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Integrated Assessment of Land Capability Classes and Land Damage Status in the Bangsal Sub-watershed

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Abstract. *The Bangsal Sub-watershed is located downstream of the greater Brantas Watershed. It is experiencing problems primarily with poor vegetation cover and high erosion rates. This study aimed to evaluate land capability classes based on land damage status across different land uses. Sampling was carried out purposively at 15 points across five land uses, namely, forests, plantations, dry fields, rice fields and shrublands. The parameters analyzed included the physical, chemical and biological properties of soil. Land capability assessment was conducted based on Arsyad's work (2010), while damage status was based on the Government Regulation No. 150 of 2000 and the Ministry of Environment Regulation No. 07 of 2006. The results show that the Bangsal Sub-watershed is dominated by land capability classes III to IV with moderate damage status (R.II). Fourteen observation points show moderate damage, and one shows severe damage. The main limiting factors found include porosity, redox potential and permeability. Forest and shrubland land uses show the most stable conditions in terms of all three aforesaid limiting factors. Meanwhile, dry field land use has the most complex limiting factors, including slope, surface rockiness, bulk density, porosity and redox potential. These findings emphasize the importance of matching land use to land capacity to prevent further degradation. Management recommendations include increasing organic matter to improve soil structure, applying contour terraces on sloping terrain to reduce runoff and erosion and developing agroforestry systems to improve soil stability and support watershed sustainability.*

Keywords: *land capability; land damage; Bangsal Sub-watershed.*

Type of the Paper: Regular Article.

1. Introduction

The Bangsal Sub-watershed is located downstream of the greater Brantas Watershed. According to the Brantas Watershed Management Center [1], the Bangsal Sub-watershed faces issues with the poor status of a significant portion of its vegetation cover (29.94%) and high erosion rates (207.2 tons/ha/year). These conditions are influenced by predominant land holdings compared to forest and plantation areas, as well as steep upstream slopes that intensify runoff and erosion. Low vegetation cover reduces soil protection from rainfall and surface runoff, while limited root systems weaken soil stability [2]. Vegetation cover reduces the kinetic energy of raindrops, thereby minimizing soil loss and increasing water infiltration [3]. Kaliraj et al. [4] demonstrate that vegetation loss in tropical watersheds, particularly on agricultural land and steep slopes, leads to increased runoff and sediment transport. This shows that vegetation is not only an

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ecological component, but also natural infrastructure that determines the resilience of river basin ecosystems.

Vegetation cover degradation in watersheds rarely occurs naturally, but is closely related to human activities and land management patterns. Agricultural expansion, settlement and other forms of land use are often carried out without considering the ecological capacity of the land, thereby accelerating the decline in soil quality [5]. Land use that exceeds or ignores the natural capacity of the land can cause severe damage and reduce the long-term sustainability of ecosystems. Bogale's research [6] in tropical regions shows that cultivation that is not in line with land conditions increases soil loss and sediment production. Therefore, land damage reflects a lack of attention to land capability limits, which serve as the basis for spatial planning.

Land capability assessment is a model that can identify the current and future capacity and potential of a piece of land to support sustainable land use [7]. Through the evaluation process, land can be analyzed and grouped into specific categories based on characteristics that determine its potential and constraints [8]. Land capability classification systems generally consider limiting factors such as slope, soil depth, drainage, erosivity and other soil characteristics, which are important to optimal spatial planning and land management [9]. Hard surface layers are also a critical barrier that reduces land productivity and increases the risk of long-term land degradation [10]. Problems in the Bangsal Sub-watershed indicate suboptimal conditions due to anthropogenic pressures and natural factors, which have caused the loss of topsoil. Meanwhile, studies in other regions, such as the Upper Blue Nile basin, show that land capability-based management can reduce runoff by up to 41% [11].

Land damage status is an important indicator that reflects the level of land degradation and land ability to maintain its ecological functions. Land degradation can reduce the soil's potential to support life and productivity, closely related to land sustainability as a measure of soil resilience in withstanding various types of damage, as well as its ability to provide ecosystem services [12]. Land that is not suitable for its use may experience physical, chemical and biological damage, thereby endangering its hydrological, socioeconomic, agricultural production and residential functions [13]. Unsuitable land use without proper conservation worsens land conditions. Linking land capability with land damage status will determine Land Degradation Neutrality (LDN) [14].

