

Cluster Model of Agroforestry Land Use to Support Food Sustainability

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ABSTRACT

This research aims to develop the model of land utilization in private forest management in order to support the food sustain in agroforestry system. The result shows that the clustering private forest for crops can predict the crops development area in private forest and management of agroforestry system performance in private forest. This model is related to knowledge management dan crops zoning. The private forest zoning can be classified into 2 main components : (i) planting area (ii) type of plants cultivated by the farmers. The forest management consists of horticulture plants stands, labor. It can be concluded that clustering model of agroforestry area utilization in supporting food sustain which is managed by laction question zoning principles can predict the domination of crops in private forest area. The crops which still become the mainstay of society, cassava value LQ 3.53 is still cultivated in 2015. In addition, for stands, mangga value 3.58 is still potential as an alternative choice in order to add income of society around the forest area in 2015.

Keywords: Food, Population, Forest, Stand, Potential.

INTRODUCTION

The growth of population can give impacts to the adequacy and availability such as impact on foodstuffs (FAO/WPG, 2010). Impact economy and social become one of issues which needs to be given attention and solution (Ministry, 2011). Forest area can also get the impact from the growth of population with various solutions for both negative and positive impact towards forest (Bekkemen *et al.*, 2009). The more pressure towards the land for any kinds of human activities such as habitation, agriculture industry, plantation and forest area diversion for other allocation has caused the forest become narrow (Alkamade *et al.*, 2009).

The existence of private forest in Indonesia is private wood producer resource and crops for

human needs in which the benefit has been felt by the society. The farmers who own private forest get good result financially and something which is priceless such as the atmosphere, waterwork and etc (Hillbrad, 2009). The rapidity of population growth and the economy movement causes the increasing of crops demand and woods for various purposes which is not along with the increasing of wood production from forest so that the role of private forest becomes more real in supporting the creation of opportunities for private forest development (Briekman *et al.*, 2011).

The government and society agree to increase the rehabilitation of society's land in order to support the realization of private forest development dan the increasing of crops (Islam, 2011). The development of private forest is for land

rehabilitation, land conservation and increasing crops for society's welfare (John S. I. Ingram and Hugh L *et al.*, 2013).

The rehabilitation and reforestation project are the starting point in developing private forest area. Yet, after the society fee the economy benefit, they them selves develop it so there are private forest centers (IFPRI,2010).

Seeing from the function of private forest development, they are the form of land management which consider the sustainable yields and conservation but still give opportunities to increase crops, income and farmers' welfare improvement (KMPG,2010).

The problems occurred in the clustering crops systems indicate that private forest area



Fig. 1: Location of the study area cluster food security

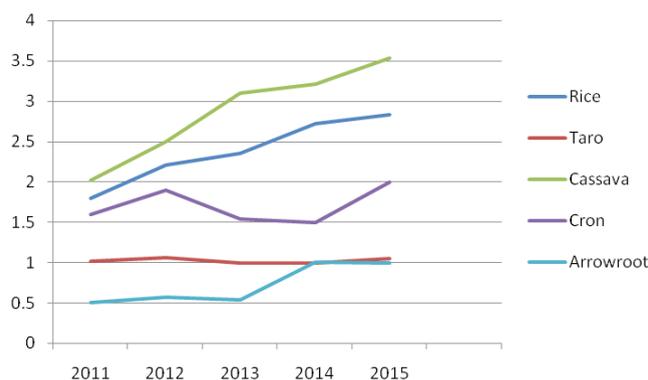


Table 1: LQ wide area region staple food crops harvest in Madiun Regency

	Rice	Taro	Cassava	Cron	Arrowroot
2011	1.8	1.02	2.02	1.6	0.5
2012	2.21	1.06	2.5	1.9	0.57
2013	2.35	1	3.1	1.55	0.53
2014	2.72	1	3.21	1.5	1.01
2015	2.83	1.05	3.53	2	1

