OBSERVING THE LANDSCAPE AND LIFESCAPE OF THE JENEBERANG HULU WATERSHED: INTERACTIONS BETWEEN DEVELOPMENT AND LOCAL COMMUNITIES

ST. KHADIJAH MUNIRAH WAHID[1,2]*, DAUD MALAMASSAM[3], ROLAND A BARKEY[3], BAHARUDDIN[3], MUNAJAT NURSAPUTRA[3]*

[1]*Doctoral candidate of Forestry Science, Forestry Faculty, Universitas Hasanuddin, Makassar, Indonesia, 90245*
[2]*Spasial Intermadiate Planner, Forestry Service of South Sulawesi Province, Makassar, Indonesia, 90126*
[3]*Forestry Faculty, Universitas Hasanuddin, Makassar, Indonesia, 90245*
**Corresponding author email: munirah.wahid.pps@gmail.com, munajatnur saputra@unhas.ac.id*

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ABSTRACT

The evolving understanding of the relationship between humans and the environment has led to the concept of landscape-lifescape, emphasizing the integration of biophysical and human elements in sustainable land management. This study analyzes the dynamics of landscape and lifescape in the Jeneberang Hulu Watershed, Gowa Regency, South Sulawesi Province, Indonesia, focusing on the influence of stakeholder interactions on rural community livelihoods. Utilizing Geographic Information Systems (GIS), structured interviews, and focus group discussions (FGDs), the study identifies significant connections between landscape changes and livelihood capitals: social, economic, natural, human, and physical. Results indicate that 60 % of lifescape conditions are moderate, 20 % are low, and 20 % are high. Natural capital has transitioned from vegetated community land to residential land as the area develops into a tourist destination, impacting economic capital by shifting livelihoods toward tourism services. Physical capital, such as road access and housing, is relatively strong, while health conditions are satisfactory. However, education, skills, and access to savings and credit remain challenges. Social capital is robust, characterized by strong harmony and kinship. The study highlights the need for better coordination among stakeholders to enhance community practices in land management, enabling villagers to optimize livelihood capitals for sustainable living.

Keyword: Landscape Lifescape Analysis, Sustainable Livelihoods, Stakeholder Coordination, Jeneberang Hulu Watershed

INTRODUCTION

A watershed is an ecosystem that requires a balance between landscape and lifescape conditions to sustain human life. Landscape refers to biophysical conditions, including topography, vegetation, and land use, while lifescape encompasses socio-economic and cultural aspects of community livelihoods (Scoones, 2015; McNamara & Morse, 2013). Together, these concepts provide a framework for analyzing sustainability in rural contexts.

Landscape-lifescape analysis evaluates landscape conditions, human land use, social factors affecting livelihoods, and the potential use of natural resources (Klopatek & Gardner, 1999). This integrated perspective is critical for effective watershed management, which aims to stabilize hydrological conditions between upstream, midstream, and downstream areas (Watson & Adams, 2012).

Unbalanced land use can lead to uncontrolled hydrological conditions within the watershed, such as flooding during the rainy season and drought during the dry season. Changes in the hydrological cycle can occur due to alterations in the landscape, driven by both natural processes and human activities at local and regional scales (Stahlschmidt *et al*., 2017). For example, reduced vegetation cover disrupts the hydrological cycle, potentially leading to flooding (Watson & Adams, 2012). In the upper Jeneberang watershed, land use changes for settlements and agriculture on steep slopes have significantly increased erosion (Tandirerung, 2017). These changes impact the operating life of the Bili-Bili Dam by increasing sedimentation, which reduces the dam's water storage capacity. The dam serves as a critical infrastructure for irrigation, flood control, hydroelectric power generation, fisheries, and tourism, particularly benefiting downstream communities in Makassar City and Gowa Regency.

The Jeneberang Hulu watershed is characterized by various natural features such as waterfalls, pine trees, and a cool climate, making it a popular tourist destination. However, the influx of tourism has transformed land use, with community settlements being converted into tourist accommodations. This shift has reduced water infiltration into the soil and increased the risk of landslides, contributing to sediment accumulation (Sudradjat *et al*., 2013). Although sabo dams have been constructed in the Jeneberang Hulu River to manage sediment, they have not been fully effective due to the rapid accumulation of sediment.

Rural communities in the area sustain their livelihoods through various forms of capital: natural, social, human, physical, and economic. These livelihood capitals are collectively referred to as lifescape conditions in this study (Scoones, 2015). For instance, social capital includes community cooperation and kinship ties, while natural capital encompasses land and water resources. Sustainable livelihoods require the responsible management of these capitals to preserve the environment for future generations (McNamara & Morse, 2013). Understanding the landscape and lifescape of community livelihoods in the Jeneberang Hulu watershed is crucial for effective watershed management.