However, a significant research gap exists in current watershed management studies. While land capability classification and land degradation assessments are widely applied, they are frequently treated as separate entities. Previous evaluations often emphasize erosion risk or soil quality decline without explicitly linking degradation indicators to the specific limits of land capability classes [15]. Consequently, it remains unclear whether the observed degradation is a result of land use practices that exceed the land's inherent capacity or if it stems from natural biophysical constraints that would exist regardless of management, as is the case with the Bangsal Sub-watershed [16]. Integrated environmental assessment frameworks highlight the need to link land condition indicators with management suitability to support ecosystem sustainability and resilience [17].

This study fills this gap by integrating land capability classes with land damage status across various land uses in the Bangsal Sub-watershed. Unlike general watershed assessments, this research advances current knowledge by identifying the specific "mismatches" between the land's natural potential and its actual degradation level. By doing so, it distinguishes between damage caused by management errors and damage inherent to the land's biophysical class. This integrated approach provides a more robust scientific basis for sustainable spatial planning. Land damage can trigger erosion and landslides in upstream areas and cause sedimentation and flooding in downstream areas along the river basin [18]. Therefore, understanding the relationship between land capability classes and damage status is crucial to determining sustainable management recommendations and reducing the risk of future disasters. This study aimed to evaluate land capability classes based on land damage status across various land uses in the Bangsal Sub-watershed to determine precise, sustainable management recommendations.

2. Materials and Methods

2.1. Research Location

The research was conducted from April 2025 to July 2025 and consisted of several stages, including data collection, laboratory analysis, data processing and report writing. Data and samples were collected in the Bangsal Sub-watershed, Mojokerto Regency and Batu City, East Java. Sample analysis was conducted at the Land Resources and Plant Health Laboratory, Faculty of Agriculture, UPN "Veteran" East Java. The location maps consist of administrative maps and land use maps of the Bangsal Sub-watershed at a scale of 1:50,000 (Fig. 1).

2.2. Research Sampling

Sampling locations were established to define the study boundaries and support spatial data management and mapping. Sampling points were selected using purposive sampling based on land use distribution derived from the Bangsal Sub-watershed maps to ensure representation of dominant land uses and landscape variability influencing land degradation processes [19].

The Bangsal Sub-watershed covers an area of 3,345.48 ha. Soil samples extracted from the Bangsal Sub-watershed were of five types of land use, namely, forests, plantations, dry fields, rice fields, and shrublands, with three spatially distributed points to represent each land use category. Land use was the main consideration for determining sampling locations, while slope conditions and general soil characteristics were considered during the site selection process to ensure that the sampling points reflected the landscape variability within the watershed.

Referring to Rayes [20], for a semi-detailed map scale of 1:50,000, the recommended sampling density is approximately one observation point per 50 ha. The number of sampling points was selected based on this recommendation to provide an adequate level of representation for semi-detailed watershed assessment. This sampling design was aimed to ensure sufficient spatial representation for watershed-scale analysis. The sampling point map can be seen in Fig. 1.