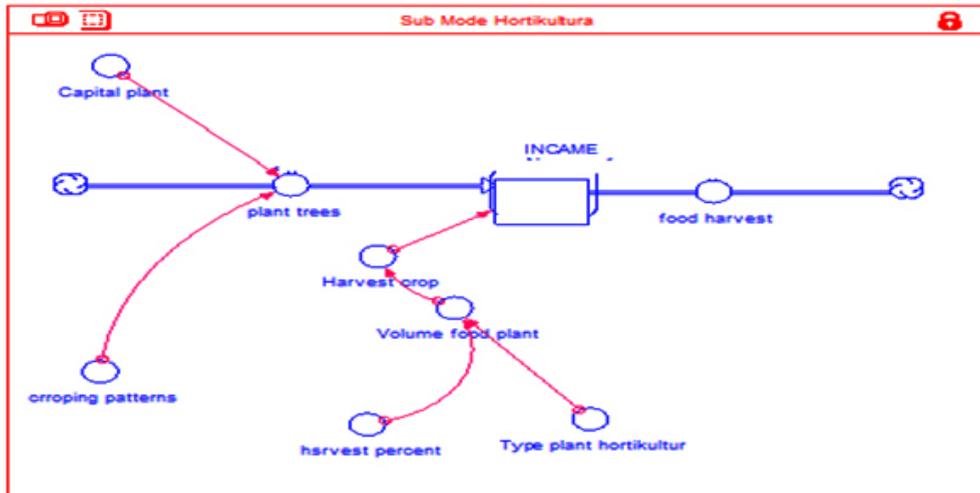


Fig. 2: Sub model horticulture

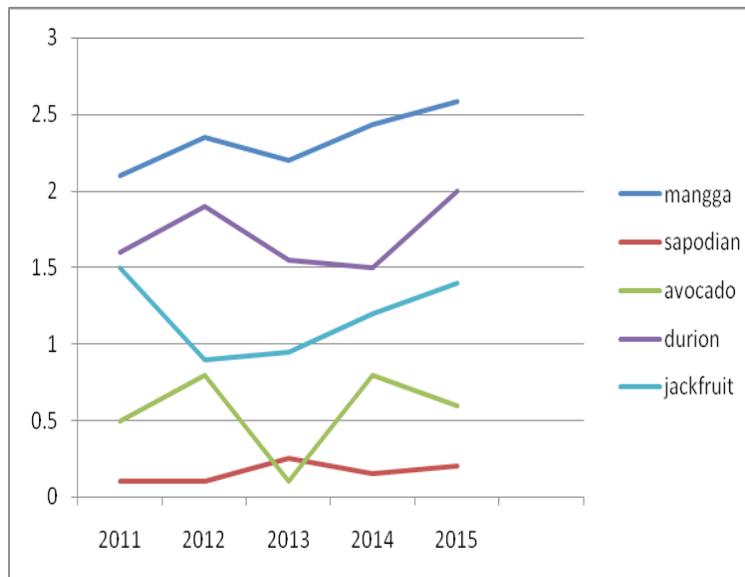


Table 2: The diversity of commodities according to district area

	Mangga	Sapodian	Avocado	Durion	Jackfruit
2011	2.1	0.1	0.5	1.6	1.5
2012	2.35	0.1	0.8	1.9	0.9
2013	2.2	0.25	0.1	1.55	0.95
2014	2.43	0.15	0.8	1.5	1.2
2015	2.58	0.2	0.6	2	1.4

consists of planting area and horticulture plants whereas private forest management is influenced by stands dynamics, horticulture dynamics and labor. As the result, land zoning study with agroforestry system is very important.

