ANALYSIS OF LABOR ALLOCATION AND INCOME CONTRIBUTION OF AGROFORESTRY SYSTEMS TO THE FARMER HOUSEHOLDS AT GUNUNG WALAT EDUCATIONAL FOREST

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Introduction

Before 1997's economic crisis in Indonesia, local people surrounding the Gunung Walat Education Forest (GWEF) lived mainly from farming activities on their own land and non-farm activities outside their villages, such as mining labor, construction labor, etc. Private land was managed by local farmers in form of rice field and gardens. Economic crisis - and then political crisis in Indonesia- have caused the leaping of prices which then drive the local people surrounding the GWEF to encroach the forest area to fulfill their need especially for staple food. So that the local farmers cleared forest area and planted rice, cassava, corn, etc. Now various farming systems have to be managed by the farmers to fulfill their household needs. It means that the farmer household must allocate their time and labor force more than before the economic crisis.

Introduction of agroforestry project by Faculty of Forestry, IPB- as manager of the GWEF, and being funded by Korea for restoration of forest condition involved the local encroaching farmers, needed bigger portion of local farmers' working time and number of labor for the project. Experience in the past showed that farmers allocated their working time and labor for a project only as second priority after their own land and other main activities. To avoid an overburden to the farmers which could cause the failure of the project and to increase the interest of farmers into the project, the existed farming system especially agroforestry systems and labor allocation of farmer household including the income contribution from various agroforestry system should be studied.

Objectives

1. To identify the types of existing agroforestry system in the GWEF and surrounding villages
2. To calculate farmers' labor allocation and time allocation for existing agroforestry systems maintenance
3. To analyze the income contribution of existing agroforestry systems into the total household income
4. To analyze the correlation between agroforestry farming area with number of labor and working time allocation.

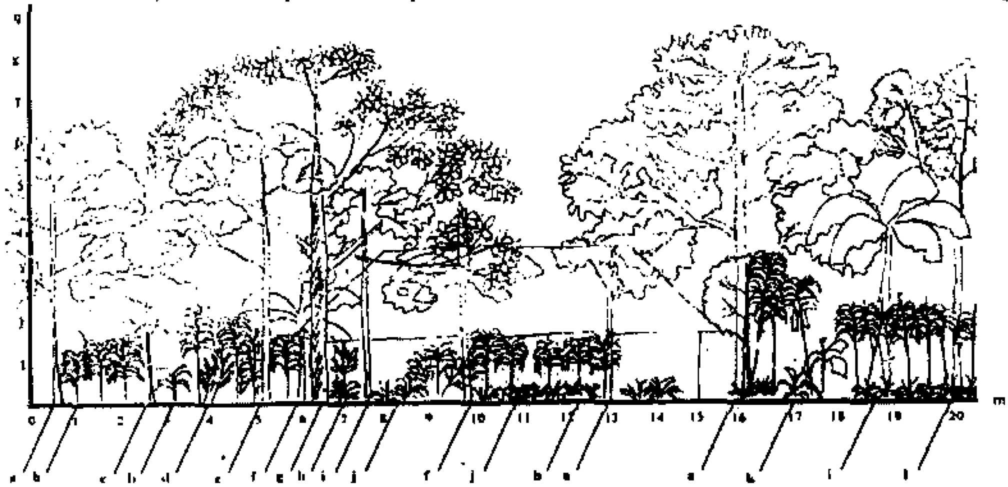
Methodology

This study used survey method. Sample of farmer households were selected randomly. Number of sample was 60 households or about 24 % of total number of encroaching farmer households in GWEF. Primary data were collected through interview using structured and unstructured questionnaires and secondary data were collected from various relevant institutions. The study was conducted on February until May, 2002.