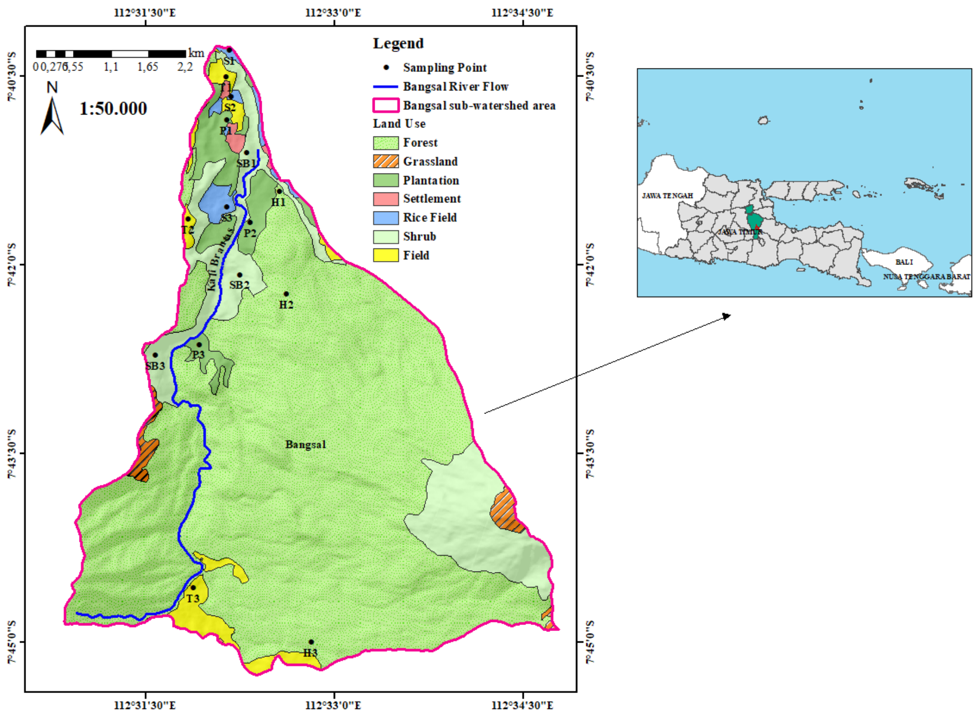

Fig. 1. Observation Point and Land Use Map

2.3. *Data Analysis*

Land capability assessment was conducted based on Arsyad [21] as shown in Table 1, while damage status assessment was based on the Government Regulation No. 150 of 2000 and the Ministry of Environment Regulation No. 07 of 2006 [22], as presented in Tables 2, 3, and 4.

Table 1. Land Capability Classification Criteria.

Inhibiting/Limiting Factors	Land Capability Class							
	I	II	III	IV	V	VI	VII	VIII
Slope	A (l_0)	B (l_1)	C (l_2)	D (l_3)	A (l_0)	E (l_4)	F (l_5)	G (l_6)
Erosion Sensitivity	KE_1, KE_2	KE_3	KE_4, KE_5	KE_6	(*)	(*)	(*)	(*)
Erosion Level	e_0	e_1	e_2	e_3	(**)	e_4	e_5	(*)
Soil Depth	k_0	k_1	k_2	K_2	(*)	K_3	(*)	(*)
Top Layer Texture	t_1, t_2, t_3	t_1, t_2, t_3	t_1, t_2, t_3, t_4	t_1, t_2, t_3, t_4	(*)	t_1, t_2, t_3, t_4	t_1, t_2, t_3, t_4	t_5
Bottom Layer Texture	Sda	Sda	Sda	Sda	(*)	Sda	Sda	Sda
Permeability	P_2, P_3	P_2, P_3	P_2, P_3, P_4	P_2, P_3, P_4	P_1	(*)	(*)	P_5
Drainage	d_1	d_2	d_3	d_4	d_5	(**)	(**)	d_0
Rockiness	b_0	b_0	b_1	b_2	b_3	(*)	(*)	b_4
Flood Risk	O_0	O_1	O_2	O_3	O_4	(**)	(**)	(*)
Salt/Salinity (***)	g_0	g_1	g_2	(*)	g_3	g_3	(*)	(*)

Source: Arsyad [21].
Explanation: (*) = can have any characteristics; (**) = the ground surface is always flooded with water; (***) = generally found in arid climates.

Soil damage assessment was carried out by determining critical thresholds for 10 soil parameters. Damage status was calculated from relative frequency, which is the ratio of the analysis results to the critical threshold multiplied by 100, and was then assigned a score from 0 to 4 based on the percentage (from 0–10%, which is classified as undamaged, to 76–100%, which is classified as severely damaged). The accumulated score represents the soil damage status from N (undamaged, score 0) to R.IV (severely damaged, score 35–40).

Table 2. Critical Thresholds for Soil Damage Standards.

