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Evaluation of Land Capability and Land-Use Direction in Baturiti District, Tabanan Regency

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ABSTRACT

Rapid population growth and agricultural expansion in Baturiti District, Tabanan Regency, have increased pressure on land resources, particularly on sloping highland areas. Land use that exceeds land capability may accelerate erosion, reduce soil productivity, and increase environmental degradation. This study aimed to evaluate land capability classes, determine land-use directions, and formulate land management recommendations for Baturiti District. The study used field surveys, purposive soil sampling in homogeneous land units (HLUs), laboratory soil analysis, and spatial overlay of land capability and land-use planning criteria. Parameters considered included slope, effective soil depth, drainage, rock outcrop or surface stones, flood hazard, soil texture, salinity, and permeability. Land capability was classified based on the criteria of Hockensmith and Steel as adopted by Arsyad, while land-use direction was determined using the scoring criteria of Sukartiko. The results showed that Baturiti District consisted of four land capability classes: Class II covering 3,532 ha (35.61%), Class III covering 836 ha (8.43%), Class IV covering 3,003 ha (30.27%), and Class VI covering 2,547 ha (25.68%). The dominant limiting factors were erosion-related constraints, including slope, soil erodibility, and actual erosion, followed by effective soil depth, permeability, and somewhat poor drainage. Recommended land-use directions consisted of perennial crop cultivation areas (3,444.2 ha), seasonal crop cultivation areas (2,524.3 ha), buffer zones (1,401.2 ha), and production forest areas (2,547.0 ha). Recommended management practices include terrace improvement, contour tillage, cover crops, strip or alley cropping, drainage improvement, mulching, balanced fertilization, and agroforestry systems. These findings provide a spatially based reference for sustainable land management and conservation planning in Baturiti District.

Keywords: Baturiti District, land capability, land degradation, land-use direction, limiting factors

INTRODUCTION

Baturiti District, Tabanan Regency, has diverse landforms ranging from flat to steep terrain and includes both dryland and wetland agricultural systems. The district receives high annual rainfall, reaching approximately 3,110 mm, and therefore has strong potential for agricultural and tourism development (BPS Kabupaten Tabanan, 2022). Agricultural land covers about 6,261 ha, or 63.12% of the district area, and is dominated by horticultural and food crops.

Despite this potential, intensive horticultural cultivation in several parts of Baturiti occurs on steep slopes. Under high rainfall conditions, intensive tillage on sloping land increases the risk of soil erosion, fertility decline, and broader environmental

degradation. Land use that is not aligned with land capability can reduce land productivity and trigger long-term ecological damage (FAO, 2020). Each land capability class requires specific management and land-use direction so that land can be used optimally without exceeding its ecological capacity.

Land capability evaluation is an essential approach for identifying the limitations and appropriate uses of land resources. It can support spatial planning, agricultural development, soil and water conservation, and sustainable land management. In highland areas such as Baturiti, capability evaluation is particularly important because land-use decisions must consider slope, soil erodibility, effective soil depth, permeability, and drainage limitations. Based on these considerations, this study evaluated the land capability classes and formulated land-use directions for Baturiti District, Tabanan Regency, Bali Province. The results are expected to support land-use planning and conservation-based agricultural management in the district.

MATERIALS AND METHODS

Study area

The study was conducted in Baturiti District, Tabanan Regency, Bali Province, Indonesia. Geographically, the district is located at approximately 08°14'30"-08°38'07" S and 114°59'00"-115°02'57" E. Administratively, Baturiti District consists of 12 villages: Candikuning, Antapan, Apuan, Angseri, Baturiti, Batunya, Luwus, Bangli, Mekarsari, Perean, Perean Tengah, and Perean Kangin. The district covers approximately 9,917 ha. Soil samples were analyzed at the Soil Chemistry and Fertility Laboratory, Soil and Environmental Science Concentration, Agroecotechnology Study Program, Faculty of Agriculture, Universitas Udayana.

Materials and instruments

The materials used in this study included soil samples from field observations, chemical reagents for laboratory analysis, soil type maps, land-use maps, slope class maps, and satellite imagery of Baturiti District. Field and laboratory instruments included a Belgian auger, ring samples, measuring tape, field knife, Abney level, sample bags, labels, QGIS 3.18, laboratory equipment for soil permeability and texture analysis, and supporting devices for data recording and spatial processing.

