

## MAPPING AND CRITICAL LAND MANAGEMENT AS EFFORTS TO CONTROL CLIMATE CHANGE IN LAMONGAN

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### Abstract

Development of agricultural sector should be able to develop the potential of natural resources, particularly optimization of land and environmentally sounding. In addition to the program intensification, extensification and agriculture diversification, rehabilitation of land is also an effort that can be taken to scale up the productivity of land. The purpose of study was to analyze the potential and critical level of land which is presented in the form of maps and recommended management actions as efforts to control climate change in Lamongan. Sample of this study was two groups; there are soil components and communities. Soil components which studied were physical environment, morphology and chemical of land, topography, land closures and nature of erosion. Communities variable which studied were perceptions of soil fertility, plant species commonly planted, plan habit at certain seasons, agricultural issues that commonly arise or encountered, strategies and expectations of development of the land. Laboratory results of soil texture in six districts showed that the majority districts were having clay loam, clay dust, and dusty clay loam textured. From the results of the laboratory, soil textures at the districts are less than ideal for agriculture but still potential. The average of land potential level at six districts was adequate, although there are some areas and villages were still moderate moreover very critical. Each district showed their average land potential, there are moderate at Sukorame District, Bluluk District, Modo District, Ngimbang District and Sambeng District, while Mantup District has the potential land. It is recommended for the management of critical land of rice fields in six districts was studied by conservation farming which combine mechanical and vegetative conservation techniques in an integrated farming patterns. The goals are to increase farm productivities and farmer incomes, reducing the rate of erosion, and increase farmer participation in conservation of soil and water resources.

Keywords: *mapping, critical lands, management, climate change*

### Preface

Development of agricultural sector should be able to develop the potential of natural resources, particularly optimization of land and environmentally sounding. In addition to the program intensification, extensification and agriculture diversification, rehabilitation of land is also an effort that can be taken to scale up the productivity of land.

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Nowadays, almost all the dry land that hasn't been well explored, are the lands that are located in a little steep to steep (hilly) areas. Due to the lack of land management that notice to the rules of preservation (conservation) plus continuously erosion, then the critical land becomes increase. Lands which are heavily eroded will no longer able to grow good crops and much less to produce. So that, these lands requires rehabilitation [1][2][3].

By the terms of agriculture, critical land is the land which condition of physical, chemical and biological were less productive in terms of agriculture. According to the level of physical damage to land, the critical land is the land that lost its upper soil layer (top soil) which is fertile due to the erosion, so that it is not productive for agriculture [4][5].

Lamongan has 181,280 Ha areas consist of forest, plantation, garden/ building, mining or cattle. Availability of land resources in Lamongan covers forest resources, soil and water. Utilization of land in a region that doesn't comply with the land potential will result the inefficient and ineffective lands.

In order to mapping of development throughout the region, needs to be integrated, harmonious and balanced implemented. These activities able to directed to the development in accordance with the priorities and potential areas. If the land utilization and land resources capacity exceed the capacity of land resources and neglecting the proper management, the longer it can decrease its function so that it will affect the onset of critical lands. Physical environment development basically aims to prevent resource degradation and declining environmental quality, enhance environmental capacities to implement the sustainable development and environmentally sound.

The result of study at least able to provides information and a detailed description of the potential and the critical level of land which is presented in the form of maps and recommended management actions. The general objective of this study is to analyze the potential and the critical level of land which is presented in the form of maps and recommended management actions as efforts to control climate change in Lamongan.

### **Methodology and Material**

Sample of this study was two groups; there are soil components and communities. Soil components which studied were physical environment, morphology and chemical of land, topography, land closures and nature of erosion. Communities variable which studied were perceptions of soil fertility, plant species commonly planted, plan habit at certain

seasons, agricultural issues that commonly arise or encountered, strategies and expectations of development of the land.

To create a potential development map of critical land in Lamongan, the method used is to use Geographic Information Systems (GIS) software – ArcView. Use of GIS based on the ability to visualize, to explore, answer the query (either spatial database and non-spatial), analyze the data geographically, and so forth. Data will be analyzed descriptively, which is describing the state of the variables studied, and presented in narrative form, frequency distribution and cross tabulation, as well as maps.