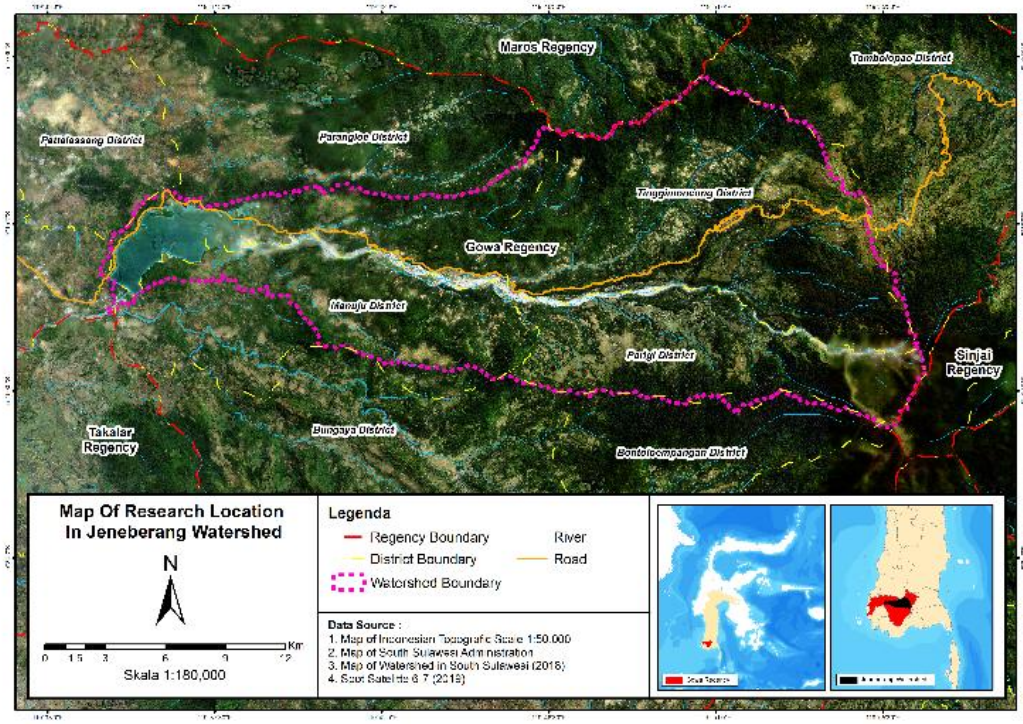
This study aims to analyze the dynamics of landscape and lifescape conditions in the Jeneberang Hulu watershed, focusing on stakeholder interactions and their influence on rural livelihoods. By addressing gaps in existing literature, this research contributes to global discussions on sustainable watershed management and offers insights into balancing ecological and socio-economic needs. The study also evaluates the potential role of community practices and local wisdom in achieving sustainable living and maintaining the hydrological conditions of the watershed.

MATERIAL AND METHODS

Research Location

This research was conducted in the Jeneberang Hulu Watershed, located in the districts of Tinggimoncong and Parigi in Gowa Regency, South Sulawesi, Indonesia, as shown in Fig. 1. The Jeneberang Hulu watershed, one of the Jeneberang sub-watersheds, covers an area of 83 km² and is located between 119°23'50" E - 119°56'10" E and 5°10'00" S - 5°26'00" S. The study focused on six villages: Pattapang, Bontolerung, and Bulutana in Tinggimoncong District, and Jonjo, Manimbahoi, and Majannang in Parigi District.

Fig. 1: Research Location Map



Landscape Analysis

The landscape analysis utilized GIS to assess topography, soil type, land cover, vegetation density, water discharge, and rainfall. Secondary data were obtained from government reports, including sedimentation studies in the Bili-Bili Dam. The dam's sedimentation and its impact on hydrology were included to illustrate the challenges faced in watershed management. These data provided insights into how landscape dynamics affect hydrological stability.

Lifescape Analysis

The lifescape analysis focused on five types of community capitals (Scoones, 1998): Human Capital, Physical Capital, Economic Capital, Natural Capital, and Social Capital. Data were collected through structured interviews and focus group discussions (FGDs) with community members, farmer groups, and local officials. The details of data collection are as follows:

1. Sampling: A total of 30 respondents per village were selected through random sampling, ensuring representativeness across the six villages, with a total of 180 respondents. Among them, 8-12 respondents per village participated in focus group discussions (FGDs), while the remaining respondents were interviewed individually. No respondent participated in both methods simultaneously. Factors such as time, cost, and labor were considered in determining the sample size (Cohen *et al*., 2007).

2. Interview and FGD Methods: Interviews were conducted in a semi-structured and in-person manner, focusing on respondents' livelihoods and their interactions with stakeholders. FGDs were conducted by recording key discussion points, which were documented in the form of field notes. Similarly, in individual interviews, responses were recorded in written form during the interviews. The assessment criteria for the five livelihood capitals (human, physical, economic, natural, and social) were applied in both FGDs and individual interviews. In FGDs, participants collectively discussed and assessed each capital based on shared experiences and group perspectives. In individual interviews, respondents provided assessments based on their personal experiences. This dual approach allowed for a comprehensive understanding of the variations and dynamics of livelihood capitals across villages. Data from FGDs and interviews were analyzed using thematic analysis, where respondents' responses were systematically coded and categorized into five livelihood capitals. Thematic coding was conducted manually by identifying patterns and recurring themes in the respondents' answers. Key insights were derived by comparing responses from different villages and stakeholder groups to understand variations in livelihood conditions and stakeholder interactions.
3. Assessment Criteria:
    a. Human Capital: Education level, skills, health, and labor availability.
    b. Physical Capital: Road conditions, housing, market access, and transportation means.
    c. Economic Capital: Income, credit access, savings, and dependency ratio.
    d. Natural Capital: Land ownership, productivity, water quality, and conflict frequency related to natural resource use, land tenure, and water access.
    e. Social Capital: Group participation, community influence, kinship ties, and social norms.
4. Scoring System: Responses were rated on a Likert scale (1-5), where 5 indicated high asset value and 1 indicated low asset value. The scoring method followed the guidelines described by Sugiyono (2016), ensuring consistency and reliability in the assessment process. Scoring was determined collaboratively by respondents and researchers to ensure accuracy.