Data collection and analysis

The study used a field survey method. Soil samples were collected using purposive sampling in each homogeneous land unit (HLU) and were subsequently analyzed in the laboratory. Observed parameters included slope using an Abney level, effective soil depth using a Belgian auger and measuring tape, drainage condition, rock outcrop or surface stones, flood hazard through visual observation and interviews, topsoil and subsoil texture using the pipette method, salinity using electrical conductivity, and permeability using the De Booth method based on Darcy's law.

Land capability classification was conducted using the criteria of Hockensmith and Steel (1943) as cited in Arsyad (2010). Spatial overlay was then performed between the land capability map and the spatial plan of Tabanan Regency to assess conformity with land-use planning policy. Land-use direction was determined based on the scoring criteria of Sukartiko (1988), which considers slope, soil sensitivity to erosion, and average rainfall intensity.

RESULTS AND DISCUSSION

Land capability classes

The land capability evaluation identified four capability classes in Baturiti

District: Classes II, III, IV, and VI. The distribution of these classes indicates that land capability in the district is strongly influenced by slope, erosion risk, effective soil depth, permeability, and drainage. The largest area was Class II, covering 3,532 ha or 35.61% of the district, followed by Class IV (3,003 ha or 30.27%), Class VI (2,547 ha or 25.68%), and Class III (836 ha or 8.43%).

Table 1. Summary of land capability classes in Baturiti District

Capability class	Area (ha)	Area (%)	Main locations	Main limiting factors	Recommended management
II	3,532	35.61	Perean Tengah, Baturiti, Mekarsari, Bangli, and Apuan	Light to moderate erosion, moderate soil depth, somewhat rapid permeability, and locally somewhat poor drainage	Crop rotation, cover crops, balanced fertilization, surface drainage improvement, and light conservation practices
III	836	8.43	Batunya, Luwus, Angseri, and Candikuning	Undulating slopes, moderate erosion sensitivity, and somewhat poor drainage	Terracing, mulching, strip cropping, crop rotation, and drainage management
IV	3,003	30.27	Baturiti, Luwus, Angseri, and Antapan	Steep slopes and high erosion limitation	Bench terraces, erosion-control vegetation, agroforestry, multistrata canopy systems, and sediment-control structures
VI	2,547	25.68	Candikuning and Batunya	Very steep slopes, severe erosion risk, shallow effective depth, rapid permeability, and somewhat poor drainage	Forest conservation, limited production forestry, non-timber forest use, infiltration structures, and multistrata vegetation

Source: Field observation, laboratory analysis, and spatial analysis.

Class II land is still suitable for agricultural use, but it requires moderate conservation measures. The main limitations in this class include light to moderate erosion, moderate effective soil depth, somewhat rapid permeability, and local drainage constraints. High permeability can reduce soil water storage and nutrient retention, especially between rainfall events, and therefore balanced fertilization, cover cropping, and improved drainage are necessary to maintain productivity.

Class III land has moderate limitations and requires more intensive conservation measures than Class II. The main constraints are undulating slopes, moderate erosion sensitivity, and somewhat poor drainage. Such land can still be used for annual or perennial crops if terracing, mulching, crop rotation, strip cropping, and drainage management are properly applied.

Class IV land has severe limitations, particularly on slopes of 15-30%. This class should be prioritized for perennial crops, agroforestry, and conservation-oriented cultivation. Intensive seasonal crop cultivation should be avoided unless strong soil and water conservation measures are implemented. Bench terraces, vegetative barriers, multistrata cropping systems, and erosion-control channels are recommended.

Class VI land is characterized by very severe limitations and is not suitable for intensive cultivation. In the study area, this class occurs mainly in Candikuning and Batunya. Because of its steep slopes and high erosion or landslide susceptibility, this land should be maintained as conservation forest, limited production forest, or non-timber forest use. Any management intervention should prioritize slope stabilization, vegetation cover, water infiltration, and ecological protection.