## **Result and Discussion**

### **Climate Conditions**

The average of climatic conditions in Lamongan shows annual rainy season tended to last longer than dry season. In the normal conditions, rainy season will occur at mid September to mid February, but the happened lately, rain will be occur from October to May, while dry season lasts only five months that is June to September.

In general, Lamongan has tropical climate with an average rainfall reaches 3916.5 mm per year. The driest areas are area which located at south that form of limestone hills. Maximum temperature is 29<sup>0</sup>C and the minimum temperature is 20<sup>0</sup>C. Beach area in Lamongan has very diverse rainfall with the amount lowest annual rain of 1.000 mm and highest annual rain of 2.500 mm in fact in some area can reach 3.700 mm per year. The average temperature ranges between 22<sup>0</sup>C.

### **Public Preferences for Agriculture Program**

The result of study shows that majority of farmer answer the obstacles of managing the critical land on his area are limitation of fertilizer, and if the fertilizer were available, it price was so expensive so that the farmers can't buy the fertilizer. Almost 90% respondent answer that limitations of fertilizer were becomes the problem at agriculture issues, only 10% that answering there was no problem on fertilizer.

In the six sub districts that serve the study, fertilizer was become scourge goods for both field and pond farmers. At the rice planting season, the demand of fertilizer was increased to soil fertility. The same condition was happened on the fish seed sowing season, fish farmer needs fertilizer for the soil fertilize, so that seed fish was growing fast. The problem is, in the same season, the farmers are always in unfavorable conditions. On

the one hand, the farmer deposits were less, even the less is up. On the other hand, fertilizer price was increase. Consequently, the farmers then had to sell their valuables goods they had, or owe to the broker/ middleman with the bonded system by mortgaging the rice fields or ponds they had. When harvest season arrives, because the low bargaining position on debt due to the middleman, the farmers were forces to sell their land cheaply. Above issues are always faced by farmers in the growing season. Urea for example, at usually urea was worth only 53-55 thousand, but in the growing season, urea could reach 65-75 thousand per kilogram.

Therefore, it is need to offering the alternative program for solving fertilizer price. For example, by organize the procurement of fertilizers through cooperatives. So that, the middleman couldn't sets fertilizer price in growing season. When each cooperative at sub district sell the fertilizers in growing season, it will be ease farmers burden. Cooperatives utilization was only conditional, a kind of market operation. When market becomes normal, this model is not necessary. It is expected the funding of local government to back up this program. If it can't be done in a whole coverage, it needs to have some of sub districts to be sampling accordance by availability of budget. For important thing, the management of this program has to be careful, because there may be the rich farmers or residents outside Lamongan will be utilize. So that, there are needs to built data collection associated by farmer area, so that they only buy the fertilizer as much as they need.

The other issue is the limitation of irrigation, the majority of respondents there are 74.4% answer that the limitation of irrigation was become their main obstacle in maximizing the land management. Only 25.6% respondents answer there are no problem on irrigation.

The other issues concerned are unhulled rice price. In south of Lamongan, each harvest arrives unhulled rice price was always dropped. Even the last harvest, the dropped price could reach Rp. 1,000,- whereas the unhulled rice price which set by the government is minimum Rp. 1,500,-. Indeed, not all farmers have the same condition because some farmers could sell their unhulled rice reach over Rp. 1,000,-. Even recently, it price slowly started to improve. However, increasing unhulled rice prices lately are not comparable by increasing the other goods.

The expected of majority farmers are attention from government to solve the lower of unhulled rice price at the harvest season. One of the proposals that proposed by community is the government provides special budget for market operational by buying the unhulled

rice which is ready for harvest. This operation could be done by cooperation or special agencies which are formed by local government. So that, in the harvest season, government buy unhulled rice from farmers, then sell it back when its price becomes better. This operation can be held if only the middleman has started to set up the unhulled rice price. So that, farmers couldn't be played by the middleman because they have alternative buyers that have courage to buy unhulled rice at the government standard price.

