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Evaluation of Land Capability in Critical Land Das Welang, Pasuruan Regency, Indonesia

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Abstract

Nowadays the watershed in Indonesia continues to experience degradation caused by the management of natural resources in it which is quite aggressive, exploitative, and expansive that exceeds the carrying capacity and capabilities. The objective of this research is the mechanism of land capability in describing the distribution of critical land agriculture in the Welang watershed in a comprehensive and integrated manner. Analysis of soil samples after being dried is carried out in the laboratory so as to obtain quantitative figures both physical, chemical, and biological soil properties. Determination of research survey points taken at the critical critical level level, somewhat critical to critical with the land use unit (SPL) of plantations, mixed gardens and fields on medium plains. The results of the study can be concluded that the coffee and mango plants become the dominant plants to be cultivated in the moderate land area, and for the moor, corn plants become the mainstay for cultivation even though based on the ability of the land to have classes that vary from III to VIII according to the characteristics of landforms ranging from sloping to steep also viewed from the actualization of the land showing the land in critical condition. The ability of the land produced from dai III to VII is in accordance with the characteristics of the landform from the sloping to steep. So that corn plants can still be planted for upland fields even though the level of soil fertility is low to moderate with limiting factors ranging from temperature, root media, nutrient retention, erosion hazards and land preparation. Provision of minimal organic matter and land management for land, making terraces is more recommended because to reduce the level of erosion even though some upland areas are not critical while those that are more critical require integrated handling in land management.

Keywords : Welang watersheed, Evaluation of land resources, Land capability

Introduction

Land degradation is an important world problem in the 21st century, because it has an impact on decreasing agricultural productivity, environmental damage, affecting food security and quality

of life as well as decreasing soil quality (Eswaran et al. 2001). In addition, increased intensification of agriculture will change the soil conditions of an agroecosystem, causing biodiversity loss in soil organisms. This is due to a decrease in the number and diversity of organic inputs in the food chain, and the use of chemicals and micro climate modification (Van Noordwijk and Hairiah 2006). The low productivity of land causes farmers to look for new fertile land and they again cut down forests, and even steep land is also cleared for farming. If the land is not fertile, they leave the land abandoned and become a bush, which in turn becomes critical land.

Sitorus (2004) argues that critical land is land that is currently not or less productive in terms of agricultural use, because its use does not or does not pay enough attention to the rules of soil conservation. In this critical land there are one or more factors that inhibit their use. The understanding of critical land varies considerably between one institution and another. There are differences in the perspectives of each of these institutions because each institution has different main tasks and functions. From agricultural institutions, the critical land is associated with its production (production), while the forestry institution sees the critical land as related to the function of land as a media for regulating water management, media for producing forest products.

Critical watersheds can be used as a clue that most of the land within the watershed is classified as critical, as a result of carrying capacity of land resources that are no longer supportive, such as its ability to store very low water, so that almost all rainfall falls above ground level into surface runoff, and then into the river. Therefore Paimin et al. (2010), stated that the current condition of watersheds in Indonesia continues to experience degradation caused by the management of natural resources in them which are quite aggressive, exploitative, and expansive that exceed their carrying capacity and capability.

Agricultural areas for moderate plains have different land surface or landscape forms ranging from hills to flat land. Most people make a living in the agricultural sector with the main commodities being food crops such as rice and corn, while for plantation crops such as mangoes and coffee. Based on the potential of moderate plains for agricultural development is largely determined by the characteristics of the land, regional agro-climate and certain crop commodity usage requirements that are preferred by farmers and able to increase farmers' income and still be able to improve land quality so that land productivity can be maintained.

The condition of the land in accordance with the level of criticality can provide an illustration or information that the land has a limiting factor that can be fixed or permanent but can still be developed for certain plants. Information that can be made a reference to prevent land degradation and support improving land quality includes the standard of damage, land capability, land fertility and, finally, the suitability of land for plants that is in accordance with local wisdom.

