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RESEARCH ARTICLE

LAND SURFACE COVERAGE, MAIN VEGETATION AND PHYSICAL SOIL CHARACTERISTICS OF WEST SIDE OF LAWU MOUNTAIN

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ABSTRACT

Sustainability of catchment area management of a mountain requires identification the vegetation and condition of the major vegetation. the research purpose was characterizing major vegetation, coverage and soil properties on since at 1000 m elevation above sea level until the top of Lawu mountain. Survey was started by identification of every vegetation unit followed by taking soil as sample thenanalyzed in laboratory. Sampling of soil and main vegetation identification were conducted at around of common climbing track line to the top, including Jogorogo and Cemoro Sewu East Java, and Cemoro Kandang and Sukuh Central java. Coverage of land surface by vegetations analyzed using sattellite immage landsad by Arview software. Results showed that intens and dense forest was 36,22% and the other was rare density forest. Major vegetation of Lawu mountain was Pinus (*Pinus merkusii*), Cemara (*Casuarina equisatifolia*), Tanganan (*Schleptera sp*), Akasia gunung (*Acasia decurren*), rumput vestuca, Cantigi (*Vaccinium sp*) kayu pasang (*Lithocarpus pruinusa*) and vegetables on agriculture land. Every type of vegetation unit had different soil physycal properties of topsoil, while elevation had effect on soil bulk volume and porosity.

Keywords: coverage, lawu, soil, vegetation

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INTRODUCTION

Increasing human demands on natural resources of water, land, forest land and pose a continuing intervention to the wider farming region, causing the changes in the hydrological function. Forest degradation commonly was caused by humans and as a result of the economic situation over the several last years. Conservation of biodiversity is one of the measures to ensure the sustainable development of the agricultural sector and other sectors. It is associated with symptoms of major global change in tropical regions about the use of land for agricultural intensification. On the other hand, for plants, soil is a habitat for different kinds of organisms, archaea, bacteria, fungi, protozoa, algae, Invertebrate, whose activities contribute to the maintenance of the productivity of agro-ecosystems with their effects on soil fertility. Therefore, soil conservation and land is an integral part of biodiversity conservation. In carrying out its role these organisms move through at least three mechanisms that greatly affect the success of the ecosystem of the region, namely the decomposition of organic matter. nutrient cycling, and bioturbation (Swift &, Bignell, 2001). Lawu mountain and surrounding areas are ideal location to be developed as National Park. The width was

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more than 10,000 ha, the natural ecosystem and endemic species are still exist. That development of National Park at Mount of Lawu need to be supported by the formation of biodiversity conservation by an integrated biodiversity conservation area (Setyawan, 2001). Lawu located on the border of Central Java and East Java with the peak at 3265 m above sea level. The topography is hilly with a slope of 75-90% in some places. The texture of gravel, cobbles up of bulk composed of a large lime and limestone. Relatively dry climate with an average temperature of 15-17oC and humidity of 55 -85%, Formation Lawu vegetation is a mixture of secondary forest and production forest and agricultural population. Forest canopy is relatively tightly causing forest floor overgrown with young trees are very rare (Puspitaningtyas et al, 2003). Some areas that are protected forests on the slopes of South Lawu belong to brown Latosol and vegetation in general forest zone production by dominant vegetation was Pinus/tusam (*Pinus merkusii*) and other vegetation was Pine Mountain (*Casuarina junghuhniana*), Rasamala (*Altingia excelsa*), Leda (*Eucalyptus deglupta*), whereas protected areas and buffer zones of vegetation dominant was kayu pasang (*Lithocarpus sundaicus*) (Yulla, 2001). This research was to identify main vegetation, vegetation zonation, soil characteristics and land surface coverage condition of Lawu mountain, thus useful for ecological management in future.

MATERIAL AND METHODS

The study was conducted at the height of the Lawu mountain by range sites between 900 - 3265 m sea level. Data analysis was performed at the Laboratory of Geographic Information System and Soil Chemistry Laboratory of Soil Science Department os Soil Science Sebelas Maret University. To achieve the objectives of this research it was be carried out data collection and analysis of distribution of Lawu vegetation on the mountain. Vegetation coverage data obtained through field observations and satellite image analysis and then mapped using Geography Information System techniques. Satellite image was analyzed using Arview software with vegetation index was classified into 5 classes of vegetation indices as open, sparse, somewhat sparse, somewhat bushy and dense. Investigation survey of vegetation unit was conducted by the field by visual observation and accompanied by determination of geographic location using GPS devices. Soil sampling was obtained by boring and identification profiles for each vegetation unit. Soil samples for analysis of chemical and physical properties of soil were taken place adjacent to the observation station topo-sequence research through three channels from an altitude of 900 to 3200 above sea level.