Stakeholder Analysis

The role of stakeholders was analyzed to understand their contributions to landscape and lifescape dynamics. Relevant stakeholders included:

1. Government Agencies: The South Sulawesi Forestry Service, the Pompengan River Basin Center, and regional offices like the Food Crops and Horticulture Service.
2. NGOs and Academic Institutions: Organizations such as the South Sulawesi Watershed Forum and the Forestry Faculty at Hasanuddin University.
3. Private Sector: Environmental tourism operators and lodging businesses.

Data collection involved:

1. Interviews: Conducted with 20 representatives from various stakeholder organizations. Topics included their roles, challenges, and contributions to sustainable watershed management.
2. Document Review: Planning documents, policy briefs, and program reports were analyzed to contextualize stakeholder activities.

Data Analysis

Quantitative data from interviews and FGDs were descriptively analyzed, while qualitative data were thematically coded. For example, patterns in stakeholder contributions were mapped to highlight overlaps and gaps in coordination. The integration of landscape and lifescape data provided a comprehensive understanding of how different capitals influence sustainability.

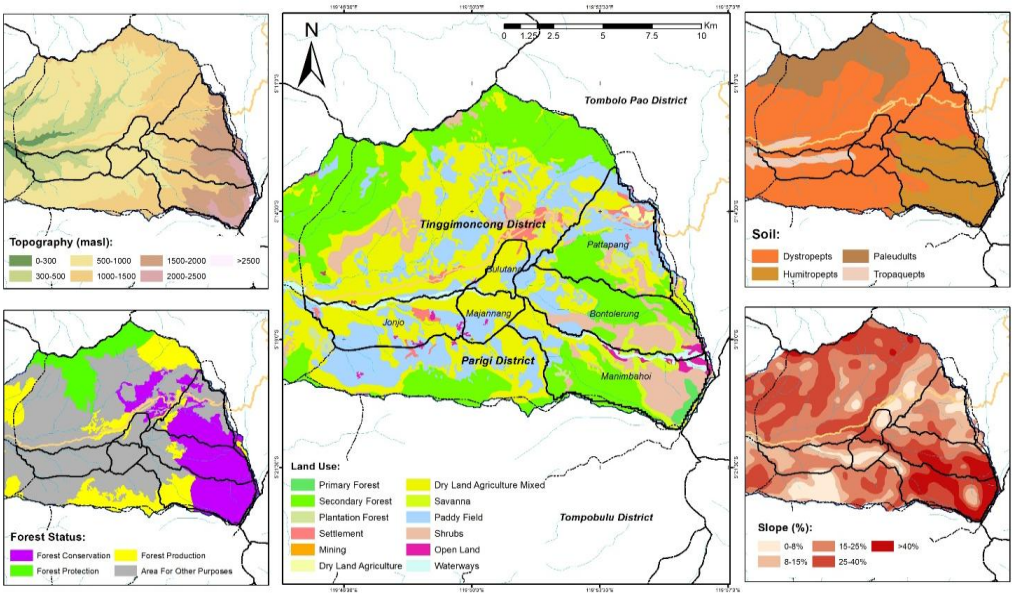
RESULT

Landscape and Lifescape of Jeneberang Hulu

The climatic conditions of the Jeneberang Hulu watershed are characterized by a high annual rainfall of 2,987 mm, spread over 82 rainy days, with maximum rainfall reaching 159 mm (BBWS Pompengan, 2020). The region's topographic elevations range from 200 to 2,800 meters above sea level (masl), with steep gradients in upstream areas contributing to frequent landslides. Land cover primarily includes primary and secondary forests, dryland agriculture, and settlements, with significant erosion rates of 813.1 tonnes/ha/year exceeding the tolerable limit of 28.9 tonnes/ha/year (Aisyah *et al*., 2022). These erosion rates contribute to sedimentation in the Bili-Bili Dam, reducing its capacity and affecting its functionality.

GIS analysis and field data reveal distinct patterns in soil types. The western region is dominated by Hunitropepts soils, which are prone to erosion, while Tropaquepts and Dystropepts soils characterize the central and eastern areas. Vegetation density varies across the watershed, with moderate to high coverage in most areas (Fig. 2). Land management efforts to reduce sedimentation include converting agricultural land into forest areas, an approach supported by studies highlighting the positive impacts of such changes in highland watersheds (Tang *et al.*, 2013).