Evaluation of land capability is a systematic assessment of land and grouping it into categories based on the nature of potential and obstacles to sustainable land use. The classification of land is intended so that the utilization of land used in accordance with its capabilities and how

to apply soil and water conservation techniques that are appropriate to the ability of the land. Land use that is not in accordance with its capabilities and not followed by good soil conservation efforts will accelerate erosion. If the soil is eroded, land productivity will decrease (Arsyad 2010),

Therefore, critical land is the main indicator of land for rehabilitation priority. Nugroho, (2000), gives a view of strategies that can be applied to reduce degraded land by rehabilitating degraded land as outlined in a land rehabilitation and conservation plan by increasing knowledge at the field level and adopting forms of land use that are in accordance with land management practices. suitable agriculture. Knowing the distribution of degraded land agriculture, makes it easier to determine the steps of protection and preservation of nature for low carbon green development efforts, recovery efforts, and improve forest and land functions through the application of soil and water conservation (KTA) can even formulate land use planning in a sustainable manner. The research question that can be asked is "How is the mechanism of land capability in describing the distribution of critical land agriculture in the Welang River Basin in a comprehensive and integrated manner".

Material and Method

Research was carried out in the medium land, which entered the Welang Watersheed area, Pasuruan Regency. Materials used in this study include supporting maps (soil type, rainfall, land use, earth appearance), and materials for analyzing soil samples in the laboratory. The tools used in this study include ground drill, sample rings, markers, scruples, field knives, label paper, and laboratory analysis tools. The research was carried out in several stages including:

a. Preparation

   Preparation consisting of activities: Identification of land capability from secondary data obtained from BPDAS Brantas, BAPPEDA Pasuruan Regency and the Regional Spatial Plan (RTRW) of Passuruan Regency in 2010-2014; Determination of research survey points taken at critical critical level, somewhat critical to critical with plantation land use units (SPL), mixed plantations and dry fields on medium plains; and Preparation of tools and materials needed for field surveys.

b. Check Ground (Ground Check)

   Checks in the field aim to observe the actual conditions of land use to support the validation and verification of the results of the analysis, especially in relation to correcting the distribution of critical land agriculture. Sampling is carried out based on consideration of limiting factors in land use.

c. Settlement

   Analysis of soil samples after being dried is carried out in the laboratory so as to obtain quantitative figures both physical, chemical, and biological soil properties. The physical

properties of the soil analyzed include permeability, texture, porosity, volume weight. Soil chemical properties analyzed include N, P, K, CEC, KB, BO, pH H2O, redox and electrical conductivity. The results of the interpretation of the data stages of the results are presented systematically in the form of data distribution of critical land agriculture from the parameters of land capability. In this stage, the data attribute table from several combinations of analysis results is exported to Microsoft Excel.

Research Findings and Discussion

1. Existing Condition of Welang River Basin

The Welang watershed is identified with an area of 518 km2 and is one of the BPDAS working areas. Astronomically the Welang River Basin is located between 112º37'30 " - 112º52'30 " East Longitude and 7º37'20 " - 7º52'30 " South Latitude. The Sampean BPDAS working area covers 1,732,877.32 ha. Welang watershed is one of the many watersheds that experience the phenomenon of land degradation to critical land. The Welang watershed is part of the hydrological cycle which is precisely in the east in Pasuruan Regency, with major rivers flowing from its headwaters in the highlands to the south, receiving flow from its tributaries in the central area and empties into the Madura Strait which is the boundary of Madura north of Pasuruan Regency. Welang River is the largest catchment area, which is 518 km2, also the longest 36 km and 35 m wide, but the flow discharge is still lower than the Rejoso River which has a smaller catchment area. This is caused by the relatively short length of the Rejoso River, so that the time of concentration is short and the flow is large and fast until it is running. This can be seen from the flood that occurred at the mouth of this river, which is greater than at the mouth of the Welang River.