Results and Discussion

Existing Agroforestry Systems in the Study Site

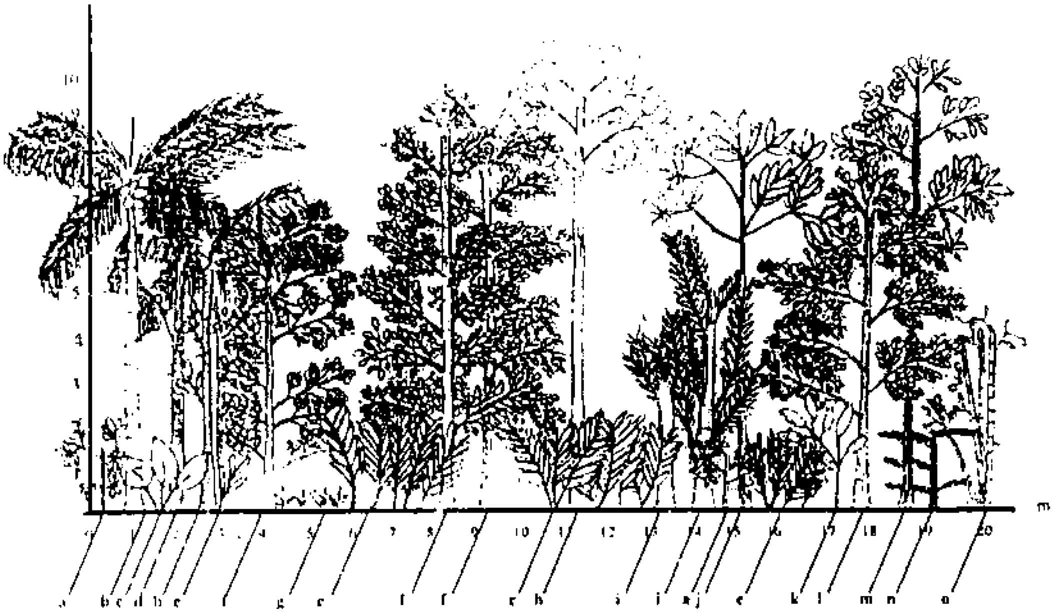
Most of encroaching farmers in GWEF practiced traditional agroforestry system in their own field, in the form of home gardens and traditional mixed gardens. At the forest area of GWEF, farmers planted upland rice and established traditional mixed gardens.



Legend: a. Nephelium lapaceum; b. Cordelia terminalis; c. Coffea sp.; d. Amomum cardamomum; e. Pithecellebium jiringa; f. Musa sp.; g. Arthocarpus heterophylla; h. Codeaum variagatum; i. Durio zibethinus; j. Ananas comusus; k. Ploemele angustifolia; l. Avocado sp.

Figure 1. Profile of Typical Home garden in the Villages Surround GWEF

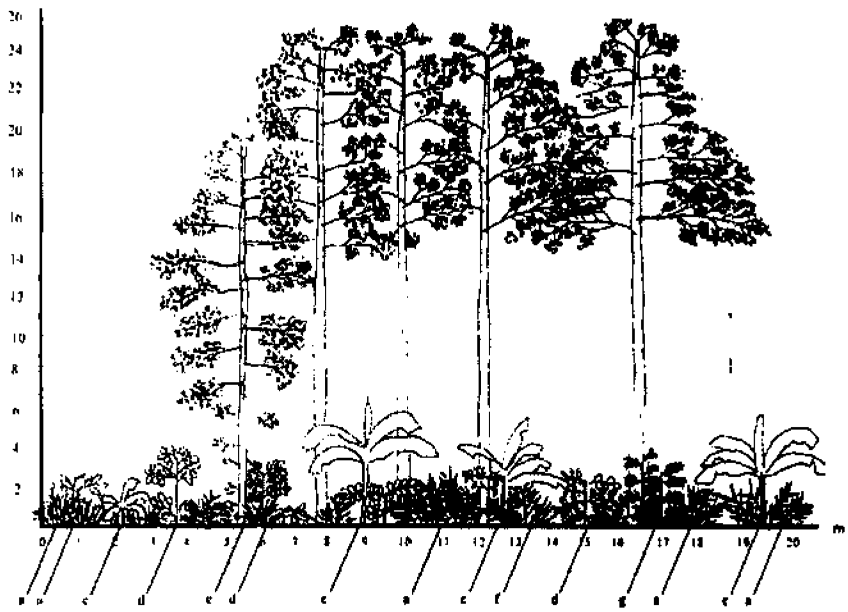
Common species planted in the home gardens were fruit trees such as rambutan (*Nephelium lapaceum*), jack fruit (*Artocarpus indicus*), durian (*Durio zibethinus*); ornamental plants such as hanjuang (*Cordiline terminalis*), suji (*Ploemele angustifolia*), puring (*Codeanum variagatum*) and food crops such as cassava (*Manihot esculenta*) and taro (*Colocasia esculentum*). Profile of typical home garden in the study site is showed in Figure 1. Beside fruit trees and agriculture crops the farmers commonly planted wood species such as sengon (*Paraserianthes falcataria*), suren (*Toona surensii*) and puspa (*Schima walichii*) in the mixed gardens. Profile of typical mixed garden in private land is presented in Figure 2.