Fig. 2: Map of Landscape Elements of the Jeneberang Hulu watershed



The Jeneberang watershed's hydrology is further impacted by steep river gradients and topographic differences between upstream and downstream regions, which exacerbate landslides during heavy rainfall. Numerous sabo dams have been constructed to manage sediment flow, but these structures face limitations due to rapid sediment accumulation (Sudradjat *et al*., 2013). These findings underscore the interconnectedness of landscape management with hydrological stability and the challenges of mitigating natural hazards in steep, erosion-prone terrains.

In addition to physical landscape features, the lifescape of Jeneberang Hulu is shaped by its socio-ecological interactions. Population growth has driven land-use changes, with agricultural and forested areas being converted into residential or commercial spaces for tourism. The development of nature tourism in villages such as Pattapang has shifted land use from vegetation to infrastructure, impacting water infiltration and increasing reliance on bore wells instead of natural springs. These transformations highlight the interplay between population dynamics, livelihood shifts, and environmental sustainability. Lifescape characteristics also reflect the community's reliance on natural resources for their livelihoods. In upstream areas, the pressure on forest resources and soil productivity necessitates improved conservation strategies. Conversely, downstream areas show a shift toward trade and tourism-related activities, illustrating the diverse ways in which communities interact with their environment.

Community Lifescape

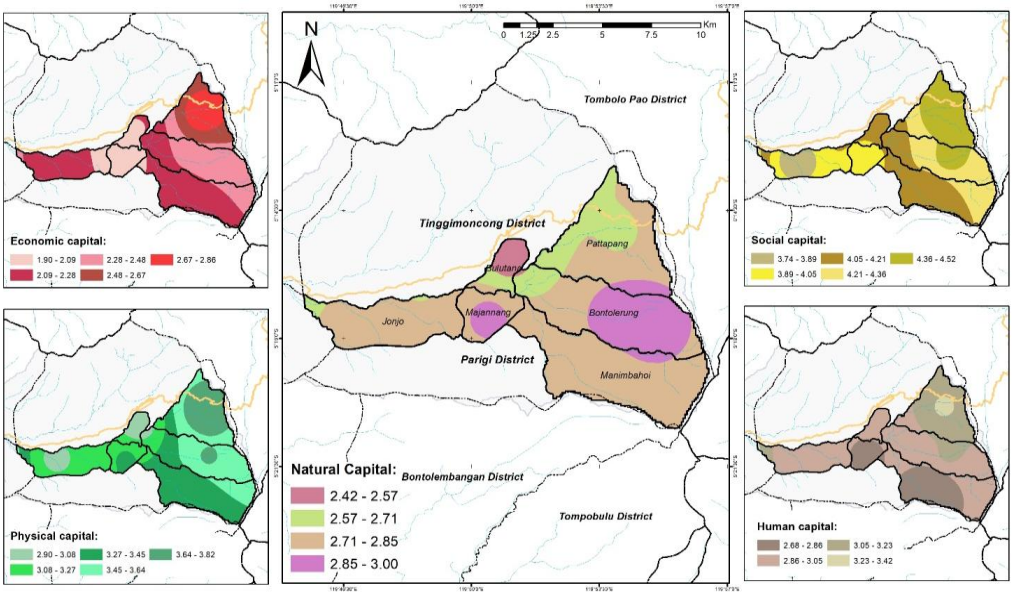
The lifescape conditions of the Jeneberang Hulu watershed were assessed using the sustainable livelihood framework, focusing on five capitals: human, physical, economic, natural, and social. Data collected from structured interviews and focus group discussions (FGDs) were scored on a Likert scale (1–5) to determine capital levels, categorized as high (4–5), moderate (2–3), or low (1). The assessment of livelihood capitals was conducted through both focus group discussions (FGDs) and individual interviews. FGDs provided a collective assessment from participants, while individual interviews were conducted for respondents who could not attend the FGDs. The scoring process was applied to responses from both FGDs and individual interviews to ensure a comprehensive evaluation across the study area. The results are as follows:

1. Human Capital: Education levels are generally low, with most residents completing only elementary or junior high school. However, health conditions are satisfactory due to access to clinics and basic health services. Limited access to non-agricultural skills restricts job opportunities beyond farming, particularly in villages like Manimbahoi and Bulutana.
2. Physical Capital: Most villages in the watershed have permanent housing and transportation means such as bicycles or motorcycles. Infrastructure, including roads, is moderately developed, but access to weekly markets remains a challenge, especially in remote villages like Majannang and Jonjo.
3. Economic Capital: Household incomes are typically low, with limited access to formal credit systems. Savings are minimal, forcing residents to rely on informal loans from neighbors or family (Ellis, 1999). In villages like Pattapang, where horticultural gardening businesses are growing, economic capital is slightly higher, but this remains the exception.
4. Natural Capital: Land ownership is small-scale, with many farmers managing less than 1 hectare of land. Soil productivity and water availability are moderate but require conservation practices to sustain them. In Manimbahoi and Bontolerung, soil erosion and water management issues exacerbate the challenges of farming.

