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PERFORMANCE OF THE SLASH AND BURN FARMING SYSTEM IN THE UPSTREAM AREA OF MANIKIN WATERSHED, WEST TIMOR, INDONESIA

Kapa Max J.*, Doctoral Student in Environmental Sciences

Totok Gunawan, Main Supervisor and Lecturer

Hardoyo Su Rito, Co-Supervisor and Lecturer

Gadjah Mada University, Indonesia

*E-mail: maxi.kapa@gmail.com

ABSTRACT

The purpose of this study was to determine the performance of the slash-and-burn farming system in the Upper Area of the Manikin Watershed along with a number of aspects behind it. The method used is the mixed model method. The data collected consists of primary data and secondary data. Primary data was gathered from key informants consisting of community leaders, traditional leaders, and government officials; while secondary data were obtained from government agencies, and private institutions. Qualitative data collection was carried out through in-depth interviews using instruments in the form of a list of in-depth questions, and field observations recorded in field log books. Two villages were selected purposively as sample villages namely Soba and Oben villages. These two villages represent the upper area of the Manikin watershed. Data analysis was carried out using case-oriented techniques. The case orientated technique used was the thematic analysis of the transcripts of in-depth interviews with stakeholders. The results of the study showed that: (1) The maize farming system in the Manikin watershed is still managed extensively traditionally without using modern production input, (2) Weeds and uncertainty in the pattern of rain are inhibiting factors which resulted in very fluctuating of the farming system productivity; and (3) Farmers in the Manikin watershed are faced with a dilemmatic choice between cultivating fields according to conservation rules with the consequence of low production, or cultivating fields on sloping land with the risk of accelerating land quality degradation due to erosion.

KEY WORDS

Extensive farming, low productivity, Manikin watershed, slash and burn farming system.

The upstream area of a watershed is an important area because it has the function of protecting the entire watershed area. This protection is mainly towards the preservation of land and water resources. Physically, this area is a region with hilly and mountainous topography, and it has a degree of slope that is large enough to be very sensitive to erosion. Therefore, regional planning is often the focus of watershed planning, considering that in some watersheds, upstream and downstream areas have biophysical relationships through hydrological recycling.

In fact, the upstream area of a watershed is not only used for conservation efforts, but also for activities related to the agricultural sector, especially dry land agriculture. In line with this, Satari (1988) argues that agricultural development in dry land areas, especially in the upstream areas of a watershed, is far more complex than in the lowlands. The potential of existing land resources is very limited by slope, severe erosion rates, and is also limited by the low accessibility of infrastructure. This condition will affect the ease of obtaining government facilities, and the socio-economic conditions of the community.

All the conditions stated above also occur in the upper reaches of the Manikin Watershed. Although it is not a large watershed in West Timor, the Manikin watershed has an important meaning, namely as a river basin between Kupang Regency and Kupang Municipality. In addition, in the downstream area are rice fields where irrigation water is sourced from the Manikin River. This rice field is one of the rice producing centers in Kupang Regency. Meanwhile, the middle and upstream parts of the watershed are dominated by

slash-and-burn farming.

Similar to farming in general, the slash-and-burn cultivation system is seen as an agricultural system that damages the environment (Uhl, 2006). Mudita (2000) and Kleinman, et al., (1995), stated that slash-and-burn cultivation causes more negative impacts than it is as the most likely option for people in dry climate regions. Few researchers have revealed that in addition to the negative impacts mentioned above, slash-and-burn cultivation is actually the most feasible choice in the various limitations faced by people living in dry climate regions in West Timor (Ataupah 2000; Pollini 2007, Kapa, 2017).

