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THE DIFFUSION PROCESS OF PLANTING *Grevillea robusta* AMONG RURAL HOUSEHOLDS IN NORTH-CENTRAL TANZANIA

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ABSTRACT This paper aims to understand the characteristics of planting *Grevillea robusta*, a popular exotic tree in east Africa, and to know the conditions stimulating its diffusion process among rural households, taking as an example north-central Tanzania. It makes clear that the process was promoted by various time-specific incentives and motivations, such as introduction of coffee growing, need for securing right on the farm during the villagization, enforcement of new agricultural policy, and free distribution of seedlings. The paper emphasizes the importance of multilateral perspective to understand diffusion process of tree planting, from the viewpoint of people's responses to secure and maintain their livelihood in the process of rural change.

Key Words: Tree planting; *Grevillea robusta*; Diffusion process; Villagization; North-central Tanzania.

INTRODUCTION

I. Background

In semi-arid central Tanzania, rural people maintain exotic trees on their holdings in various forms. This practice was generally started only a few decades ago, and is a new phenomenon compared to that in the humid highlands. In some cases the governmental forestry extension programs affected the practice and its diffusion process in points of seedling distribution and technical guidance. With regard to the issues of forest resource management and afforestaion in the central area, the Tanzanian government has been warning that "deforestation" is going on, especially in the Dodoma and Arusha regions, and that the "firewood shortage" is getting more serious in many rural areas (Government of Tanzania, 1977; Nilsson, 1986). At the same time it has been encouraging rural people to plant more trees on their holdings, through the "National Village Afforestation Program." Based on the "firewood shortage" approach, the program has been producing tree seedlings and distributing them to rural households (Kilahama; 1988). In this context, the practice of planting trees and their utilization by the rural people is regarded as their direct response to the ongoing process of deforestation, and to the "rising crisis of firewood shortage." But in the north-central areas, tree planting has expanded in recent decades when the forest degradation did not occur and the "firewood shortage" was not serious (Yasu, 1998). This implies that there were other elements in the background which stimu-

lated people to plant more trees and to maintain them on their holdings. Taking as an example a village in north-central Tanzania, this paper aims to make clear those elements of the background which promote tree planting among the rural households.

As Arnold points out, the practice of tree planting by the rural people can be understood as their response to dynamic rural changes, which is due not only to the decline of forest product availability but also to the raising risks in their rural lives such as soil erosion and instability of income, labor and land tenure. Trees are essentially multi-purpose items and the practice of tree planting is regarded as one of the strategies to maintain their security of livelihood (Arnold, 1995). Although the forestry sections of the Tanzanian government have concentrated upon the afforestation of bare land and distribution of tree seedlings in the rural area, its actual achievements are far lower than the target levels, which was supposed to be less than 10% of the projected area in the whole country (Government of Tanzania, 1989). Concerning this problem, the preceding studies and reports have pointed out the problems with regards to the institutional and technical aspects of tree planting projects (Kihiyo, 1991; Kilahama, 1988; Mnzava, 1983). These studies do not touch the issue of why people do or do not plant trees in a local situation under the project's intervention, which I think is essential to understand the issue of tree planting in the rural areas. According to the ethnobotanical survey of trees and shrubs in Tanzania, many indigenous and exotic species are distinguished by the various uses for woods and symbols and maintained in the traditional homesteads and farms (Mbuya et al., 1994). As is indicated in the survey, the relation between human life and trees is "various," that is, not limited to be the relation of supply and demand on wood resources, but includes also some socio-cultural aspects of their rural life.

II. Purpose

Planting of *Grevillea robusta* and its utilization in the households is observed in

Table 1. Bonga village

Altitude		1,100～1,300meters		
Annual rainfall		790mm*		
Area		15.2km^2		
Population (1993)**		2,609		
Population density		172/km^2		
Number of households		507		
Number of livestock (1993)		1,517		
		Cattle 842, Goats 578, Sheep 97		
Average area of holdings per household		1.67ha	Homestead	0.43ha
			Farmland	1.24ha
Main crop	Homestead farm	Maize, Pigeon pea, Banana, Cassava, Coffee		
	Farmland	Maize, Piegon pea, Beans		

* Recorded at Babati district office

** Data of the neighboring two villages are as follows:

Village	Population	Households	Livestock
A	2,891	376	1,533
B	2,001	339	1,943

most villages in the southern part of Arusha region, i.e. the Babati, Hanan, and Mbulu districts (Johansson, 1992). *G. robusta* is one of the most popular exotic trees among those introduced in recent decades, which makes an interesting case for the study of tree planting in this area. It was introduced in the 1950s with the immigration of coffee farmers from the Kilimanjaro area (Talle, 1991).

In Bonga village, a center of rural administration in the southern part of Babati district (Fig. 1; Table 1), planting of *G. robusta* was introduced in the earliest time and expanded on a large scale. As a typical case, explaining its background clearly presents a perspective for understanding the diffusion process of tree planting in other parts of the Arusha region, and also in the wider area of central Tanzania.