5. Social Capital: Community cohesion is strong, supported by active participation in farmer groups, social organizations, and shared norms and trust (Field, 2008). However, a lack of awareness and capacity to adopt advanced conservation technologies limits the effectiveness of collective actions (Nuraeni *et al*., 2013).

Fig. 3 illustrates the spatial distribution of Lifescape Elements in the Jeneberang Hulu watershed, which consist of five livelihood capitals: natural, economic, social, human, and physical. The figure highlights spatial variations in these capitals across different villages.

Fig. 3: Map of Lifescape Elements of the Jeneberang Hulu watershed



The development of nature tourism in the Jeneberang Hulu watershed has significantly altered land use, transforming vegetated areas into tourism infrastructure such as lodges, villas, and restaurants. This shift has impacted local hydrology, leading communities to increasingly rely on bore wells instead of natural springs for clean water. These land-use changes, along with evolving livelihood strategies, emphasize the need for integrated land-use planning that balances economic growth with environmental sustainability.

Livelihoods have shifted from predominantly agricultural activities to sectors such as tourism, environmental services, and trade. However, many residents still rely on farming, with most household heads possessing only 1–2 skills beyond agriculture. Limited skills diversification makes communities vulnerable to economic and environmental shocks. For example, in Pattapang Village, farmers often manage land without considering topographical conditions, crop diversification, or conservation techniques. While yields are abundant, susceptibility to disasters and pests increases (Nuraeni *et al*., 2013). In remote villages like Bulutana and Bontolerung, plantation crops such as cocoa, bananas, and coffee yield lower returns compared to horticultural crops like carrots, cabbage, and potatoes. These productivity gaps highlight the need for tailored land-use strategies and conservation

practices. Households' livelihood choices are strongly influenced by ecological conditions and their reliance on environmental resources (Zhang *et al.*, 2016).

Market access is centralized in subdistrict capitals, leaving villages like Majannang and Jonjo isolated. Many residents lack financial security and access to formal banking systems. This reliance on informal credit sources often perpetuates poverty and limits long-term planning. As Ellis (1999) emphasizes, the availability of credit systems significantly affects rural communities' ability to achieve sustainable livelihoods. The Sustainable Livelihood approach underscores the importance of managing resources in a way that supports long-term community resilience (Turton, 2000). For example, families with two or three income sources or skills are better positioned to save or invest, often selling land to pay for education or acquire production equipment. However, opportunities for income diversification remain limited. Table 1 presents the capital conditions in the Jeneberang Hulu watershed, offering a comparative view of resources across villages.

Table 1: Landscape and Lifescape Conditions of Jeneberang Hulu Watershed

No	District/ Village	Landscape				Lifescape				
		Topography (masl)	**Soil Type**	**Landcover**	**Forest Area Status**	**Human Capital**	**Natural Capital**	**Physical Capital**	**Economic Capital**	**Social Capital**
1	Tinggi Moncong District									
	Village:									
	Pattapang	1200-1500	Dystropepts	Secondary Forest/Primary Forest	Forest Conservation / Area For Other Purposes/ Forest Production	Moderate	Moderate	High	Moderate	High
	Bulutana	700-900	Dystropepts	Dryland Agriculture	Area For Other Purposes	Moderate	Moderate	Moderate	Low	High
	Bontolerung	900-2800	Humitropepts	Secondary Forest/Primary Forest/Shrub	Forest Conservation/ Area For Other Purposes/ Forest Production	Moderate	Moderate	High	Low	High
2	Parigi District									
	Village:									
	Majannang	500-700	Dystropepts	Paddy Fields/ Dryland Agriculture	Area For Other Purposes	Moderate	Moderate	Moderate	Low	High
	Manimbahoi	900-2800	Humitropepts	Secondary Forest/ Dryland Agriculture	Forest Conservation/ Forest Production / Area For Other Purposes	Moderate	Moderate	Moderate	Low	High
	Jonjo	200-500	Tropaquepts	Dryland Agriculture/ Paddy Fields	Area For Other Purposes	Moderate	Moderate	Moderate	Low	High

Stakeholder Contribution

Government Stakeholder contributions in the Jeneberang Hulu watershed involve diverse entities, including government institutions, non-governmental organizations (NGOs), universities, private sectors, and local communities. Their activities aim to enhance watershed management, address erosion, improve livelihoods, and support biodiversity conservation. The Gowa Regency's Department of Food Crops and Horticulture, along with the Department of Animal Husbandry and Plantations, leads efforts to distribute seeds, fertilizers, and livestock support. These programs target different farmer groups annually, providing around 100 seedlings per hectare outside forest areas. The focus includes coffee and cocoa cultivation, horticultural crops like chili peppers, potatoes, and staple crops like corn and rice. Livestock support includes cattle and elephant grass for fodder. These efforts are intended to enhance productivity and reduce soil erosion.