Slash-and-burn farming in West Timor is carried out on a rotating basis. According to Monk et al (1997), such cultivation is relatively less destructive compared to shifting cultivation. The reason for this is because in rotating cultivation, the land to be abandoned is first planted with perennials. But according to McWilliam (2000), planting perennials is actually more aimed at obtaining legality on abandoned land and not to accelerate the succession process to the forest. Moreover, shifting cultivation according to McWilliam (2000) can still cause environmental damage when the fallow period is getting shorter due to the pressure of an increasingly dense population. In such circumstances, rotating cultivation will also have an impact that is not much different than irregular shifting cultivation. One of the effects that McWilliam (2000) is very concerned about is the threat to biodiversity considering that forests in West Timor are dry forest areas with very limited and fragmented areas. In contrast to the results of the research of McWilliam (2000), the research conducted by Mudita et al. (2001) in villages around the Mutis Mount Natural Reserve area, showing an increase in population was not significantly related to fallow time. For villages around the Mutis Mount Natural Reserve area, this occurs because the right to open land for cultivation is not limited by administrative boundaries, but rather on communal rights, so that residents from one village still have access to land in another village. Moreover, according to the community there is no point in clearing land with short fallows because the results will not be as expected. So that if land with a minimum fallow period is not available, they will be more likely to extend the cultivation period than shorten the fallow period which requires more energy and greater costs.

By paying attention to the polemics as stated above, it is important to know how the performance of the farming system as a form of slash and burn cultivation is practiced in the upstream of the Manikin watershed, to be used as a foundation in formulating management policies for both the upstream region and the entire watershed. Therefore, the purpose of this study was to determine the performance of the cultivation system in the upper reaches of the Timor Manikin Watershed along with a number of aspects behind it. The aim of this study was to determine the performance of the cultivation system in the Upper Area of Manikin Watershed along with a number of aspects underlying it.

METHODS OF RESEARCH

This research was conducted using a mixed model method (Teddlie & Tashakkori, 2003). The data used consists of primary and secondary data. The primary data was obtained from 36 key informants consisting of community leaders, traditional leaders, and government officials; while secondary data was collected from government agencies, and other parties, including researchers who have conducted research at the location of this study.

Qualitative data collection was carried out through in-depth interviews and field observations, while quantitative data collection was required to support the qualitative data.

Primary data includes data on field management, production, production adequacy, as well as various existing inhibiting factors and how to overcome them, and so on. Meanwhile, secondary data such as potential areas, policies, etc. are obtained from relevant agencies and literature as well as the results of previous studies.

Data collection is done by using instruments in the form of a list of in-depth questions (in the form of open questions), and field activity books (field log book). Two villages were selected purposively as sample villages based on considerations that the two villages

representing the upper area of the Manikin watershed, the number of people involved in slash-and-burn farming systems, and accessibility of locations. Based on these criteria, two villages were selected, namely Soba Village and Oben Village.

Data analysis was carried out using case oriented techniques. The case orientation technique used is thematic analysis of the transcripts resulted from in-depth interviews with stakeholders (Falk et al. 2008).

RESULTS AND DISCUSSION

Farm Management System. Farming enterprise in the study area can be divided into two groups based on the main component arrangement, namely Maize, and rice farming. Nonetheless, Maize cultivation is the most predominantly cultivated. The decision to operate a Maize field and/or paddy field is mainly based on the needs of farmers and the conditions of soil fertility. Rice plants, generally local cultivars, are more preferred to be planted in new opening land with relative deep soil solum. On the other hand, for the Maize field, such criteria are not very important.

Traditional mixed intercropping is a form of dominant cropping pattern that reflects diversification in space. Diversification in space is done by mixing various plants not only in one plot but also in one planting hole to save time and work. In addition, the reason for choosing this system is based on the consideration of minimizing the overall risk of failure, in addition to the benefits of the possibility of Nitrogen contributions by types of legumes combined with non-legumes.

The types of plants mixed in one planting hole with the main plants are turis beans (*Cajanus cajan*), nasi beans (*Phaseolus calcaetus*), arbila beans (*Phaseolus lunatus*), and pumpkin (*Cucurbita moscata*). Especially in the maize field, in one planting hole is usually filled with five local cultivar maize seeds plus one seed of another plant. The types of plants planted in one plot with the main plants are cassava (*Manihot esculenta*), watermelon (*Citrullus sp.*), and sweet potato (*Ipomoea batatas*) on land that allows it.