No.	Parameter	Critical Threshold (Government Regulation No. 150/2000)	Measurement Method
1.	Soil Thickness	< 20 cm	Direct measurement
2.	Surface Rockiness	> 40%	Direct measurement
3.	Fraction Composition	< 18% colloids; > 80% quartz sand	Pipetting
4.	Bulk Density	> 1.4 g/cm^3	Volumetric
5.	Soil Porosity	< 30%; > 70%	calculation of weight and specific gravity
6.	Water Permeability	< 0.7 cm/hour; > 8.0 cm/hour	Measurement with a constant head permeameter
7.	Soil pH	< 4.5; > 8.5	Measurement with a pH meter
8.	Electrical Conductivity	> 4.0 mS/cm	Electrical resistance measurement
9.	Redox Potential	< 200 mV	Electrical voltage measurement
10.	Number of Microbes (Bacteria and Fungi)	< 10^2 cfu/g soil	Dilution and planting techniques

Source: Minister of Environment Regulation No. 07 of 2006.

Table 3. Relative Frequency Scoring of Damaged Soil.

Relative Frequency of Damaged Soil (%)	Score	Soil Damage Status
0–10	0	Undamaged
11–25	1	Slightly damaged
26–50	2	Moderately damaged
51–75	3	Severely damaged
76–100	4	Extremely damaged

Source: Minister of Environment Regulation No. 07 of 2006.

Table 4. Scoring for Determining Soil Damage Status.

Symbol	Soil Damage Status	Accumulated soil damage score for dry lands
N	Undamaged	0
R.I	Slightly damaged	1–14
R.II	Moderately damaged	15–24
R.III	Severely damaged	25–34
R.IV	Extremely damaged	35–40

Source: Minister of Environment Regulation No. 07 of 2006.

Laboratory analysis was performed using calibrated instruments and standard procedures. Selected measurements were repeated to ensure analytical accuracy and consistency. Field observations were rechecked to minimize measurement errors and improve data reliability. In addition, quality control samples and repeat readings were used to verify measurement stability.

All data were checked for consistency and deviation values prior to analysis to ensure the reliability of the results.

3. Results and Discussion

3.1. Classification and Distribution of Land Capability

The classification of land capability in the Bangsal Sub-watershed shows that the area is dominated by Classes II and IV, covering areas of 1,102.40 ha and 1,864.53 ha, respectively. The rest of the area is classified as Classes I, III and VI, reflecting varying degrees of limitations in land use. The distribution of land capability classes and land uses is presented in Table 5.

Table 5. Land Capability Units.

Capability Class	Area (ha)	Land Use	Limiting Factors
I	95.74	Forest (3)	-
II	1,102.40	Forest (2), Plantation (2), Dry Field (3), Rice Field (2) and Shrubland (2)	Slope, Soil Depth, Drainage and Erosion Rate
III	250.20	Plantation (1), Rice Field (1) and Shrubland (1)	Slope, Drainage, Erosion Rate and Texture
1V	1,864.53	Forest (1), Dry Field (2), Rice Field (3) and Shrubland (3)	Slope and Erosion Rate
VI	32.61	Plantation (3) and Dry Fiels (1)	Slope

Source: Primary Data Analysis.

The dominance of Class II indicates that most of the watershed area is still suitable for agricultural activities, despite several limiting factors, such as slope gradient, soil depth, drainage and erosion risk, which require proper management. Meanwhile, the extent of Class IV indicates moderate to severe limitations, particularly in relation to steeper slopes and higher erosion potential. Class VI is only found in limited areas with steep slopes, making it more suitable for conservation than intensive cultivation. The spatial distribution of these land capability classes is presented in Fig. 2.

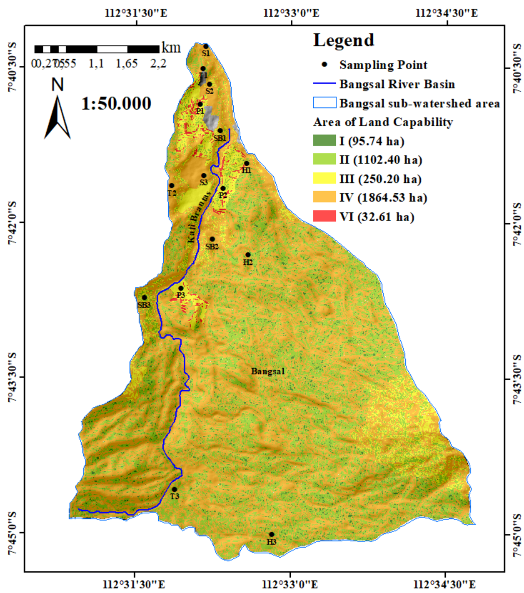

Fig. 2. Capability Class Map.