However, interviews reveal that some distributed seedlings and fertilizers do not match community preferences, leading to suboptimal outcomes. Aligning government initiatives with local needs is crucial to improving the effectiveness of these programs (Mardaeni *et al*., 2014; Saida, 2011). Central government agencies, including the Natural Resources Conservation Centre in the Sulawesi Region and the Jeneberang Saddang Watershed Management Centre, focus on sedimentation and erosion control, reforestation, and land rehabilitation. Activities include distributing seedlings (Mahogany, Eucalyptus, avocado, and mango), constructing Sabo dams, and developing greenbelt zones to manage debris flow and protect riverbanks. Fig. **4** illustrates the spatial distribution of these activities, highlighting the extensive coverage of stakeholder contributions across the watershed.

Fig. 4: Map of Stakeholder Activities in the Jeneberang Hulu watershed

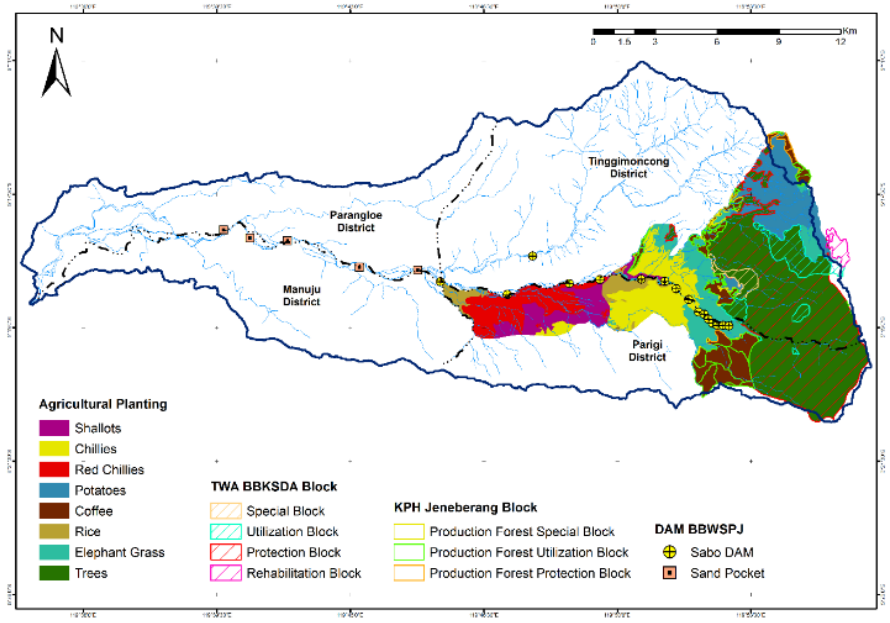


Table 2: Stakeholder Activities in the Jeneberang Hulu Watershed

No	Stakeholder			District/Village					
	Element	Institution	Activity	Tinggi Moncong			Parigi		
				Pattapang	Bulutana	Bontolerung	Manimbahoi	Majannang	Jonjo
1	**Government**: Province	Jeneberang Forest Management Unit/Forest Service	Maintenance, Security, Facilitation of Social Forestry/ permit, Cooperation	Horticulture for forest farmer groups	Coffee plants for Forest Farmers Group				
	Central	Natural Resources Conservation Centre in Sulawesi Region/ Jeneberang Saddang Watershed Management Centre/ Pompengan River Basin Management Centre	Coordination/ Planting maintenance	Protection Blocks in Conservation Areas/ Protection and prevention of sedimentation and erosion Land rehabilitation/ technical civil structures such as sabo dams and sandpockets				Land rehabilitation/civil engineering	
	Regency	Department of Agriculture/ Plantation	Utilisation/ Rehabilitation/ Protection	Horticultural Crops: Potatoes	Elephant grass, coffee, cattle			Red chilli, rice	
	District	District Office	Coordination/empowerment/counselling	Planting, community empowerment, keeping clean and removing rubbish, making irrigation					

No	Stakeholder			District/Village					
	Element	Institution	Activity	Tinggi Moncong			Parigi		
				Pattapang	Bulutana	Bontolerung	Manimbahoi	Majannang	Jonjo
	Village	Village Office	Community development/empowerment	Planting, community empowerment, protection of forests and springs, keeping clean and removing rubbish					
2	**Organisation**	South Sulawesi Watershed Forum/Nature Activist Communication Forum/SakawanaBakti	Socialisation/ Facilitation	Establishment of Watershed Forum at Regency level, socialisation, facilitation, coordination of environmental conservation, rehabilitation, planting, watershed protection					
3	**Universities**	Forestry Faculty, Hasanuddin University	Research/ Education	Jeneberang River Watershed Research					
4	**Private Sector**	Resort Langit Topidi/ Adimitra Company	Environmental Services/ Planting	Planting, tapping Pine sap		Lodging/ Camp area			
5	**Community**	Village Youth Groups/ Community Leaders/Farmer Groups	Planting/ Irrigation	protection of forests and springs, making irrigation, planting, environmental cleanliness					

Universities, such as Hasanuddin University, contribute through research, education, and community engagement. Academic studies provide insights into hydrological conditions, sediment management, and sustainable land use. NGOs like the South Sulawesi Watershed Forum and the Nature Activist Communication Forum facilitate coordination among stakeholders. Their activities include planting programs, environmental education, and establishing watershed forums for better management at local levels. The private sector's role primarily revolves around ecotourism and environmental services. Resorts and lodging facilities outside forest areas, such as Resort Langit Topidi, integrate conservation practices into their operations. These entities provide alternative livelihood opportunities but also contribute to changes in land use, as agricultural areas are often converted to tourist accommodations.