RESULTS AND DISCUSSIONS

Analysis of satellite imagery using GIS by dividing the estimated index of vegetation density to five consecutive classes from most dense area is open to the open area of 11.7% (2546.84 ha), vegetation rarely, 33.13% (7212.69 ha), rather sparse 18.95% (4125.62 ha), rather dense 21.25% (4627.32 ha) and dense vegetation 14.97% (3258.14 ha). Dense forest areas and a bit heavy dense was only 36.22%, which is a little area for a water catchment area. Therefore Lawu Mountain needs reforestation program and maintenance to an increase in the dense forest areas. Less vegetation can cause surface runoff due t o effect of rain water which could not be stored and infiltrated the soil.

Data from field observations at three toposequence follow route of Sukuh, Cemoro Kandang and Jogorogo showed that there were eight major vegetation in the Lawu mountain region. The vegetations are

pines (*Pinus merkusii*), Casuarina (*Casuarina equisatifolia*), Tanganan (*Schleptera sp*), the mountain Acacia (*Acacia decurren*), vestuca grass, Cantigi (*Vaccinium sp*) and Lamtoro Gunung and Kayu Pasang (*Lithocarpus pruinusa*) and vegetables on agriculture land. In general, Soil of Lawu is Andisol and Entisol, although found peat soil in savanna on the track of Jogorogo. Peat soil is formed due to flat topography that allows the emergence of a pool of water, which is accompanied by cold temperatures causing organic material of Spagnum not well decompose. While the andisol soil has andic properties, indices light bulk volume (BV) and high NaF acidicy and dominated by amorphous clay minerals.

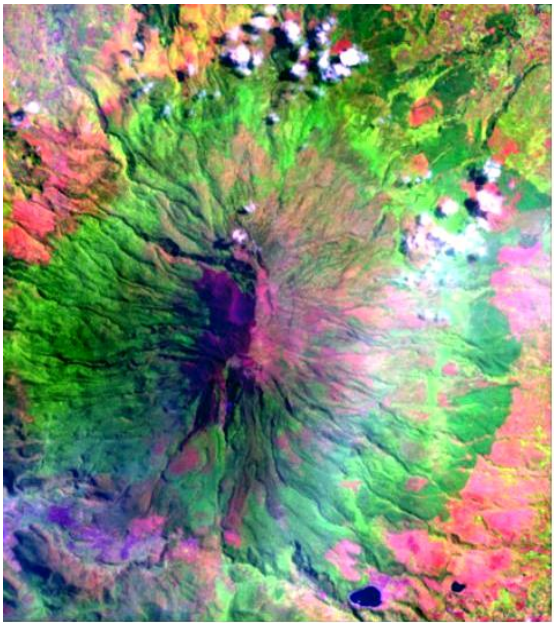

Figure 1. Landsat image of Lawu Mountain by sharpening and band manipulation.