The spacing used is generally between 75 cm x 75 cm x 75 cm to 100 cm x 100 cm x 100 cm, depending on the slope of the land. Setting the spacing based on the slope of the land combined with the use of fallen resistant cultivars is more directed at minimizing wind disturbances, especially in sloping areas. In managing the fields, land management and fertilization actions are practically not carried out. This seems to be closely related to land conditions that are generally relatively flat or rocky with a shallow solum. Therefore, burning is a shortcut to restore soil fertility. This is in line with the opinion of Sanchez (1980) cited by Rambo (1984) which states that biomass combustion will help produce a number of nutrients that are beneficial for plant growth.

The application of chemical pesticides in controlling pests, diseases, and weeds is practically not done. To control the presence of pests such as stem borer caterpillars on corn plants, it is enough to do with fumigation that is by burning raw leaves around the cultivation area. Although the odds are still in doubt, the cultivators believe that this method is able to reduce the attack of these pests.

Productivity and Inhibiting Factors. Weed is a major factor in reducing dry field production in the research area. Thus, farmers' attention to weeds is far more meaningful when compared to other disturbing microorganisms. This is evident from the weed control efforts that have begun to be carried out since the preparation of land for dry fields, namely through burning and selection of relatively sloping land.

Based on the experience of farmers, burning biomass in arable land besides being able to fertilize the soil, is also able to suppress weed growth. Akobundu (1980) cited Shenk (1986) stated that if done well, combustion can suppress weed disturbances for some time, and even reduce the frequency of weeding. However, according to Moody (1973; 1975) and Nyoka (1982) cited by Shenk (1986) stated that if the heat produced by the combustion process is inadequate because at least the biomass is burned, it will stimulate the germination and re-growth of weeds.

Apparently the phenomenon as stated by the last two experts is now being

experienced by farmers in the research area. This is evident from a large amount of time and energy allocated by farmers to hoe weeds (Figure 1). Weeding is done manually by removing or gouging with machetes, which are carried out for almost the entire life of the corn crop.

The productivity of the farming system in the study area is very volatile, but in general, it is actually experiencing a downward trend. Quantitative calculation of the trend of production of this system is difficult, given the unit of measure of production used - especially for corn - is not a common unit of measurement that refers to units of weight such as kilograms or quintals, but local units of measurement which refer to units of quantities in this case corn. What's interesting here, the number of corn grains is fixed for each unit of measure and is not influenced by the size of the corn grain. Therefore, it is difficult to convert this number-based local unit into a plurality of units based on weight. The results of interviews in the field indicate that production fluctuations are mainly determined by two factors, namely climate, in this case, the pattern of rain, and weeds. By itself, the climate and weeds are a disturbance in this system.

Figure 1 – Calendar of farmer activities in cultivating dryfields in the Upper Area of Manikin Watershed

If the rainfall is sufficient and evenly distributed in space and time dimension, and weeding is performed well, then the yield obtained is adequate for food needs a year, sometimes even more so that it will be sold for cash. Conversely, if the rainfall is less favorable and the weeding process does not go well because of a shortage of labor, for example, the results obtained are very small. If this occurred then sometimes the seeds set aside for the next planting season are consumed. The latter circumstance is more common nowadays, giving rise to the phenomenon of ordinary hunger. To overcome this, farmers have several choices, namely increasing the number of parcels of cultivated land or looking for alternative foodstuff.

The above explanation is basically a strong indication of the occurrence of land degradation that has been predicted half a century ago by Ormeling (1955) who stated that if the development of field management techniques is not in line with population growth, the threat of land quality degradation and weed infestation becomes serious and very affect productivity. The result is that both the planting period and the fallow period are shorter. This condition does not indicate a rapid recovery of land, but the opposite. Another interesting thing related to accelerating land quality degradation is the strong tendency of farmers to open fields on sloping land without terrace. According to farmers, the presence of weeds on such land both in the number of individuals and the number of species is less.