Community contributions, particularly through youth groups and farmer associations, are vital in managing the watershed's lifescape. These groups participate in tree planting, irrigation improvement, and environmental cleanliness. However, challenges such as limited access to markets and financial resources persist. Empowering these groups through capacity-building programs and better coordination with external stakeholders is essential for sustainable watershed management. The detailed breakdown of stakeholder activities by type and village location is presented in Table 2. These data emphasize the critical role of multi-sectoral collaboration in achieving sustainable watershed management.

DISCUSSION

The findings of this study highlight the interplay between the landscape and lifescape of the Jeneberang Hulu watershed. While some interventions by stakeholders have had positive impacts, significant challenges remain, particularly in coordinating efforts across multiple actors and sectors. The complexity of managing the watershed requires a strategic approach that integrates ecological, economic, and social dimensions (Ellis, 1999).

One of the key challenges identified is the lack of coordination among stakeholders at various levels local, regional, and national. For example, the distribution of seeds and fertilizers by government agencies often does not align with local needs, reflecting a top-down approach in decision-making that limits community participation. This misalignment suggests unequal power dynamics between government entities and local communities, where the latter have limited influence in shaping programs that directly affect their livelihoods.

Additionally, private sector involvement in the development of tourism infrastructure has led to the acquisition of community land for villas and lodges. While this creates economic opportunities, it also alters land use patterns and impacts hydrological conditions. This demonstrates how economic power can shift land use priorities, often at the expense of long-term sustainability. Empowering local institutions, such as village youth groups and farmer organizations, is critical to balancing these power dynamics and ensuring equitable participation in decision-making (Shames *et al*., 2017).

The sustainable livelihood framework emphasizes the need to balance natural resource management with economic and social well-being. In the Jeneberang Hulu watershed, changes in land use driven by demographic growth and tourism development—have transformed the landscape, reducing forest cover and increasing sedimentation in water systems. These changes directly affect community lifescapes, as livelihoods shift from agriculture to tourism and trade. However, the lack of proper conservation techniques, such

as terracing or crop diversification, exacerbates vulnerability to disasters like landslides and floods (Nuraeni *et al*., 2013).

While social capital is relatively high, with strong community cohesion and active participation in farmer groups, economic capital remains a significant limitation. Limited access to credit, savings, and markets hampers the ability of households to diversify their income sources. The findings underscore the need for targeted interventions to strengthen economic capital while leveraging existing social capital for collective action.

The insights gained from this study have broader implications for watershed management in other developing countries. The challenges faced in the Jeneberang Hulu watershed such as misaligned stakeholder priorities, inadequate community engagement, and uncoordinated interventions are common in many regions with similar socio-economic and ecological contexts. This study highlights the importance of fostering multi-stakeholder collaboration, integrating local knowledge into decision-making processes, and aligning interventions with community priorities to achieve sustainable watershed management (Martopo & Hardiman, 2013).

To address these challenges, policy interventions must prioritize:

1. Strengthening Community Institutions: Empowering local organizations and farmer groups to actively participate in land management decisions and access resources for sustainable practices.
2. Enhancing Coordination Mechanisms: Establishing platforms for regular dialogue among stakeholders to align goals, share resources, and avoid duplication of efforts.
3. Promoting Sustainable Land Use: Implementing conservation techniques, such as terracing and agroforestry, to reduce sedimentation and enhance water infiltration.
4. Improving Economic Capital: Expanding access to credit and markets, and providing financial literacy training to improve household resilience and investment capacity.

By addressing these areas, the Jeneberang Hulu watershed can serve as a model for sustainable development that balances environmental conservation with community well-being.

CONCLUSIONS

This study reveals the intricate interplay between landscape and lifescape in the Jeneberang Hulu watershed, where ecological challenges intersect with socio-economic dynamics. The findings highlight that while social capital is strong, economic capital remains a critical limitation, necessitating targeted interventions to improve community resilience and livelihood diversification. The lack of coordination among stakeholders and the misalignment of interventions with community needs underscore the importance of fostering multi-stakeholder collaboration. Empowering local institutions and integrating community voices into decision-making are essential to addressing power imbalances and ensuring equitable and sustainable outcomes.

The sustainable livelihood framework offers a valuable lens to understand and address these challenges. By balancing natural resource management with economic and social well-being, this framework provides actionable insights for promoting sustainable watershed management, not only in Jeneberang Hulu but also in other regions with similar socio-environmental contexts. Future policy interventions should focus on strengthening community institutions, enhancing coordination mechanisms, and promoting sustainable land use practices. By addressing these priorities, the Jeneberang Hulu watershed can serve

as a model for integrating conservation efforts with community-driven development strategies.

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CONFLICT OF INTEREST

The authors state that they have no conflicts of interest.