a. Manihot esculenta
b. Colocasia esculentum
c. Cocos nucifera
d. Paraserianthes falcataria
e. Amomum cardamomum
f. Myristica fragrans
g. Ananas comosus
h. Garcinia mangostana
i. Arenga pinata
j. Toona sureni
k. Cocoa sp.
l.. Schima walichii
m. Durio zibethinus
n. Coffea sp.
o. Bambusodeae sp.

Figure 2. Profile of typical mixed garden in private land of study site

In the forest area of GWEF cassava, taro, coffee, banana and cardamom (*Amomum cardomum*) were planted under already existed stands of damar (*Agathis loratifolia*) and mahogany (*Swietenia macrophylla*). Profile of typical mixed garden in the GWEF located on the study site is shown in Figure 3.



Legend:
a. *Amomum cardomum*
b. *Coffea Robusta*
c. *Musa* sp;
d. *Swietenia macrophylla*
e. *Agathis lorantifolia*
f. *Colocasia esculentum*
g. *Manihot esculenta*

Figure 3. Profile of typical mixed garden in the area of GWEF

Number of species in the mixed garden was the lowest compared to number of species in home garden and mixed garden in private land surround GWEF. Most of plant species in the mixed garden were also existed in home garden and mixed garden in private land, except for Agathis and Swietenia which are original tree species of the GWEF (see Table 1). It means also that the farmers planted only well known plant species in the GWEF which. Most of plant species planted in the GWEF was annual crops. Coffee was considered as cash crop which could be harvested in shorter time than woody trees. Uncertainty of farmers' land use right in the GWEF was the reason why farmers planted annual crops rather than highly valuable woody trees.

Number of plant species in the mixed garden on private lands as well its standing stocks were the highest. Valuable woody tree species also existed, such as *Paraserianthes falcataria, Schima walichii* and *Toona sureni.* That means farmers knew well and willing to plant woody tree species which is important for the aim of forest restoration project.

Table 1. Species and Standing Stock of Home garden, Mixed Garden at private land and at the GWEF according to Height Stratum

Height (m)	Species	Number of tree		
		Home-garden ($500\ m^2$)	Mixed garden at private land ($1000\ m^2$)	Mixed garden at GWEF ($1000\ m^2$)
< 3	Pineapple (*Ananas comosus*)	13	15	-
	Hanjuang (*Cordiline terminalis*)	2	-	-
	Puring (*Codeaum varigatum*)	10	-	-
	Cardamom (*Amomum cardamomum*)	7	40	40
	Cassava (*Manihot esculenta*)	1	17	20
	Coffee (*Coffea robusta*)	-	6	15
	Mahagoni (*Swietenia macrophylla*)	6	-	20
	Taro (*Colocasia esculentum*)	-	5	25
	Cocoa (*Cocoa sp.*)	-	5	-
3 - 6	Banana (*Musa* sp.)	8	17	10
	Rambutan (*Nephelium lapaceum*)	3	-	-
	Jengkol (*Pithecellebium jiringa*)	1	-	-
	Nutmeg (*Myristica fragrans*)	-	6	-
	Aren (*Arenga pinnata*)	-	3	-
> 10	*Damar* (*Agathis lorantifolia*)	-	-	15
	Jackfruit (*Arthocarpus heterophylla*)	1	-	-
	Avocado (*Avocado sp.*)	1	-	-
	Durian (*Durio zibethinus*)	2	7	-
	Cocos (*Cocos nucifera*)	-	4	-
	Jeunjing (*Paraserianthes falcataria*)	-	7	-
	Manggis (*Garcinia mangostana*)	-	2	-
	Suren (*Toona sureni*)	-	3	-
	Puspa (*Schima walichii*)	-	6	-
	Bamboo (*Bambusoideae sp.*)	-	6	-
	Total	68	149	145

