HORISONTAL AND VERTICAL LAND COVER PROFILE OF AGROFORESTRY SYSTEMS IN GUNUNG WALAT EDUCATIONAL FOREST, INDONESIA

By

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Abstract

Agroforestry system has been adopted in the Gunung Walat Educational Forest, the university forest of the Faculty of Forestry Bogor Agricultural University in the district Sukabumi, Indonesia. The system has shown its effectiveness to reduce illegal logging and forestland encroachment by villagers from the surrounding forest. Due to variation in the intensity of villagers in cultivating their forestland parcel, there were two types of agroforestry (complex and simple agroforestry systems). This study was aimed to describe the vertical and horizontal profile of vegetation in both agroforestry system and the nearby monoculture forest of the same tree species. Primary data was collected in the field including tree and plant dimension and distribution. Secondary data, such as cultivation techniques, harvest time, yield, and income distribution were collected through interview. The results show that complex agroforestry has close characteristic with the monoculture forest with more advantages, especially economic values.

Keyword : land cover profile, agroforestry

Introduction

There are many definitions for agroforestry, one of them is the definition by Nair (1990) who simply define agroforestry as a land use system that combines forest trees with agricultural crops and livestock. There are at least two objectives of establishing agroforestry in forestland, i.e. firstly, establishment of forest which could function optimally for the forestry company (owner of the newly establish forest) and the surrounding villagers. Secondly, to increase the role, the skill, and the ability of the surrounding villagers to utilise and participatively manage the forest (Harisetijono, 1992). In over-populated areas such as in the villages around the Gunung Walat Educational Forest (GWEF), the adoption of

agroforestry system in the forestland is essential to accommodate the need of the surrounding villagers of land without destroying the existing trees. Indeed this strategy has reduced significantly reduced the pressure of the villagers to the forest. This was indicated by the reduction of illegal logging and forestland encroachment.

Agroforestry system was first introduced in the GWEF in 1998 when Indonesia experienced monetary crisis. Many villagers who worked in the nearby cities lost their jobs and return to the village. They do not have sufficient land to cultivate to support their daily life. As a result the GWEF experienced the worst ever illegal logging and land encroachment. About 100 families were than trained and supported by the GWEF management to practice agroforestry under the existing forest trees. Unfortunately, not all of the villagers eager enough to cultivate their land parcel allocated by the GWEF management. Therefore, there are at least to types of agroforestry based on the intensity of land cultivation, i.e. complex and simple agroforestry. Not all area of the forest was converted into agroforestry. Since the forest is originally monoculture forest of various species including *Agathis lorantifolia*, now there are three types of *A. lorantifolia* forest, i.e. monoculture, complex and simple agroforestry under *A. lorantifolia*.

The aims of this study were to describe the profile of monoculture forest of A. lorantifolia, complex and simple agroforestry under *A. lorantifolia*. To predict the effectiveness of the three forestland use systems to prevent erosion and to secure farmers income.

Materials and Methods

The study was conducted at the GWEF with two methods, i.e. primary data collection by observing the number of species and spatial distribution of trees and agricultural crops in the sampling area of the three land use systems. Measurement of tree and plant dimension, including total and branch-free height, stem and canopy diameters, and also relative positions of the trees and plants in the sampling area. Interviews was conducted to obtain secondary data such as cultivation techniques, yields, and selling prices of agricultural crops.

Results and Discussion

The results of the measurement of trees and agricultural crops dimension and distribution are presented in **Table 1**. The areas of the study were relatively close to each other and the *A. lorantifolia* trees are of the same age (planted in 1958). **Table 1** shows that complex agroforestry has higher

number of trees, volume, and total land cover (total canopy of trees and agricultural crops, including those overlaped to each other) compared to simple agroforestry, but lower than that of monoculture forest. Agroforestry complex has a total land cover of above 100% the same as monoculture forest meaning land cover was intensive. However, the complex agroforestry has more commercial species (agricultural crops) and higher tree diameters (also implies it has higher stem volume per tree) compared to the other two-land use systems.

Table 2 shows that vertically complex agroforestry has more strata than the other two land use systems. With land cover of more than 100% and strata more than 2, the complex agroforestry was expected to be an effective system to protect soil from erosion. Indeed the total land cover of monoculture forest was more than 100%; unfortunately the second stratum was shrub only which have not had economical values.

From the interview conducted to the farmers cultivating complex and simple agroforestry systems, it was found that in the complex agroforestry there was a continuous monthly income from the agricultural crops. By contrast, in the simple agroforestry the income was discrete, i.e. only in certain months when there was a harvest of a certain crop. In monoculture forest, if timber is regarded as the main product, definitely there was no immediate product before the timber was harvested. As an alternative product for *Agathis* was the resin. However, it took 10-15 years before the resin could be tapped from the tree.

Tabel 1 Trees and agricultural crops dimension and spatial distribution in the sampling area

No.	Land use systems	Tree/plant species	Average					
			Number of individual/ha	Diameter (cm)	Total Height (m)	Branch-free Height (m)	Volume (m3)	Total land cover (%)
1.	Complex agroforestry	*Agathis*	77	52,2	26,4	18,6	84,7	112,5
		Schima	77	37,3	24,3	17,7	34,5	
		Cardamon	188					
		Cassava	547					
		Banana	156					
		Coffee	156					
		Tumeric	133					
		Salaca	234					
2.	Simple agroforestry	*Agathis*	56	51,2	26,3	15,3	46,8	35,7
		Schima	562	38,9	24,3	14,6	52,5	
		Cassava	2500					
		Ground nut	2813					
		Soybean	-					
3.	Monoculture forest	*Agathis*	533	43,4	26,3	19,5	340,9	151,7

Table 2 Vertical profile of vegetation in complex and simple agroforestry, and in monoculture forest.

Land use systems	Strata	Tree/Plant species
Complex agroforestry	1	Agathis and Schima
	2	Banana and Salaca
	3	Cardamon, Cassava, and Coffee
Simple agroforestry	1	Agathis and Schima
	2	Cassava, Ground nut, Soybean
Monoculture forest	1	Agathis
	2	Shrubs

Conclusion

From this study it could be concluded that complex agroforestry has better vertical profile than monoculture forest. Total land cover (horizontal profile) of the complex agroforestry was above 100% similar to the monoculture forest. Complex agroforestry is a good land use system to protect the environment and to secure income of farmers.

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