The other way which can do is provide machines of grain drying in some sub districts which is known as barn of rice. For example, local government provides machines of grain drying which can be managed by local farmer groups, while farmers who use drying machines which only have minimum funding that are operational and maintenance costs. So that, farmers don't face grain price obstacles in harvest season if it coincides with the rainy season. If it can't be done in all sub districts, it can be done in several sub districts as a pilot project.

### **Level of Critical Land**

According to the results of laboratory tests about soil texture at six studied sub districts, the most textures were loamed clay, dusty clay and loamed dusty clay, it is described that the lands weren't suitable for agriculture. However, this condition would be maximized utilization when the available lands are managed properly (adequate irrigation) and adjusting the suitable crops.

Land could be considered as ideal land when it contains 22.5-52.5% sands, 30-50% dusts and 10-30% clays. Basically, soil texture is divided into 12 classes, and we can say the soil has sand texture when it contains a minimum of 85% sands, dusty texture when it contains a minimum of 80% dusts and loamed/clay texture when it contains a minimum of 40% clays.

Soil texture will affect crop growth and production. It could be shown according to several studies on corn and potato production were ideal for clay texture, while potatoes were ideal for sand texture than loamed or clay texture. However, both of them could grow at sand texture if followed by well irrigation. When the soil has no irrigation, clayed soil would give physical characters as described before. Resinova pine is ideal for loamed clay sand texture though when compared with sand texture irrigated (Foth, 1984).

In analyzing the potential of land based on soil texture, it can be described that smaller flake size means more quantity and surface area per unit weight of soil, which indicates increasing density of particles per unit volume of soil. This means that more and

more micro pore size is formed. Otherwise if flake size bigger, land dominated by sand will have a lot of macro pores (large) as called as poreus, land dominated by dust will have a lot of meso pores (quite poreus), whereas a predominantly clay will have a lot of micro pores (small) or not poreus.

According a little comparison of the results of study and above explanation, the potential of land in six sub districts that serve the study wasn't ideal. So that, it needs special treatments to produces an optimal agriculture.

Based on pH examination, shows that some districts were acid condition and the others were too saturated (pH ranges from 6.81-7.84). Soil pH could be use to indicate chemical soil fertility because reflecting the availability of nutrient. The availability of nutrient can be shown at reaction of acid (pH < 7.0), neutral (pH = 7.0) and wet (pH > 7.0).

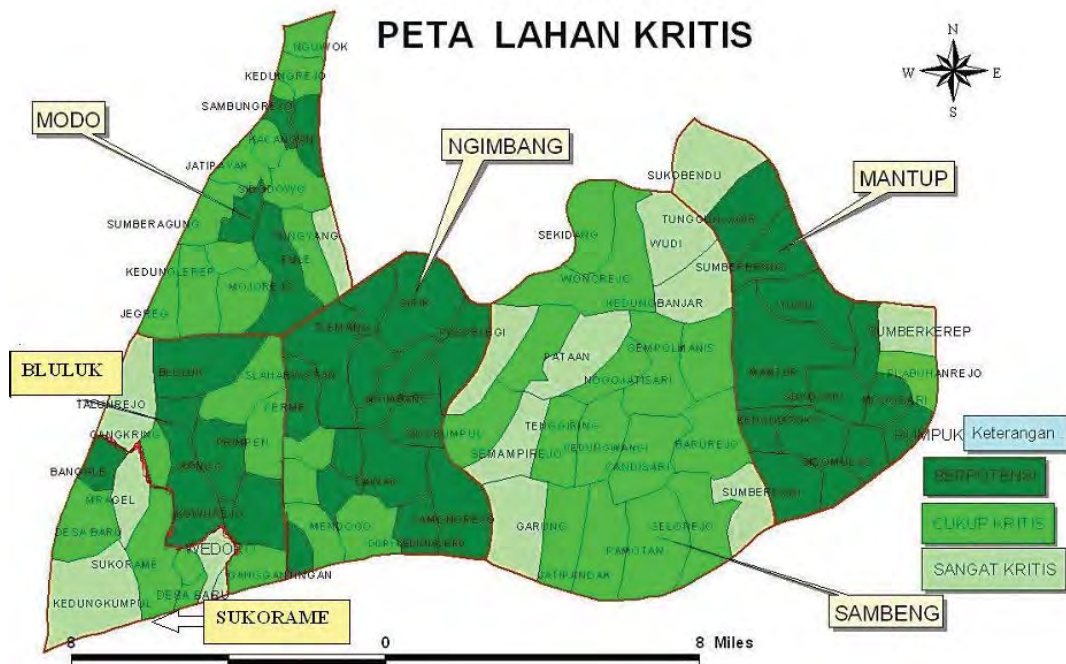
Optimum pH for availability of nutrients are approximately at 7.0 because all of macro nutrients in this condition were available, while micro weren't available except Mo, so that it is possible of occurrence of toxicity to micro nutrients. At ph < 6.5, it is possibility of occurrence to P, Ca, and Mg deficiency, toxicity to B, Mn, Cu, Zn and Fe. At ph > 7.5, it is possibility of occurrence of deficiency to P, B, Fe, Mn, Cu, Zn, Ca and Mg, and also toxicity to B and Mo.