REFERENCES

Aisyah, B. N., Baskoro, D. P. T., & Murtilaksono, K. (2022). Pendugaan Erosi Tanah dan Perencanaan Tutupan Lahan Hulu DAS Jeneberang, Sulawesi Selatan. *Jurnal Ilmu Pertanian Indonesia*, *27*(2), 302–310. https://doi.org/10.18343/jipi.27.2.302

BBWS Pompengan, B. (2020). *Laporan geologi (Pemetaan Permukaan Kaldera) Kajian Sedimen Balance pada Sungai Jeneberang Hulu*. Kemeterian PUPR.

Cohen, L., Manion, L., & Marrison, K. (2007). Research Methods in Education. In *Routledge Taylor and Francis Group London and New York* (First 2007). Routledge 2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN Simultaneously published in the USA and Canada by Routledge 270 Madison Avenue, New York, NY 10016. https://doi.org/10.4324/9781315158501-17

Ellis, F. (1999). Rural livelihood diversity in developing countries : Evidence and policy implications. *Natural Resource Perspectives*, *40*, 1–10.

Field, J. (2008). *Social capital*. First published by Routledge the Taylor & Francis e-Library,.

Mardaeni, M., Munir, A., & Useng, D. (2014). Land Use Scenario's to Reduce Erosion Based on FuzzyMulti Attribute DecisionMaking in Das Jeneberang. *Journal Sains and Teknologi*, *14*(3), 1689–1699.

Martopo, A., & Hardiman, G. (2013). *(Sustainable livelihood) Di Kawasan Dieng (Kasus Di Desa Buntu Kecamatan Kejajar Kabupaten Wonosobo)*. 47–56.

McNamara, N, Morse, S. (2013). *Sustainable Livelihood Approach A Critique of Theory and Practice* (© Springer Science+Business Media Dordrecht (ed.)). Springer Dordrecht Heidelberg New York London. https://doi.org/10.1007/978-94-007-6268-8

Nuraeni, N., Sugiyanto, S., & Zaenal, Z. (2013). Usahatani konservasi di hulu das jeneberang (Studi kasus petani sayuran di hulu das jbneberang sulawesi selatan) (Conservation Forming in The Watershed Upstream Jeneberang (Case study of Vegetable Farmers in the Watershed Upstream Jeneberang South Sulawes. *Manusia Dan Lingkungan*, *20*(2), 173–183.

Saida, S. (2011). Analysis keberlanjutan usahatani hortikultura sauran pada lahan berlereng di hulu DAS Jeneberang, Sulawesi Selatan. *Jurnal Matematika Sains dan Teknologi*, 12(2), 101–112.

Scoones, I. (1998). Sustainable rural livelihoods: a framework for analysis. *IDS Working Paper*, *72*(May), 22.

Scoones, I. (2015). *Sustainable livelihoods and rural development*. Practical Action Publishing Rugby.

Shames, S. A., Heiner, K., & Scherr, S. J. (2017). *Public Policy Guidelines for Integrated Landscape Management*. *January*.

Stahlschmidt, P., Swaffield, S., Primdahl, J., & Nellemann, V. (2017). Landscape Analysis: Investigating the potentials of space and place. In *Landscape Analysis: Investigating the Potentials of space and Place*. https://doi.org/10.4324/9781315682792

Sudradjat, A., Massinai, M. A., Sulaksana, N., Muslim, D., & Sukiyah, E. (2013). the Tectonic Rejuvenation in Jeneberang Watershed, South Sulawesi. *Proceedings Hagi-Iagi Joint Convention Medan 2013*, *October*.

Sugiyono, S. D. P. (2016). Metode Penelitian Kuantitaf Kualitatif Dan R&D. In *Angewandte Chemie International Edition, 6(11), 951–952.*

Tandirerung, W. . (2017). Prediksi Erosi Berbasis Unit Lahan di Sub DAS Jenelata, DAS Jeneberang. *AgroSainT UKI Toraja*, *VIII*(1), 47–55.

Tang, Q., Bennett, S. J., Xu, Y., & Li, Y. (2013). Agricultural practices and sustainable livelihoods : Rural transformation within the Loess Plateau , China. *Applied Geography*, *41*, 15–23. https://doi.org/10.1016/j.apgeog.2013.03.007

Turton, C. (2000). *The Sustainable Livelihood Approach and Programme Development in Cambodia* (ISBN 0 85003 463 9; In Development Ltd. PO Box 20 Crewkerne Somerset TA18 7YW). https://doi.org/© Overseas Development Institute 2000

Watson, D., & Adams, M. (2012). Design for Flooding: Architecture, Landscape, and Urban Design for Resilience to Flooding and Climate Change. In *Design for Flooding: Architecture, Landscape, and Urban Design for Resilience to Flooding and Climate Change*. https://doi.org/10.1002/9781118259870

Zhang, J., Dai, M., Wang, L., & Su, W. (2016). Household livelihood change under the rocky desertification control project in karst areas , Southwest China. *Land Use Policy*, *56*, 8–15. https://doi.org/10.1016/j.landusepol.2016.04.009