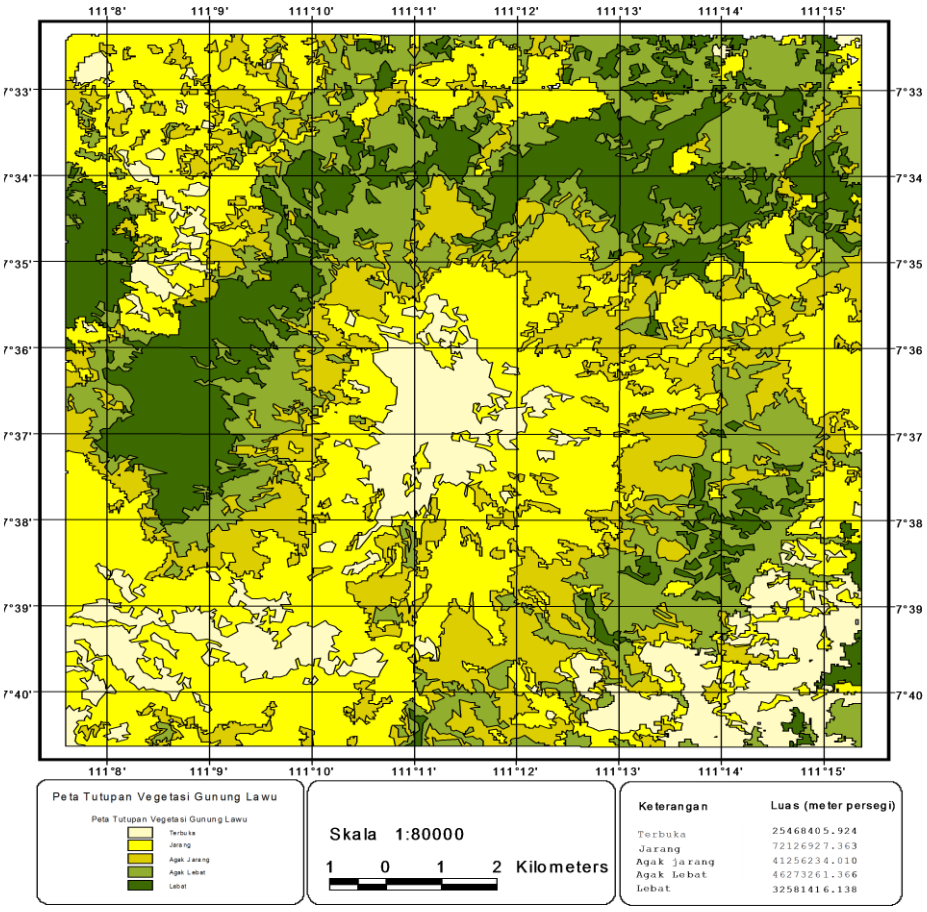

Fig 2. Density of vegetation Coverage of Lawu by classification analysis.

Tabel 2. Geographic position of major vegatation and soil ordo below.

No	Position		Elevation (m sea level)	Vegatation unit	Vegetation density	Soil Ordo
1	S:07^0 33' 55,5"	E:111^0 13' 27,6"	1030	Pinus (*Pinus merkusii*)	Dense	Andisol
	S:07^0 38' 07,4"	E:111^0 08' 31,5"	1387	Kirinyu (*Chromolaena odorata*)	Dense	Andisol
2	S:07^0 38' 08,8"	E:111^0 08' 47,6"	1503	Cemara	Dense	Andisol
	S:07^0 37' 59,6"	E:111^0 10' 12,2"	2246	(*Casuarina equisetifolia*)	Rather rare	Andisol
	S:07^0 37' 59,6"	E:111^0 10' 18,2"	2305		Rare	Andisol
3	S:07^0 34' 13,6"	E:111^0 12' 30,0"	1327	Tanganan	Rather dense	Andisol
	S:07^0 35' 13,2"	E:111^0 12' 08,7"	1770	(*Schlefera sp*	Rather rare	Andisol
4	S:07^0 35' 13,2"	E:111^0 12' 04,0"	1977	Akasia gunung	Rather rare	Entisol
	S:07^0 38' 40,3"	E:111^0 11' 08,6"	2300	(*Acasia decurens)*	Rather dense	Andisol
	S:07^0 36' 35,0"	E:111^0 11' 49,7"	2880		Open	Andisol
5	S : 07 36'40.0"	E : 111^0 11'50.2"	2900	Vestuca,	Open	Entosol
	S:07^0 36' 54,8"	E:111^0 11' 51,5"	2960	Spagnum (khusus pada histosol)	Open	Histosol
	S:07^0 37' 56,3"	E:111^0 11' 02,6"	3006		Open	Andisol
6	S:07^0 38' 08,0"	E:111^0 08' 02,7"	1156	Vegetables, Ageratum	Open	Andisol
	S:07^0 33' 50,5"	E:111^0 12' 48,0"	1143		Open	Andisol
7	S:07^0 37' 59,6"	E:111^0 10' 24,1"	2385	Cantigi (*Vaccinium sp*)	Rare	Andisol
	S:07^0 37' 55,6"	E:111^0 11' 11,5"	3147	Edelweis (*Anaphalis*)	Rare	Entisol
8	S:07^0 38' 08,2"	E:111^0 09' 11,6"	1814	Pasang (*Lithocarpus pruinosa)*	Rather dense	Andisol
	S:07^0 39' 12,1"	E:111^0 11' 11,6"	2071		Rather rare	Andisol