The distribution of land capability classes is influenced by biophysical factors, particularly topography and slope gradients, which increase surface runoff and erosion risk [23]. In addition, physical characteristics such as depth, texture, permeability and hydraulic properties affect water infiltration and root development, thereby playing a role in determining the level of land limitations [24]. Rainfall and land use on sloping areas can also accelerate erosion and soil degradation [2]. The dominance of Classes II and IV reflects the interaction between natural conditions and land management, so that without proper soil conservation measures, areas with moderate limitations have the potential to experience degradation and decreased productivity.

Table 6. Results of Land Capability Class and Damage Status Analysis.

Sample Code	Capability Class		Damage Status		
	Capability Class	Limiting Factors	Frequency Score Relative	Land Damage	Limiting Factors
Forest (1)	IV-l_3	Slope	21	R.II (Moderately Damaged)	Redox Potential
Forest (2)	II-l_1, k_1	Slope and Soil Depth	19	R.II (Moderately Damaged)	Porosity and Redox Potential
Forest (3)	I	-	20	R.II (Moderately Damaged)	Porosity and Redox Potential
Plantation (1)	III-l_2, d_3	Slope and Drainage	19	R.II (Moderately Damaged)	Bulk Density and Redox Potential
Plantation (2)	II-l_1, d_2	Slope and Drainage	18	R.II (Moderately Damaged)	Redox Potential
Plantation (3)	VI-l_4	Slope	19	R.II (Moderately Damaged)	Porosity and Redox Potential
Dry Field (1)	VI-l_4	Slope	25	R.III (Severely Damaged)	Surface Rockiness, Bulk Density, Porosity and Redox Potential
Dry Field (2)	IV-l_3	Slope	21	R.II (Moderately Damaged)	Porosity and Redox Potential
Dry Field (3)	II-e_1	Erosion Rate	21	R.II (Moderately Damaged)	Porosity and Redox Potential
Rice Field (1)	III-e_2, t_4	Erosion Rate and Texture	23	R.II (Moderately Damaged)	Bulk Density and Redox Potential
Rice Field (2)	II-l_1, e_1, k_1	Slope, Erosion Rate and Soil Depth	19	R.II (Moderately Damaged)	Bulk Density and Redox Potential
Rice Field (3)	IV-l_3, e_3	Slope and Erosion Rate	23	R.II (Moderately Damaged)	Porosity and Redox Potential
Shrubland (1)	III-d_3	Drainage	20	R.II (Moderately Damaged)	Porosity and Redox Potential
Shrubland (2)	II-l_1	Slope	19	R.II (Moderately Damaged)	Porosity and Redox Potential
Shrubland (3)	IV-l_3	Slope	21	R.II (Moderately Damaged)	Porosity and Redox Potential

Source: Primary Data Analysis.

3.2. Interrelationship between Land Capability and Land Damage Status

The results of the analysis of land capability classes and soil degradation status from 15 samples taken from various land uses in the Bangsal Sub-watershed have been evaluated based on physical, chemical and biological soil parameters. The analysis results show variations in land degradation related to land capability classes in various land uses, as presented in Table 6.

Higher capability classes (IV–VI) generally correspond to greater damage risk due to steeper slopes and increased potential for surface runoff and erosion [25], while moderate damage in Classes I and II areas indicates that degradation is also influenced by land management practices. Across the watershed, low redox potential and poor soil porosity are the most common limiting factors. These conditions reflect soil aeration disturbance and structural degradation that reduce infiltration and increase surface runoff [26]. Additional limiting factors such as high bulk density, low permeability and surface rock fragments further indicate a decline in soil quality. These findings confirm that soil degradation in the Bangsal Sub-watershed is caused by the interaction between natural biophysical constraints and anthropogenic pressures.

