regency. *Journal of State Administration, 29*(2), 147–170. https://doi.org/10.33509/jan.v29i2.2385

Alsa, B., Priyambodo, D., & Dinda, G. (2023). Implementasi Kebijakan Pemerintah dalam Pengelolaan Daerah Aliran Sungai Terhadap Aktivitas Alih Fungsi Lahan: Implementation of Government Policies in Watershed Management as a Result of Land Use Change. *Reformasi Hukum*, *27*(1), 1-11. https://doi.org/10.46257/jrh.v27i1.497

Bekele, Y., Kebede, B., & Kuma, T. (2023). Assessing the role of community participation in integrated watershed management in Dandi Lake watershed Dandi district, West Showa, Oromia, Ethiopia. *Applied Water Science*, *13*(11), 207. https://doi.org/10.1007/s13201-023-02009-x

Clareza, Y., Barchia, M. F., Brata, B., Simarmata, M., & Romdhon, M. (2023). Community-Based Watershed Conservation in an Effort to Manage Natural Resources with the Development of a Tourism Village in Padang Kedondong Village, Tanjung Kemuning District, Kaur Regency. *Naturalist: Journal of Natural Resource and Environmental Management Research, 12*(1), 87–93. https://doi.org/10.31186/naturalis.12.1.27180

Defar, T. (2024). Watershed-Based Participatory Sustainable Land Management using Integrated physical SWC Measure in Ilasa Watershed of Goba District, Bale Highland South-Eastern Ethiopia. *Cross Current International Journal of Agriculture and Veterinary Sciences.* 6. https://doi.org/10.36344/ccijavs.2024.v06i 02.003

Fatmala, I. K., Pratiwi, C. I. B., Setiyono, K. A., Merlina, M., Dewantara, E. J., Fauziyyah, L., Rais, M. L., & Hizbaron, D. R. (2023). Analysis of Flood Disaster Prevention and Management Ecosystem Services in the Blukar Watershed, Kendal Regency. *Journal of Environmental Science, 21*(4), 965–973. https://doi.org/10.14710/jil.21.4.965-973

Fazeza, N., Suhendra, S., Barasa, H., & Halaudin, H. (2024). Identification of Potential Flood-prone Areas Based on Resistivity and Porosity Values of Rocks Using the VES Method in Batik Nau Village, North Bengkulu Regency. *Journal of Physics Unand, 13*(3), 343–350. https://doi.org/10.25077/jfu.13.3.343- 350.2024

Firmansyah, D., & Dede. (2022). General Sampling Techniques in Methodology. *Scientific Journal of Holistic Education (JIPH), 1*(2), 85–114. http://dx.doi.org/10.55927/jiph.v1i2.937

Gwal, S., Sena, D. R., Srivastava, P. K., & Srivastava, S. K. (2024). Identifying conservation priority areas of hydrological ecosystem service using hot and cold spot analysis at watershed scale. *Remote Sensing*, *16*(18), 3409. https://doi.org/10.3390/rs16183409

Hartati, H. (2018). Community Participation in Improving the Environmental Quality of the Batanghari Watershed in Sungai Duren Village. *Al-Risalahan: Forum for Legal and Social Studies, 18*(1), 13–28. https://doi.org/10.30631/alrisalah.v18i1.132

Indrawati, D. R., Supangat, A. B., Purwanto, Wahyuningrum, N., & Subandrio, B. (2022). Community participation in soil and water conservation as a disaster mitigation effort. *IOP Conference Series: Earth and Environmental Science, 1109*(1). https://doi.org/10.1088/1755-1315/1109/1/012030

Irwan, S. (2016). The Impact of Climate Change on Tropical Forest Ecosystems in East Kalimantan: An Environmental Crisis Analysis. *Journal of Thengkyang, 8*(2), 1–23.