Labor Allocation

Table 2 showed that average area of home garden owned by a farmer was about 0.04 ha. To manage the home garden the farmer needed 23 man days per year or 572.7 man days/ha/years. Average area of mixed garden owned by farmer was about 0.25 ha which needed 30.5 man days per year or 121.8 man days/ha/year. In the GWEF, encroaching farmers occupied about 0.3 ha which needed 74 man days per year or about 246.8 man days/ha/year.

Table 2. Average land ownership and labor allocation according to type of agroforestry system

Type of AF System	Land Ownership (ha)	Labor Allocation (man days/years)
Home garden	0.04	23.0
Mixed garden in private land	0.25	30.5
Mixed garden in GWEF	0.30	74.0
Total	0.59	127.5

Activities conducted by farmers to manage their farming were land preparation, planting, weeding, fertilizing, harvesting and post harvesting. Because average number of family labor was only 3 people (father, mother and 1 child), thus to manage their farming, labor needed to be hired, especially during land preparation activity.

Income Contribution

Average land ownership of the farmers was very low (see Table 1), therefore besides farming they seek other occupation to fulfill their household needs. Other income sources were from paddy field, labor at agriculture field, construction labor, petty trading and home industry. From the home garden the farmers could get income about Rp 376,590/year or about US $ 41.84, from traditional mixed garden Rp 878,700/year or US $ 97.63/year and from the forest area they could get income only about Rp 469,190/year or about US $ 52.13/year. Total income from the agroforestry system was Rp 1,724,480/year or US $ 191.6/year.

Income contributions of home garden, traditional mixed garden at private land and mixed garden at forest area were 6 %, 14 % and 7.5 % respectively. Total income contribution of agroforestry system to household income was about 27.5 %. The low income contribution of agroforestry system practiced traditionally by farmers showed that their agroforestry systems should be improved to get highly economical benefit and ecologically, so that the welfare of the farmers could be increased.

Table 2. Income Contribution of Agroforestry Systems

Source of Income	Average Income (Rp/year)	Income Contribution (%)
1. Agroforestry System:		
a. Home garden	376,590	6.0
b. Mixed garden in private land	878,700	14.0
c. Mixed garden in GWEF	469,190	7.5
2. Paddy field	1,917,430	30.6
2. Non-agriculture sector	2,624,510	41.9
Total	6,266,420	100.0

Conclusionss and Recommendation

Conclusionss

a. Farmers surrounding the GWEF practiced home garden and traditional mixed garden in private land and in the forest area of GWEF.
b. Farmers planted mostly known annual crops in the GWEF.

c. The existence of valuable tree species in their private mixed gardens showed that farmers knew well forest tree species and willing to plant woody trees.
d. Farmer household tend to allocate their labor to manage their mixed garden in the GWEF implied high needs of income and food from outside resources.
e. Even though contribution of agroforestry systems into household income was still low, that contribution was very meaningful for farmer household.

Recommendations

a. Traditional agroforestry practiced by local farmers in the private land as well as in the forest area of GWEF should be improved to increase its contribution to the farmer household income
b. Introduction of improved agroforestry system is necessary to improve farmer knowledge
c. Introduction of agroforestry product processing could strengthen farmer income generation.

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