3.3. Evaluation of Land Capability and Damage Status across Land Use Types

This section evaluates the variation in land capability classes and land degradation status across major land use types within the watershed. Differences in land use reflect varying levels of land suitability, management intensity and conservation effectiveness, which in turn influence land stability and degradation risk. Understanding these relationships is essential to identifying land uses that align with land capability and determining appropriate management strategies to support sustainable watershed management.

3.3.1. Forests

Forest areas in the study site are classified as production forests dominated by pine, mahogany, and sengon, with land capability classes ranging from I to IV, predominantly of moderate damage status. Although slope-related limitations occur in certain locations, continuous tree cover provides important soil conservation functions through canopy interception, root reinforcement and improved infiltration. Consequently, forest areas tend to maintain better soil stability compared to more intensively used land. However, sites located on steeper slopes still require conservation measures such as terracing and organic matter enrichment to support long-term sustainability of production forest systems [27].

3.3.2. Plantations

Plantations show moderate damage across all capability classes except Class I, indicating the influence of slope conditions and land management practices. These lands are planted with banana, coffee and avocado in monoculture and intercropping systems. Lands located on steeper slopes show a higher risk of damage, while diverse cropping systems provide better soil protection than monoculture systems. These findings indicate that erosion vulnerability in plantations is strongly influenced by slope gradient and vegetation management [28].

3.3.3. Dry Fields

Dry field areas demonstrate the highest degradation risk among land uses, including the only site categorized as severely damaged. These dry fields are cultivated with maize and banana under intercropping systems and carrot monoculture on sloping terrain. Intensive cultivation and frequent soil disturbance reduce soil structural stability and increase erosion vulnerability, highlighting the sensitivity of dryland cultivation systems when conservation practices are not implemented [29].

3.3.4. Rice Fields

Rice fields are classified within capability classes II–IV and exhibit moderate damage conditions. All sites are cultivated with paddy under monoculture systems. Limitations related to erosion, soil structure, drainage and slope affect cultivation sustainability. Conservation measures such as terracing, improved water management and soil fertility enhancement are necessary to maintain long-term productivity [30].

3.3.5. Shrublands

Shrubland areas exhibit moderate damage with limitations related to slope, drainage and soil structure. Despite these constraints, shrub vegetation contributes to soil protection and ecological recovery by supporting microbial activity and vegetation succession processes, helping maintain land stability under varying environmental conditions [31].

3.4. Discussion

Soil capability classes IV–VI accompanied by high damage scores indicate the strong influence of topography on increased land degradation risk. Steep slopes increase surface runoff velocity and reduce infiltration time, thereby accelerating the release and transport of soil particles [25]. Low redox potential values indicate poor soil aeration conditions, which are generally associated with compaction or prolonged water saturation [32]. This condition reduces infiltration capacity and increases surface runoff, thereby accelerating erosion under intensive land use as reported in various tropical watersheds [33].

An evaluation of fifteen sampling points indicates that the Bangsal Sub-watershed is dominated by capability classes III–IV with concerning damage conditions. Fourteen sites are moderately damaged (R.II), while one dry field is severely damaged (R.III). Land capability reflects the soil's capacity to support crops without long-term degradation [34], and improper land use can accelerate soil damage [35].

The predominance of moderate damage suggests degradation is driven not only by biophysical limitations but also by land use pressure. Watershed-scale studies show that conversion of natural vegetation to agricultural land significantly increases erosion risk and soil degradation [36]. Therefore, degradation patterns in the Bangsal Sub-watershed reflect the interaction between natural constraints and anthropogenic pressures.

Higher land capability classes are associated with more severe limiting factors. Analysis indicates that low redox potential is the dominant constraint across most sites, followed by widespread soil porosity limitations. These conditions indicate structural and drainage problems in the Bangsal Sub-watershed. Variations in limiting factors reflect the influence of land management practices and topographic conditions across different land uses [37]. Additional constraints, including permeability, slope, bulk density and surface rock presence, further indicate ongoing soil degradation. Therefore, soil improvement and management should be implemented through integrated conservation measures aligned with land capability to maintain soil fertility, capacity and long-term productivity [38].