Dilemma of the Farming System in the Upper Area of the Manikin Watershed. Seeing the phenomenon as above, it seems that field farmers in the Upper Manikin Watershed may even be on the island of Timor in a dilemmatic choice. Trying to cultivate fields on land with physical conditions in accordance with the principle of feasibility and then be ready to compete with weeds, or sacrifice the principle of feasibility to minimize competition with

weeds are two difficult choices, because they both carry myrageous implications for decreased productivity.

To obtain a comprehensive picture of the appearance of the farming system in the Upper Manikin Watershed, in Figure 2 a flow chart of the system is presented. The interesting thing in Figure 2 is that it relates to the existence of traditional leaders and Field Agricultural Extension (PPL). Customary leaders are local institutions that have authority in licensing and determining the location of farms in this region. Therefore, this institution is basically the key to improving field management. However, it seems that this role has not been fully utilized in the pattern of approaches both by the PPL and by other motivators in incorporating innovations.

The Dilemma of the Agricultural System in the Upper Areas of the Manikin Watershed. Looking at the above phenomenon, it seems that the field farmers in the Manikin upper watershed may even be on the island of Timor in a dilemma choice. Trying to process land on the ground with physical conditions in accordance with the principle of feasibility and then being ready to compete with weeds, or sacrificing the principle of feasibility to minimize competition with weeds are two difficult choices, because both have enormous implications for reducing productivity.

To get a comprehensive picture of the appearance of the agricultural system in the Manikin upper watershed, Figure 2 presents a system flow chart. The interesting thing in Figure 2 is that it relates to the existence of traditional leaders and Agricultural Extension Field worker (PPL). Customary leaders are local institutions that have authority in licensing and determine agricultural locations in this region. Therefore, this institution is basically the key to improving field management. However, it seems that this role has not been fully utilized in the pattern of approaches both by the PPL and by other motivators in incorporating new innovations.

Figure 2 – Flows of Slash and Burn Cultivation Systems in Manikin Upper Wathershed.

This fact has caused especially the role of Agricultural Extension institutions as a source of information to be weak, because it is as if this institution is outside the system. This condition is also exacerbated by other weaknesses which include the educational background of the majority of PPLs based on wetland agriculture, extensive working areas with heavy terrain but very facilities, and the behavior of early adopter farmers in accepting and adopting new innovations.

For future improvements, then of course the two institutions must establish a coherent collaboration, which must first be based on mutual understanding, so that PPLs are no longer "outsiders" who "patronize" and even traditional leaders are no longer considered "inhibitors" the entry of new innovations into the PPL program.

CONCLUSION AND RECOMMENDATIONS

The Maize farming system in the Manikin watershed is still managed extensive traditionally, by diversifying the types of commodities in one area as a strategy for food security and availability. In addition, inputs of modern production facilities such as superior seeds, synthetic fertilizers and pesticides are practically not used.

Weeds and uncertainty in the pattern of rainfall are inhibiting factors which result in very fluctuating productivity of the farming system.

Farmers in the Manikin watershed are faced with a difficult choice between cultivating fields according to conservation rules (on flat land) with low production consequences due to disturbance of weeds that are quite high in this condition, or cultivating fields on sloping land with the risk of accelerating degradation. land quality due to erosion.

Recommendations:

- A more in-depth study needs to be carried out regarding the strength of the slash-and-burn based farming system which, although it has been practiced for a long period of time but in fact still persists to this day.
- Improvements to the farming system should begin with improvements in terms of plant arrangement both from the aspect of species composition and spatial aspects, perceptions of weed biomass which have not been reused in the system as a source of organic material, as well as soil conservation efforts that support two actions.

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