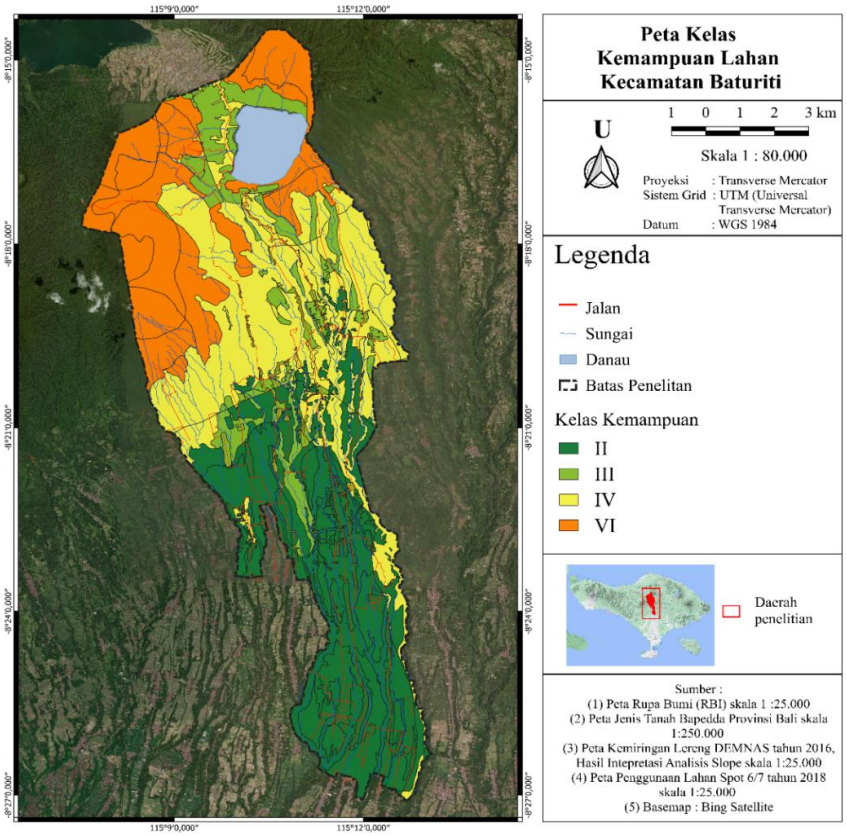

Figure 1. Land capability class map of Baturiti District

Land-use direction

The land-use direction analysis identified four recommended land-use categories: production forest, buffer zone, perennial crop cultivation area, and seasonal crop cultivation area. The recommended allocation was based on slope, soil sensitivity to erosion, average rainfall intensity, and compatibility with conservation principles.

Table 2. Recommended land-use directions in Baturiti District

Land-use direction	Area (ha)	Area (%)	Main locations	Recommended management focus
Production forest	2,547.0	25.69	Candikuning and Batunya	Maintain permanent vegetation cover, use native or erosion-resistant tree species, restrict intensive cultivation, and protect slopes and water recharge areas
Buffer zone	1,401.2	14.13	Baturiti, Luwus, Antapan, and Candikuning	Apply agroforestry, contour planting, natural mulch, vegetative strips, and runoff control
Perennial crop cultivation	3,444.2	34.74	Batunya, Luwus, Perean Tengah, Mekarsari, Angseri, Bangli, and Apuan	Develop perennial crops such as coffee, cacao, clove, avocado, and other tree crops within conservation-based agroforestry systems
Seasonal crop cultivation	2,524.3	25.45	Perean Tengah	Use controlled irrigation, crop rotation, organic amendments, residue retention, balanced fertilization, and conservation tillage

Source: Spatial analysis, laboratory data, and field observation.

The production forest category is appropriate for areas with steep slopes and high sensitivity to erosion. Maintaining permanent vegetation cover is essential to reduce surface runoff, protect slope stability, and improve water infiltration. In these areas, land use should be restricted to conservation-compatible forestry and limited non-timber forest activities.

Buffer zones function as transition areas between protected areas and cultivation areas. In Baturiti, these zones are important for reducing runoff and sediment movement from upper slopes to lower agricultural areas.

Agroforestry with contour-based planting and organic mulch is recommended because it can combine ecological stability with economic benefits.

Perennial crop cultivation is recommended in areas with gentle to moderately steep slopes. Tree crops such as coffee, cacao, clove, and avocado can support soil conservation because their root systems stabilize soil aggregates and their canopies reduce raindrop impact. However, this land use should still be accompanied by terraces, vegetative barriers, and nutrient management.