Vegetation cover strongly influences soil quality. Loss of vegetation reduces organic matter and microbial activity, leading to compaction and declining fertility [39]. Increased compaction restricts root growth and reduces productivity [40]. In contrast, forest and shrubland areas exhibit more stable soil conditions, demonstrating the protective role of natural vegetation against erosion and runoff. Forest and shrubland vegetation plays an important role in protecting soil and sustaining the land's ecological functions and long-term productivity [41].

Land classified as Class II generally shows moderate levels of degradation. Although Classes I–IV are suitable for agriculture, the moderate degradation of Class II land requires the implementation of conservation measures. This land has certain limitations that restrict its use options, requiring careful management [42]. Therefore, its development should be carried out at a lower intensity than Class I, through a low-input cultivation system that reduces the use of synthetic fertilizers and pesticides and integrates organic materials. This approach has been proven to increase soil fertility and maintain crop productivity in the long term [43].

Class III consists of land with moderate damage and a higher level of risk. This land can still be used for agriculture, but requires more intensive conservation technology inputs. According to Rubiantoro and Susilowati [44], Class III land is suitable for various forms of utilization, including agricultural cultivation activities that integrate various land protection techniques, such as terracing, crop rotation and contour-following planting.

Class IV land generally shows moderate damage with the main constraints being slope, erosion rate, porosity and redox potential. The risk of degradation in this class is higher than in Class III, mainly due to erosion that reduces the topsoil layer and infiltration capacity, thereby reducing productivity [45]. The application of conservation techniques, such as organic mulch application, is effective in reducing runoff and erosion and increasing soil moisture and organic matter to support sustainable slope-based land management [46,47]. Meanwhile, Class VI land is classified as severely degraded with constraints such as steep slopes, surface rockiness, heavy soil texture, low porosity and limiting redox potential. Class VI land is not suitable for intensive agriculture and is better allocated for conservation or limited use, such as grasslands [48].

Conservation strategies must clearly distinguish between protection and restoration. Forested areas on steep slopes must be maintained as conservation zones to safeguard slope stability and hydrological functions. Conversely, agricultural land on Classes IV–VI slopes requires restoration through agroforestry systems or intensive conservation practices. This agroforestry model serves as an optimal scheme for preserving forest functions while simultaneously enhancing local livelihoods through sustainable cultivation. For example, a land capability-based zoning approach aligns with the principles of sustainable watershed management and Land Degradation Neutrality (LDN), emphasizing a balance between land utilization and restoration in accordance with the land's ecological capacity [49,50].

4. Conclusions

The Bangsal Sub-watershed is primarily dominated by land capability classes III and IV, exhibiting a moderate damage status (R.II), with critical degradation (R.III) observed in dry field areas. The main contribution of this study is the integration of land capability mapping with soil damage indicators to pinpoint specific "mismatches" between natural land potential and actual management practices. The results identify low redox potential, poor porosity and low permeability as the critical biophysical constraints that restrict soil aeration and infiltration across the watershed. While forest and shrubland areas remain relatively stable, intensive cultivation in dry field areas faces significant degradation risks. Recommended management strategies include increasing soil organic matter and implementing contour terraces on sloping terrain. Furthermore, the adoption of agroforestry systems is proposed as an optimal model to bridge the gap between forest conservation and local economic cultivation. This study is limited by a restricted number of observation points, which may not capture the full spatial heterogeneity of the watershed. Consequently, future research should expand the spatial coverage and incorporate long-term monitoring coupled with hydrological modelling to provide a more comprehensive framework for sustainable watershed management and Land Degradation Neutrality.

Abbreviations

Not applicable.

Data availability statement

Data will be shared upon request by the readers.

CRediT authorship contribution statement

Maroeto: Conceptualization, Investigation, Funding acquisition. **Zeti Salsabila Putri Itsnaini:** Writing – Original draft, Methodology, Resources, Formal Analysis. **Bakti Wisnu**

Widjajani: Investigation, Project administration, Resources. **Dinna Hadi Sholikah:** Writing and Editing, Formal Analysis, Resources.

Declaration of Competing Interest

The authors of this manuscript declare no conflict of interest or competing interest.

Declaration of Use of AI in the Writing Process

Nothing to disclose.

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