

Soil Physical Properties Of The Camba Formation And Volcanic Camba Formation In The Bulusaraung Lower Mountain Forest At Bantimurung Bulusaraung National Park

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Abstract: The physical properties of the soil, specifically the soil texture as a result of rock weathering, is an important factor to study since it is one of the determinants of forest soil quality. This study aims to determine the soil physical properties of the Camba Formation (Tmc) and Volcanic Camba Formation (Tmcv) in the Bulusaraung Lower Mountain Forest. Twenty soil sampling points were systematically placed on each formation. Soil samples obtained were subsequently analyzed at the Chemical and Soil Fertility Laboratory, Department of Soil Science, Faculty of Agriculture, Hasanuddin University. The research variables are soil textures and parameters include the percentage of sand, silt and clay content. Data is analyzed using EXCEL and Discriminant Analysis using SPSS Version 22. The average sand content of soil in the Camba Formation (Tmc) is higher than that in the Volcanic Camba Formation (Tmcv), while the opposite applies for the average content of silt and clay. Sand content is the variable that discriminates (p value <0.05) between soil physical properties of the Camba Formation and soil physical properties in the Volcanic Camba Formation.

Keywords: Physical properties, sand, silt, clay, soil, rock formation, Camba Formation (Tmc), Volcanic Camba Formation (Tmcv), Bulusaraung

1 INTRODUCTION

The lower mountain forest is a type of mountain forest in Indonesia typically located 750 m - 1500 m above sea level [1]. The Bulusaraung Mountain Complex is representative of the type of ecosystems found in lower mountainous tropical forests within Bantimurung Bulusaraung National Park [2]. As a mountain range, Bulusaraung is composed of five main rock formations with two dominant formations, namely the Camba Formation or Tmc (Tertiary Miocene Camba), which are marine sedimentary rocks interspersed with volcanic rocks, and the Volcanic Camba Formation or Tmcv (Tertiary Miocene Camba Volcanic), consisting of volcanic rock sediments in the form of breccias, conglomerates, tuffs and lava [3]. The composition of parent rock plays a role in soil formation, particularly soil texture [4], in addition to other factors such as climate, topography, organism (biota) and time [5], [6], [7]. Rocks that undergo intensive weathering through physical and chemical processes [8] are then vertically differentiated to form different horizons, both in terms of morphology such as thickness and color, as well as physical, chemical and biological characteristics [9]. Forest management sustainability is contingent upon information regarding the soil's physical and chemical properties [10] as these factors determine soil quality and productivity [11], [12]. Based on this, it is important to conduct research on the physical properties of the soil in the Bulusaraung mountains as basis

for sustainable management of the Bantimurung Bulusaraung National Park. This study aims to examine soil physical characteristics in the Camba Formation (Tmc) and Volcanic Camba Formation (Tmcv) in the Bulusaraung Mountain Range Complex at Bantimurung Bulusaraung National Park.

2 RESEARCH METHOD

2.1 Research Location

The research was carried out in the Bulusaraung Lower Mountain Forest Complex in the Bantimurung Bulusaraung National Park. Field data collection was conducted over a period of 3 months, from August to October 2018.

Soil sampling points were systematically placed along the contour lines at an altitude of 900 masl and 1000 masl. In the Camba Formation (Tmc), five points were placed at an altitude of 900 m above sea level and five points at an altitude of 1000 m above sea level. Similarly, in the Volcanic Camba Formation (Tmcv), five points were placed at an altitude of 900 m above sea level and five points at an altitude of 1000 m above sea level. Therefore, there are 20 soil sampling points in total. The process of taking soil samples for the purpose of analyzing the physical properties of the soil [13] was done using the ring (cylinder) method. The ring method works by inserting a cylindrical ring into the soil and gently pressing it down until it reaches the desired soil depth, then slowly dismantling it so as to ensure that the volume remains unchanged. Exact locations of the soil sampling points can be seen in Fig. 1.

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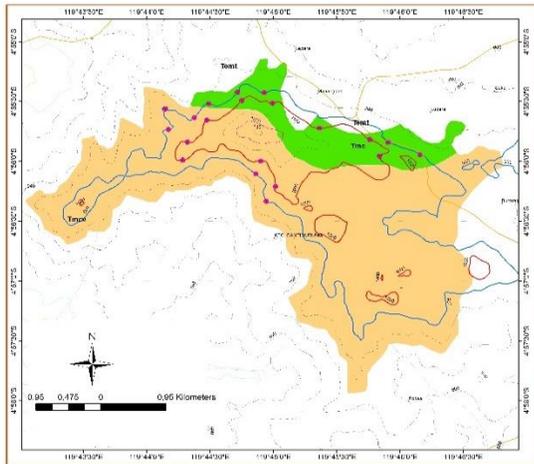


Fig. 1 Schematic layout of soil sampling points

- Camba Formation (Tmc)
- Volcanic Camba Formation (Tmcv)
- 900 m asl contour line
- 1000 m asl contour line
- Sampling point

2.2 Data Analysis

Soil samples obtained from all 20 sampling points were subsequently tested at the Chemical and Soil Fertility Laboratory, Department of Soil Science, Faculty of Agriculture, Hasanuddin University. Variables observed in the study were soil texture components (sand, silt and clay), and the percentage of each variable was used as parameters. Data was analyzed using Excel and Discriminant Analysis using SPSS Version 22. Discriminant analysis is used to classify an entity or object into classes or groups based on a set of variables [14].