Each crop needs on different composition of nutrients. Knowledge of pH effects to nutrients availability pattern, could be use as reference in appropriate plants selection according to type of land. By some studies, we also can find the certain plants have a range for ideal pH.

In case, planting at inappropriate pH, it is necessary to improvements pH so that the ideal pH can be realized. Alkaline soil, reduction for pH can be done with the addition of sulfur material, because sulfur will released and forming a acid sulfuric ground, while in acid soils, increasing pH can be done with calcification. Lime carbonate or calcite ( $\text{CaCO}_3$ ) – in the market known as "Kaptan" – when it hydrolyzed will result hydroxyl ions as pH a enhancers and Ca for saturation enhancers.

When we look for the results of study about pH examination, we can't find ideal pH (7.0) at six sub districts that serve the study, however, by the appropriate plants selection based on soil pH and adequate treatments, the potential of land at six sub districts that serve study can be optimize.

### Critical Land Maps



### Conclusion and Advices

#### Conclusion

Based on above describes about mapping and critical land utilization at south of Lamongan, it can be concluded that:

1. Communities expect on development agriculture strategy are: local government provides field counseling institution; agriculture intensification by drill manufactured and tractor provided; agriculture market stabilization when harvest arrives; capital provided by low interest; develops community cooperatives.
2. Laboratory results of soil texture in six districts showed that the majority districts were having clay loam, clay dust, and dusty clay loam textured. From the results of the laboratory, soil textures at the districts are less than ideal for agriculture but still potential. The average of land potential level at six districts was adequate, although there are some areas and villages were still moderate moreover very critical.
3. Each district showed their average land potential, there are moderate at Sukorame District, Bluluk District, Modo District, Ngimbang District and Sambeng District, while Mantup District has the potential land.

## Advices

Based on above describes about mapping and critical land utilization at south of Lamongan, it is recommend to:

1. In order to agriculture development improvement at south of Lamongan, government should provides strategies expected by communities. The strategies are reactivate field counseling institution; agriculture intensification by drill manufactured and tractor provided; agriculture market stabilization when harvest season arrives; capital provided by low interest; develops community cooperatives.
2. Critical lands utilization should followed by 3 utilization models according to the land utilization. The models are critical land utilization in rice field; critical land utilization in dry soil; critical land utilization in garden.
3. Critical land utilization in field rice can be done by conservation farmer technique which combine mechanical and vegetative conservation in an integrated farming patterns. The goals are to increase farm productivities and farmer incomes, reducing the rate of erosion, and increase farmer participation in conservation of soil and water resources. There are 3 recommended conservation farmer techniques. There are:
  - a. Bench Terrace, one of farming systems conservation which is planted with annual food crops in the field though, grass feed on the terrace forward and peripheral, as well as involving livestock.
  - b. Gulud Terrace, one of farming systems conservation which is planted with annual food crops in the field though, grass and legume trees in guludan and livestock.
  - c. Individual Terrace, one of farming systems conservation which is planted with annual food crops in the field though, grass and legume trees in guludan and livestock.

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