MATERIALS AND METHODS

The field data collection through the making of plots is done in private forest area and then analysed with secondary data in which the result is plotted becoming thematic map such as a cluster map, leading sector map and leading center map of basic crops area and leading crops in the form of local crops in Madiun Regency. Analysis concentration and distribution are used to determine the agroforestry clusters while LQ (Location Quotient) is to determine leading sectors in a certain area. The formula is :

$$LQ_{ij} = \frac{X_{ij}/X_i}{X_{.j}/X_{..}}$$

Where,

X_{ij} = Production of crops type J in Madiun Regency

X_i = Total Production of crops in Madiun Regency

$X_{.j}$ = Total Production crops type J in East Java

$X_{..}$ = Total Production of crops in East Java

Interpretation of LQ Value to interpret the analysis result

If LQ Value > 1, shows that there is crops product concentration in Madiun sud-district which is relatively compared to the total in Madiun Regency or there is surplus production in Madiun sub-district and that commodity is basic sector in Madiun Regency.

If LQ value = 1, means Madiun sub-district has segment of crops production activity which equals with total segment in Madiun Regency.

If LQ value < 1, means that Madiun sub-district has relatively small segment compared to crops productivity in Madiun Regency or there is crops deficit in Madiun sub-district while software sttela 10.1 is used to make the model.

RESULTS AND DISCUSSIONS

Geographically, private forest area in Madiun Regency is located on 111° BT-112° BT and 7° LS - 8° LS and directly bordered by Madiun City of which the height is about 335 meter above the sea level. Rainfall is about 0-147 mm per day. The map of private forest locations is on figure 1.

The concentration analysis is done with LQ method. With this analysis, it can be determined whether this kind of private forest management activity is concentrated in a certain area or spread in some areas. The result of LQ data counting on crops production staple crops group such as corn, cassava, rice, in Madiun Regency is shown on table 1.

From this analysis, it can be seen if the type of private forest management activity is concentrated in a certain area or spread in some areas. The projection of LQ counts on staple crops such as corn, cassava, and rice in Madiun Regency from 2011 to 2015.

Determining leading sector dan priority sector

With its prioritized development, the crops commodity is expected to increase the amount of the crops. Eventually, it can increase the income of the society and contribute to the economics in Madiun Regency. The figure of variety development of crops in research area is on figure 2.

To determine the best crops commodity in Madiun sub-district, further analysis is used toward LQ value and SI with quality score technique. From 5 commodities of crops recorded in Madiun regency for 5 years from 2011 to 2015, there are 6 best crops if they are developed, they will give big impact towards the increasing of income of the society around the forest. They are manggo and durian those best commodity can be made as one of priorities of crops commodity development in Madiun regency.

The planting of horticulture plants with material cycle model in the form of planting pattern and planting capital in the research is influenced by the the dimension of planting pattern and

planting capital. The planting pattern in this model is intercropping as large as 1 hectare with 3x1 meter row spacing. The material comes out from this system is crops. This crop is influenced by the age of the plant and the number of the trees on the area. For horticulture plants, the harvest is at the age of 4-11 months based on the age of the plants. The harvest is influenced by the volume of the plant, the percentage of the crops and the type of horticulture plants. The percentage of the crops which is used in this model 100%, and it is done in order to have maximum crops and can be used for other types which have good opportunity in economics at that time.

Crops volume can be predicted by knowing the total plants and the result per stalk so that the volume of cropping gotten from that crop forest area is at the age of 4-11 months. It is predicted to be influenced by type of the plants and the breadth of the area.

The choosing of option for the model used in making recycle in the option influences the level of income of horticulture private forest farmer at the recycling level and the price per kg which is different. The effective income can be obtained if the price of

crops is changed based on the cropping period. The shorter the cropping period, the higher the volume of the crops.

CONCLUSION

Based on the analysis and model towards income in private forest area, it can be seen that: food sustainability can be increased by using horticulture model in private forest management in some sub districts in Madiun regency especially Madiun sub-district which is still potential. Horticulture plants still dominate be planted in forest area and cassava still becomes the priority in the society. The using of stand cluster model in managing the stand needed in following the trend of wood price in the market. The cropping volume affected by diameter and the height of the trees left at the end of recycling. Besides, the price of wood per cubic also influences the income of the farmers from the crops.

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