Seasonal crop cultivation should be concentrated in flatter areas where erosion risk is relatively low. In these areas, paddy, maize, vegetables, and horticultural crops can be cultivated with proper irrigation and input management. Crop rotation, organic amendments, and residue retention are important for maintaining long-term soil fertility.

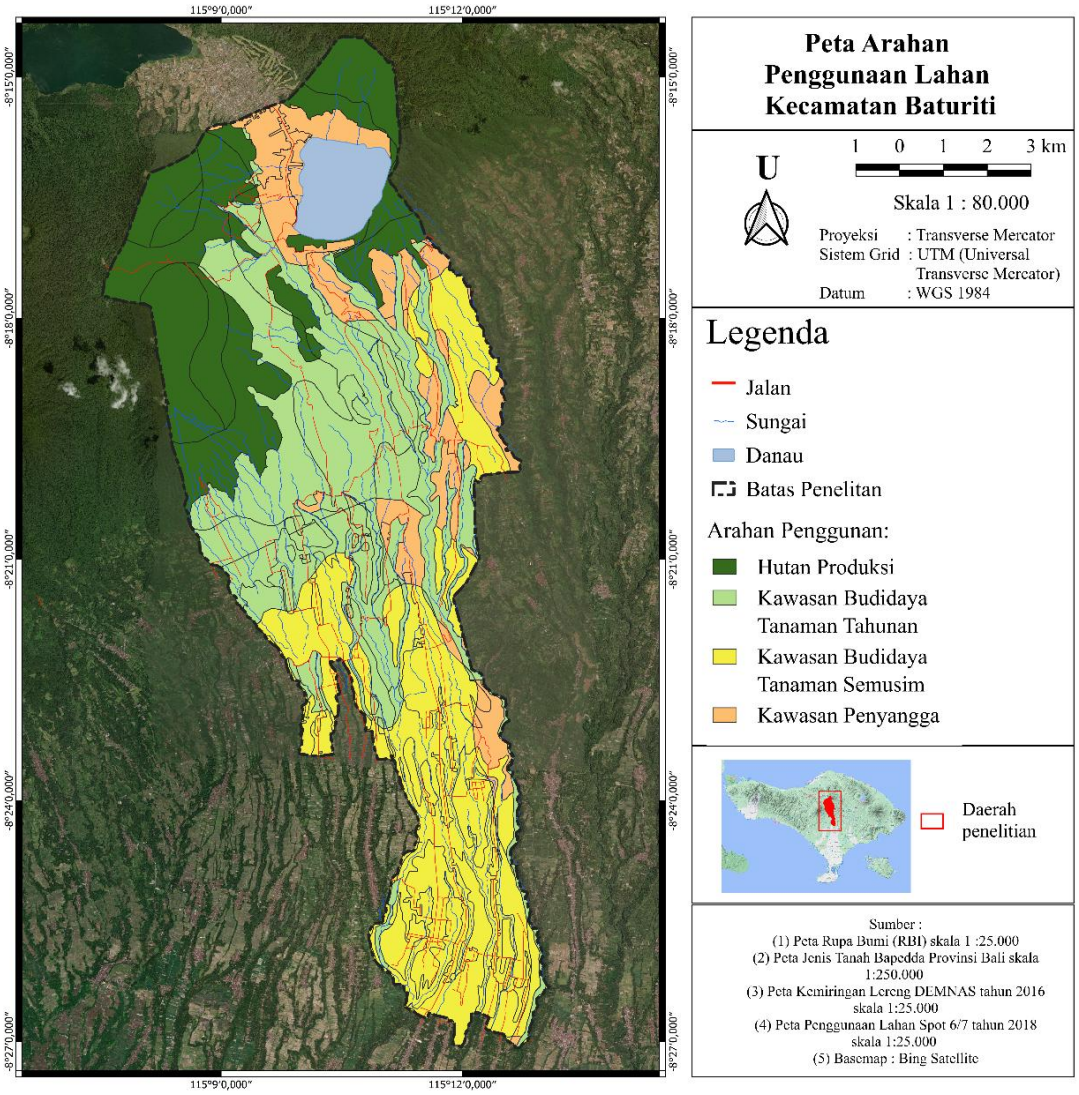

Figure 2. Land-use direction map of Baturiti District

CONCLUSION

Baturiti District was classified into four land capability classes: Class II (3,532 ha; 35.61%), Class III (836 ha; 8.43%), Class IV (3,003 ha; 30.27%), and Class VI (2,547 ha; 25.68%).bThe dominant limiting factors were erosion-related constraints, including slope, soil erodibility, and actual erosion. Additional limiting factors included effective soil depth, permeability, and somewhat poor drainage. Recommended land-use directions consisted of production forest (2,547.0 ha), buffer zones (1,401.2 ha), perennial crop cultivation areas (3,444.2 ha), and seasonal crop cultivation areas (2,524.3 ha). Sustainable land management in Baturiti should prioritize soil and water conservation through terracing, contour cultivation, cover crops, strip or alley cropping, drainage improvement, mulching, balanced fertilization, and agroforestry systems.

RECOMMENDATIONS

Farmers, landowners, and government institutions should use the land according to its capability class and apply soil and water conservation practices to prevent land degradation. The results of this study can be used as a spatial reference for sustainable land management policies in Baturiti District, Tabanan Regency. Future studies should integrate higher-resolution erosion modeling, socioeconomic feasibility analysis, and long-term monitoring of land-use change.

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REFERENCES

Adnyana, I. W. S., Sudika, I. W., & Sutjiningsih, D. (2015). Arahan penggunaan lahan dan perencanaan konservasi tanah dan air di DAS Yeh Empas, Tabanan, Bali. Ecotrophic: Jurnal Ilmu Lingkungan, 9(1), 47-54.