3 RESULTS AND DISCUSSION

Texture is the relative comparison of sand, silt and clay fractions that make up the soil mass [10], [15]. The comparison can be seen in Fig. 2.

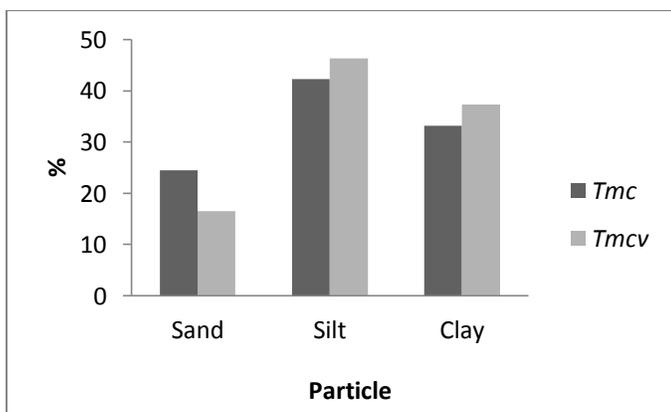


Fig. 2. Relative comparison of the average sand, silt and clay content in the soil on the Camba Formation (Tmc) and Volcanic Camba Formation (Tmcv)

Laboratory analysis was carried out to determine sand, silt and clay content. Analysis was conducted on 10 soil samples from the Camba Formation and 10 soil samples

from Volcanic Camba Formation. The analysis shows that the average sand content in the Camba Formation (Tmc) soil is 24.5% and the average sand content in Volcanic Camba Formation (Tmcv) soil is 16.5%. The data shows that the average sand content in the Camba Formation (Tmc) soil is higher than the average sand content in the Volcanic Camba Formation (Tmcv) soil. The average silt content in the Camba Formation (Tmc) soil is 42% and the average silt content in Volcanic Camba Formation (Tmcv) soil is 46%. This shows that the average silt content in the Camba Formation (Tmc) soil is lower than the average silt content in TMCV soil. Furthermore, the average clay content in the Camba Formation (Tmc) soil is 33% and the average clay content in Volcanic Camba Formation (Tmcv) soil is 37%. The data shows that the average clay content in the Camba Formation (Tmc) soil is lower than the average clay content in the Volcanic Camba Formation (Tmcv) soil.

TABLE 1
DISCRIMINANT VARIANCE IN THE ANALYSIS OF SOIL PHYSICAL PROPERTIES

	Wilks' Lambda	F	df1	df2	P value
Sand	.723	6.882	1	18	.017
Silt	.933	1.289	1	18	.271
Clay	.876	2.548	1	18	.128

Results of discriminant analysis (Table 1) show that only the sand content variable has a p value of 0.017 < 0.05. Meanwhile, the silt and clay content variables have a p value of > 0.05, indicating that these variables have no significant difference. Therefore, sand content is the sole variable that discriminates between the soil physical properties of the Camba Formation (Tmc) and Volcanic Camba Formation (Tmcv). The average sand content in Camba Formation (Tmc) soil is higher than the average sand content in Volcanic Camba Formation (Tmcv) soil. The higher sand content in Camba Formation (Tmc) soil can be attributed to its makeup of marine sand deposit interspersed with volcanic rocks [3]. Although Camba Formation (Tmc) soil has an average sand content of 24.5%, higher than the average sand content in Volcanic Camba Formation (Tmcv) soil (16.5%), it cannot be said that the former has a sandy texture. Based on the Texture Class Triangle Diagram [16], soil is said to be sandy if its sand content is at least 50%. However, higher presence of sand content could affect the soil's macro pores. The higher the sand content, the more porous it becomes. Macro pores enable roots to penetrate both vertically and horizontally, making it easier for water and air to travel and circulate, but also less easier to retain water [9]

4 CONCLUSION

The average percentage of sand content in the Camba Formation (Tmc) soil is higher than the average percentage of sand content in Volcanic Camba Formation (Tmcv). Conversely, the average percentage of silt and clay content in Camba Formation (Tmc) soil is lower than the average percentage of silt and clay content in Volcanic Camba Formation (Tmcv) soil. Sand content is the soil variable that discriminates (p value<0.05) between soil physical

properties in the Camba Formation (Tmc) and Volcanic Camba Formation (Tmcv). Understanding soil physical properties as one of the key factors that determine soil quality and productivity could serve as basis to improve the sustainable management of Bantimurung Bulusaraung National Park.

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