Land characteristics for moderate plains have site-specific characteristics and provide information on supporting and inhibiting factors for annual and annual crop farming efforts so that the degradation process can be avoided if land management patterns are in accordance with capability, land based on local wisdom.

2. Land Capability

The ability of land has the benefit of seeing the potential of land to be optimized according to its characteristics, especially in the moderate plains. Utilization, land management and policy planning towards sustainable agriculture need to assess the potential of land in the formulation of cohesion very much needed continuous information that can be informed by land capability data based on critical levels that are informed can be in the form of maps or tables of land capability along with limiting factors. Relief conditions and the slope varies in each unit of land use in the plains while the Welang watershed allows for variations in land capability and variations in land

management, thus it is necessary to deepen studies on evaluating the ability of land and agricultural land use.

Land resources in watersheds (DAS) tend to be under pressure along with rapid population growth. The increase in population must be accompanied by an increase in the necessities of life such as food needs so that the land around the community will be utilized to the maximum so that it is possible that there will be continuous damage if without any effort to sustain the damage caused by humans or due to natural conditions themselves that can cause a decrease in ability DAS in storing water has an impact on increasing the frequency of floods, erosion and spread of landslides in the rainy season and drought in the dry season. Land management must be in accordance with the ability of the land so as not to cause land damage and reduce land productivity.

Careful use of land and use of land resources requires caution, so before utilizing land use planning is needed according to the type of plants and actual conditions with the participation of farmers as actors and landowners required so that the land can survive the degradation process. Based on the characteristics of the land can be informed of the value of the ability of land according to table 1. according to the critical land.

Table 1. Recapitulation of land capability in medium land, Pasuruan Regency

No.	Land Use	Criticality Land	Land Capability	Explanation
1.	Estate	a. Critical	IV	t2,i3,d0,k0,e2,b1,o0
		Potential	IV	t2,i3,d0,k0,e2,b0,o0
		b. Rather critical		
2.	Mixed Estate	a. Critical	IV	t2,i3,d0,k1,e2,b0,o0
		Potential	IV	t3,i3,d0,k1,e2,b1,o0
		b. Rather critical	VIII	t3,i6,d0,k0,e3,b1,o0
		c. Critical		
3.	Moor	a. Critical	III	t1,i2,d0,k0,e1,b0,o0
		Potential	IV	t3,i3,d0,k1,e2,b1,o0
		b. Rather critical	III	t1,i1,d1,k2,e1,b1,o0
		c. Critical		

Source: Data Processed (2017)

Explanation :

t: Texture
l: Slope
d: Drainage
k: Effective Depth
e: Erosion Rate
b: Stone / Gravel
o: Flood Hazard

3. Land Capability for Medium Land Plantations

Plantation plants based on the ability of land, especially plains based on the level of land criticality, obtained the ability of land classes III and IV with limiting factors varying according to location characteristics, not to critically have limiting factors on the surface slope (i) for potential and rather critical to have limits on surface slopes (i) and erosion levels (e).

Land covered by plantation crops can hold rainwater that falls on the surface of the land not directly on the surface of the land, but is held in advance by the canopy and canopy of plants and pepohonon so that the kinetic energy from rain water is reduced so as to reduce the rate of erosion caused by kinetic energy in destroying soil aggregates so that plantations are still suitable for use because class III is intended only for production forests, protected forests so that if used for plantations such as mangoes, coffee and cloves can still be applied but if the problems in the slopes that fall into the slope class category i2 is 10% on the condition is slightly skewed and bumpy, so caution is needed in land management.