Arsyad, S. (2010). Konservasi Tanah dan Air. Bogor: UPT Produksi Media Informasi Lembaga Sumberdaya, Institut Pertanian Bogor.

Badan Pusat Statistik Kabupaten Tabanan. (2022). Kabupaten Tabanan dalam Angka 2022. Tabanan: BPS Kabupaten Tabanan.

Brady, N. C., & Weil, R. R. (2016). The Nature and Properties of Soils (15th ed.). Pearson Education.

Djuariah, R., Senawi, S., & Setyarso, A. (2016). Mempertimbangkan kerawanan longsor dalam arahan penggunaan lahan berhutan di Kabupaten Kulon Progo, Daerah Istimewa Yogyakarta. Jurnal Wana Tropika, 16(2), 71-80.

Hanifa, I., & Suwardi. (2022). Nilai erodibilitas tanah pada berbagai penggunaan lahan dan tingkat kemiringan lahan di Sub Daerah Aliran Sungai Tulis, Banjarnegara, Jawa Tengah. Jurnal Biofarm, 18(2), 160-165.

Hardjowigeno. (2007). Evaluasi Lahan dan Perencanaan Tataguna Lahan. Bogor: IPB Press.

Prasad, I. G. N. G. G., Trigunasih, N. M., & Sumarniasih, M. S. (2021). Prediksi erosi dan perencanaan konservasi tanah dan air pada Daerah Aliran Sungai Yeh Ho di Kabupaten Tabanan. Jurnal Agroekoteknologi Tropika, 10(2), 161-172.

Sitorus, T. A., Sumarniasih, M. S., & Trigunasih, N. M. (2023). Analisis tingkat erosi dan perencanaan konservasi berbasis sistem informasi geografis di Kecamatan Rendang, Kabupaten Karangasem, Provinsi Bali. Jurnal Agrotrop, 13(2), 256-267.

Suarsana, I. W., Merit, I. N., & Adnyana, I. W. S. (2016). Prediksi erosi, klasifikasi kemampuan lahan dan arahan penggunaan lahan di Kecamatan Baturiti Kabupaten Tabanan Provinsi Bali. Jurnal Ecotrophic, 10(2), 148-158.

Trigunasih, N. M., & Saifulloh, M. (2022). Spatial distribution of landslide

potential and soil fertility: A case study in Baturiti District, Tabanan, Bali, Indonesia. Journal of Hunan University Natural Sciences, 49(2), 229-241.

Trigunasih, N. M., & Wiguna, P. P. K. (2020). Land suitability for rice field and conservation planning in Ho Watershed, Tabanan Regency, Bali Province, Indonesia. Geographia Technica, 15(1), 124-131.

Wijaya, I. N. A. K., Trigunasih, N. M., & Sumarniasih, M. S. (2022). Pemetaan erosi dan perencanaan konservasi tanah dan air di Kecamatan Baturiti, Kabupaten Tabanan. Jurnal Agrotrop, 12(1), 25-38.