Table 3. Soil Characteristics under the major vegetation

No	Vegetation	Soil Dept (cm)	Elevation (m sea level)	pH H_2O	pH NaF	pH KCl	Particle Density (g/cm3)	Bulk Densit (g/cm3)	Porocity (%)
1	Pinus	40	1030	5.56	10.72	4.55	1.77	1.26	28.85
2	Pinus	23	1143	5.69	10.44	4.76	1.89	1.02	45.68
3	Pinus	30	1387	5.72	10.63	5.23	.	0.86	.
4	Tanganan	15	1327	5.81	10.96	4.97	2	0.93	53.39
5	Tanganan	.	1770	5.46	10.62	4.67	1.81	0.45	75.24
6	Lamtoro	25	1977	5.7	10.42	4.67	2.13	0.82	54.63
7	Lamtoro	25	2300	6.18	11.05	5.68	1.99	0.42	78.64
8	Cemara	20	1503	5.63	10.17	5.13	2.1	0.7	66.73
9	Cemara	15	2246	5.77	10.35	5.28	1.77	0.29	82.52
10	Cemara	.	2305	6.49	10.66	5.4	2.02	0.4	80.09
11	Cantigi	.	2385	5.7	10.99	4.9	2	1.24	37.86
12	Cantigi	20	3147	5.09	10.63	4.23	1.98	0.89	55.96
13	Vestuca	23	3006	.	.	.	2.28	0.23	89.99
14	Vestuca	16	2960	5.13	10.06	4.36	2.23	0.47	78.82
15	Vestuca	.	2880	5.17	11.05	4.9	2.02	0.35	82.79
16	Pasang	.	1814	5.72	10.05	4.97	2.05	0.64	66.84
17	Pasang	40	2071	5.29	10.05	4.7	2.07	0.52	74.92
18	Sayuran	30	1156	6.06	10.68	5.33	1.6	1.05	37.01

Soil pH of Lawu soils appear that all the soil pH was below 6. Soil with Vestuca grass vegetation as savanna and Cantigi plant appeared more acidic than other vegetation. Instead evergreen vegetation and agricultural areas have a relatively higher pH, whereas pine vegetation, and Poncosudo and Kayu Pasang have almost the same pH. Higher acidity usually have more alkaline iron elements such as K, Na, Mg and Ca in ionic form (Sutanto, 1995). High NaF pH above 10 indicates the soil is Andisols, whith characteristics black soil, formed in a cool area with an altitude above 800 meters above sea level. Land in the mountain colors Lawu topsoil is black with color values ranging between 7.5 YR 2.5 / 1pada pine vegetation, 10 YR 3/1 on vegetation Poncosudo, 10 YR 2/1

on vegetation vestuca and quite a bit of brown on agricultural land in Sukuh path ie 7.5 YR ¾. KCl pH value is a potential acidity of the soil and is used to determine the ΔpH. ΔpH values associated with the sign of the charge of land, and is determined by the pH KCl pH minus H_2O. If ΔpH worth negative shows clay minerals existing soil is clay minerals that have a net negative charge cation exchange capacity (CEC) (Shiddieq, 2003). Andisol create highly appropriate function as a water catchment area. Andosol soil is very porous, but the rice fields in the layer andisol have graduated less water than accumulation of iron and Mn (Buringh, 1979). Bulk density of topsoil was ranges at 1.75 g/cm3 of farm area to 2.06 g/cm3 of woody vegetation. Bulk density (BD) of topsoil was range 0.46 g/cm3 at evergreen vegetation, savanna regions with 0.54 g/cm3 to 1.06 g/cm3 in pine vegetation. The nature of the andisol soil is low BD, thus is an advantage for the development of the merystem root (Maas, 2002). BD is low due to the complex amorphous materials and organic materials that are loose. BD correlated with altitude. It appears that the higher places from sea level has smaller BD with correlation -0.573. BD is determined by the amount of pore space in the soil, resulting in the same number of particles do not necessarily have the same heavy volume. Basically amount of organic matter content in soil is an important determinant the magnitude of BD. Differences value of particle density with BD refers to size of soil pore, both macropores and micro pores. Large pores allow the soil to hold water until the water retention capacity reserve. However, large pores are also has risk rapid loss of water due to evapotranspiration, thereby covering the land by dense vegetation becomes very important as a water catchment area maintaining. Porosity correlated with altitude which appears that the higher elevation has higher porosity with a correlation coefficient of 0.614. The amount of porosity is determined by the amount of BV, with correlation -0833. This mean that the higher BD has lower porosity.

CONCLUSION

1. Land condition of Lawu was 11.7% open area, 33.13% sparse vegetation, 18.95% somewhat sparse vegetation, bushy 21.25% vegetation rather dense and 14.97% dense.
2. Vegetation units grouped by toposequences were pines (*Pinus*), Casuarina (*Casuarina equisatifolia*), Tanganan (*Schlefera sp*), the mountain Acacia (*Acacia decurren*), grass *Vestuca*, Cantigi (*Vaccinium sp*) wood pairs (*Lithocarpus pruinusa*) and vegetables on agricultural land.
3. Elevation has correlation with bulk volume and porocity of topsoil.

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