The constraints on land in class IV land are greater than those in class III land, and the choice of plants is also more limited. The use for plantation crops can still be applied but conservation measures by making such as bench terraces, vegetation canals and irrigation dams can reduce the rate of erosion because on potential and rather critical lands have a slope of 16-17% in hilly sloping conditions with moderate erosion rates (e2), utilization of land with production garden plants can still be applied because during the rainy season falling water that touches the surface of the land, kinetic energy has been reduced very far because there are still many plantations that cover the surface of the land so that the damage to the soil becomes reduced. but land management must remain more careful especially with regard to land slope.

4. Land Capability for Mixed Plain Medium-Scale Gardens

Based on the physical characteristics of mixed garden land has very diverse limiting factors for potential and somewhat critical values obtained grade IV ability with limiting factors on sloping surface slopes (i3) and moderate erosion levels (e2) for the critical class results obtained the ability of land VIII with considerable limiting factors includes very steep surface slopes (i6), and erosion rates (e3) or weight with main crops including mango, durian and banana.

The mixed estate area applied by the community in the Welang watershed is based on the results of the land capability assessment which can still be applied especially for classes II and IV although the designation of the mixed estate area is an area that can be considered for a variety of other uses, one of which is the appropriate direction of using mixed garden land. is to maintain the agroforestry system which is a model of coffee-based agroforestry land management without leaving the land and water conservation efforts.

The appropriateness of land use for critical mixed gardens with land capability class VIII is the most suitable use only for protected forests but based on field observations there are still many uses for mixed garden plants especially mango, durian and banana so that a lot of erosion occurs. This is in accordance with the opinion of Arsyad S, (2010) that class VIII land is not suitable for agricultural cultivation, but more suitable to be left in natural conditions, class VIII is useful as a protected forest, recreation area or nature reserve. Current land use is still used for mixed gardens should be propagated annual plants and plant management to a minimum so that roots are more

able to hold the soil from the process of decreasing aggregate stability and soil quality can be maintained, reduce or negate crop inter alia, especially for critical land and for class IV land with a limiting factor on the surface slope performs the action of planting along the contour lines and making terraces and / or ridges on sloped land and regulating the irrigation system by making check dams or inhibiting dams.

5. Land Capability for medium land of Moor

The determination of land capability class is based on factors that are used as limiting factors such as surface slope, level of erosion, soil depth, soil texture, drainage, gravel / rocks and the threat of flooding. The division of land capability classes in the plains area with land use units for dry land can be seen in table 1.

Upland fields are suitable for the use of annual crops. Critical and critical potential on dry land obtained class III results with inhibiting factors that are almost the same as non-critical but the surface slope has a slope of 11% so that it falls into the class slope i2 in a slightly tilted or bumpy condition and on critical land the soil depth is only 40 cm so that it is included in K2 class so that its handling in land improvement is more careful, including the application in land improvement on land that has the potential to cause surface erosion.

Class IV of land assessment for critical land is rather critical with obstacles in the interconnected combination of surface slopes, erosion and gravel / rock levels, with 19.5% slope, then there is a chance of erosion with signs of a large amount of soil. lost so that the surface rock that appears is 45% with the class of coarse material b1, land improvement is expected so that the horizon of the soil, especially the fertile soil layer or top soil, is not quickly lost by surface water flow. The construction of terraces and irrigation canals by making water reservoirs and reducing intensive land management are expected to reduce erosion.

Results and Suggestions

Coffee and mango plants are the dominant crops to be cultivated in the middle level, and for moor, corn plants are the mainstay for cultivation even though based on the ability of the land to have classes that vary from III to VIII according to the characteristics of landforms ranging from sloping to steep, also shown in terms of actualization of land showing the land in critical condition.

The ability of the land produced from dai III to VII is in accordance with the characteristics of the landform from the sloping to steep. So that corn plants can still be planted for upland fields even though the level of soil fertility is low to moderate with limiting factors ranging from temperature, root media, nutrient retention, erosion hazards and land preparation. Provision of minimal organic matter and land management for land, making terraces is more recommended

because to reduce the level of erosion even though some non-critical upland fields while the critical ones require more integrated handling in land management.

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