J., Yonatan Sing, S., P.W. Bhokaleba, B., & Imaculata Rume, M. (2021). The existence of mangrove forests in Reroroja Village, Malepanda District, Sikka Regency. *Journal of Marine and Fisheries Sciences, 03(*02). https://repository.nusanipa.ac.id/id/eprint/1117/

Kalembiro, M., Rajamuddin, U. A., & Zaenuddin, R. (2018). Physical characteristics of soil on various slopes of the Poboya watershed, Palu City. *Agrotechnology: Journal of Agricultural Sciences, 6*(6), 748–756. http://jurnal.faperta.untad.ac.id/index.php/agrotekbis/article/view/595

Kamaluddi, Blasius, Emanuel M. Y. (2024). Tree Architecture Model Around Watershed (DAS) of Central Insana District. *Tree Architecture Model Around Watersheds (DAS) of Central Insana District, 11*(1), 56–65.

Muhammad, F., Maryono, Hadiyanto, Retnaningsih, T., & Hastuti, R. B. (2023). Reforestation as a conservation effort in the Khdtk Dipoforest of Penggaron Forest, Semarang Regency. *Pasopati Journal, 5*(1), 2.

Muis, H., Rahman, A., Maiwa, A., Fitrah, R., Pribadi, H., & Paulus, S. (2024, January). Land Cover Change of Kawatuna Sub-Watershed in Central Sulawesi. In *2nd International Interdisciplinary Conference on Environmental Sciences and Sustainable Developments 2022 Environment and Sustainable Development (IICESSD-ESD-22)* (pp. 66-70). Atlantis Press. https://doi.org/10.2991/978-94-6463-334-4_12

Naharuddin, H. H., & Wahid, A. (2018). Pengelolaan Daerah Aliran Sungai Dan Aplikasinya Dalam Proses Belajar Mengajar.

Prakoso, S. B., Miyake, Y., Ueda, W., & Suryatmojo, H. (2024). Application and development of invertebrate indices for water quality assessment in Indonesian streams. *Journal of Tropical Ecology*, *40*, 26.. https://doi.org/10.1017/S0266467424000257

Rahmi, S., Lipu, S., Amaliah, T., Mesi, E., (2019). Study of the Rate of Basic Sediment Transportation on the Pondo-Poboya River. *Stability of the Scientific Journal of Civil Engineering, 7*(3).

Razak, N. A., Zulkifli, C. Z., Abdullah, Y., Khairuddin, A. Z., & Misron, A. (2025). Bridging technology and humanity : Humanising online pedagogy in digital environments. *International Journal of Evaluation and Research in Education, 99*(1), 1–14. https://doi.org/10.11591/ijere.v99i1.paperID

Rezekiah, A. A., & Rianawati, F. (2022). Roles and Community Against-Rehabilitation Activities Compose Diamond Banjar Districts Community-Participation in Watershed Rehabilitation-Activities in Pulau Nyiur Village, Karang Intan District, Banjar Regency. *Jurnal Sylva Scienteae, 5*(4), 547–556. http://dx.doi.org/10.20527/jss.v5i4.6140

Saddam, S., Setyowati, D. L., & Juhadi, J. (2016). Integrasi nilai-nilai konservasi dalam habituasi kampus untuk pembentukan kepribadian mahasiswa Universitas Negeri Semarang. *JESS (Journal of Educational Social Studies)*, *5*(2), 128-135. https://journal.unnes.ac.id/sju/index.php/je ss/article/view/14077

Sing, S. Y., Bhokaleba, B. P. P. W., & Rume, M. I. (2021). Analysis of Community Perception and Attitude to the Existence of Mangrove Forests in Reroroja Village, Malepanda District, Sikka Regency. *Journal of Marine and Fisheries Sciences, 03*(02), 1–11.

Sudarma, I. M., & Widyantara, W. (2016). Persepsi masyarakat terhadap ekosistem daerah aliran sungai ayung menuju sumberdaya air berkelanjutan. *Bumi Lestari Journal of Environment*, *16*(2), 78-91. https://doi.org/10.24843/blje.2016.v16.i02.p01

Suhesti, E., Zalizar, L., Triwanto, J., Ervayendri, E., Setyobudi, R. H., Waskitho, N. T., ... & Pakarti, T. A. (2023). Quality assessment on honey produced from six months old Acacia crassicarpa. In *E3S Web of Conferences*, 374, 00012. https://doi.org/10.1051/e3sconf/202337400202

Susanto, E., & Sirnawati, N. K. (2023). Perilaku Keuangan Berkelanjutan: Dampak Investasi Sosial Dan Lingkungan. *Syntax Idea*, *5*(12). https://doi.org/10.31862/9785426311961

Trisdayanti, N. putu E., & Kristiana, N. I. (2024). Woman Leaders: Framing Cultural Tourism Through Healthy and Sustainable Culinary. 71–89.

Ujud, S., Nur, T. D., Yusuf, Y., Saibi, N., & Ramli, M. R. (2023). The application of the discovery learning model to improve the learning outcomes of students of SMA Negeri 10 Ternate City Class X on environmental pollution materials. *Journal of Bioeducation, 6*(2), 337–347. https://doi.org/10.33387/bioedu.v6i2.7305

Walia, S. S., Kaur, K., & Kaur, T. (2024). Factors Affecting Watershed Management and Impact of Watershed Management Program on Sustainable Agriculture. In *Rainfed Agriculture and Watershed Management* (pp. 81-90). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978- 981-99-8425-1_10

Wiasta I, (2016). Conservation of the Pakerisan Watershed (Das) Based on Community Role. 287–302.

Widiastuti, W., Rajamudin, U. A., & Isrun, I. (2016). Studi Kualitas Tanah Pada Toposequen Sub Das Poboya, Kota Palu. *AGROTEKBIS: JURNAL ILMU PERTANIAN (e-journal)*, *4*(5), 544-552. http://jurnal.faperta.untad.ac.id/index.php/agrotekbis/article/view/57

Zhang, W., Xu, M., Feng, Y., Mao, Z., & Yan, Z. (2024). The Effect of Procrastination on Physical Exercise among College Students—The Chain Effect of Exercise Commitment and Action Control. *International Journal of Mental Health Promotion, 26*(8), 611–622. https://doi.org/10.32604/ijmhp.2024.052730

Biographies of Authors

Moh. Dian Zulham, Faculty of Engineering, Universitas Tadulako, Central Sulawesi, 94118, Indonesia.
- Email: dianzulham0@gmail.com
- ORCID: N/A
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: N/A

Sudirman Daeng Massiri, Department of Forestry, Universitas Tadulako, Central Sulawesi, 94118, Indonesia.
- Email: sudi_untad@yahoo.co.id
- ORCID: 0000-0003-3974-7761
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: https://sinta.kemdikbud.go.id/authors/profile/6008500

Abdul Rahman, Department of Forestry, Universitas Tadulako, Central Sulawesi, 94118, Indonesia.
- Email: abdoel.arf@gmail.com
- ORCID: 0000-0001-6316-0130
- Web of Science ResearcherID: N/A
- Scopus Author ID: 59336612200
- Homepage: https://sinta.kemdikbud.go.id/authors/profile/6025303

Hendra Pribadi, Department of Forestry, Universitas Tadulako, Central Sulawesi, 94118, Indonesia.
- Email: hendra.pribadi@untad.ac.id
- ORCID: N/A
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: https://sinta.kemdikbud.go.id/authors/profile/6042649

Arman Maiwa, Department of Forestry, Universitas Tadulako, Central Sulawesi, 94118, Indonesia.
- Email: armanmaiwa88@gmail.com
- ORCID: 0000-0001-5442-187X
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: https://sinta.kemdikbud.go.id/authors/profile/6665409

Andi Sahri Alam, Department of Forestry, Universitas Tadulako, Central Sulawesi, 94118, Indonesia.
- Email: andisahrialam77@gmail.com
- ORCID: 0009-0009-5626-4180
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: https://sinta.kemdikbud.go.id/authors/profile/6161918