The earlier stage of the diffusion process was focused on in a previous paper, the background of the people's adoption of *G. robusta* in the mid 1970s was analyzed. It

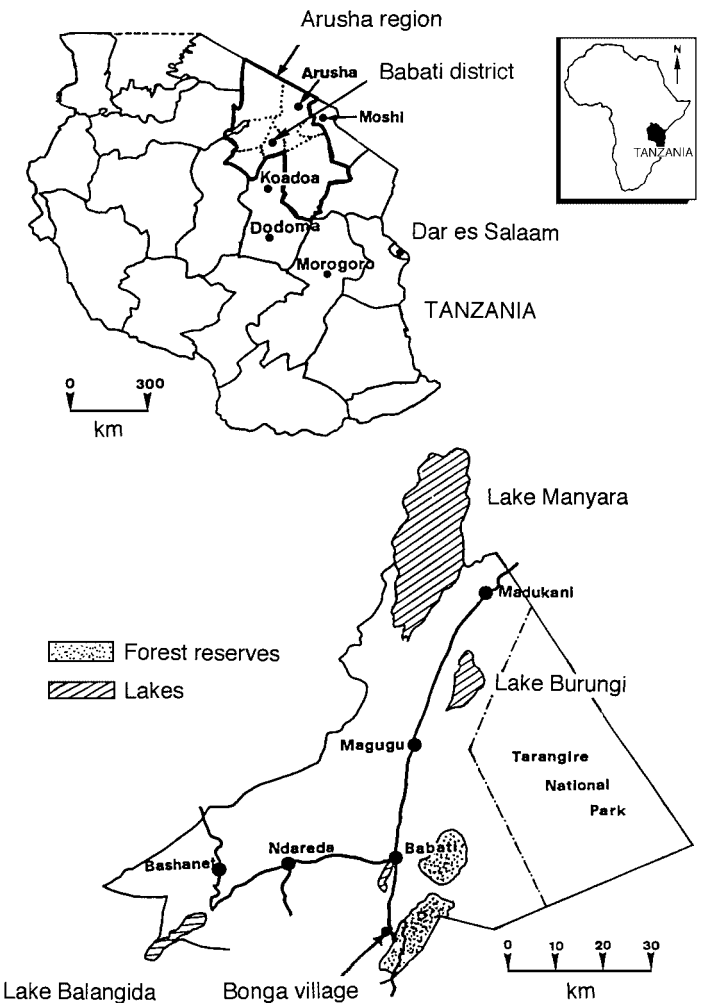

Fig. 1. The study area.

was clear that to plant *G. robusta* on the boundary of homestead farms functioned well to secure their rights of occupancy on farms in the confusing situation which was brought about by the villagization program from 1974 to 1981 (Yasu, 1999). Villagization in the 1970's operated by the government aimed to build a village by moving people into target areas which would become units of receiving public services and achieving agricultural modernization (Miti, 1982). Although the situation ended with the program, planting of *G. robusta* further expanded after 1980 to most of the households in the village. This process means that along with the land matters other factors were raised to promote expansion of *G. robusta* planting.

This paper makes clear the backgrounds of the diffusion process before and after the villagization program. Taking together the findings on various diffusion stages, a viewpoint is presented which attempts to understand the whole diffusion process of tree planting, relating to the multi-sided rural changes which occurred during the process.

III. Method

In the field research, 110 households which is about 20% of the total households in Bonga were selected at random, in order to understand the general situation of landholding and tree management. Further, 30 households which belong to the higher rank in the total number of planted trees were selected from the 110 households, in order to discover the details of tree management and household economy. While the average number of planted trees in the 110 households was 29, these 30 households averaged 67 trees. They were selected because the is supposed that the practices of tree planting in these households indicates their needs and motivations more clearly than those of the households belonging to the lower rank. The data shown in the figures and tables in the following chapters were obtained from interviews and inventory surveys in these households, and from interviews of the persons of authority in the village. Table 2 indicates the times of obtaining a homestead farm and starting to plant trees of the 30 households. Seven households obtained land before the villagization program. They were permitted by the village authority to retain their homesteads and farmlands. Sixteen households obtained land during the villagization program. These householders were given the right of homestead farms by the authority. Seven households obtained land after the villagization program. They bought the homestead farms from people who moved out from Bonga, or were given the right of unused land by the authority. In any case, these 30 households belong in the higher rank among 110 households in respect to the number of planted *G. robusta*, regardless of their times and circumstances of obtaining homestead farms.

GENERAL BACKGROUND OF RESEARCH AREA

I. Babati District

A working paper entitled "Land and tree tenure in Babati district" by Aud Talle

Table 2. Thirty Surveyed Households

Number*	Year of obtaining homestead farm	Area of homestead farm (ha)	Starting year of tree planting	Total of planted trees
1	1930	0.41	1963	68
2	1954	0.30	1987	48
3	1956	1.20	1975	***
4	1960	1.14	1978	32
5	1965	0.56	1982	128
6	1965	0.67	1982	72
7	1971	0.21	1984	30
8	1974**	0.32	1974	27
9	1974	0.55	1976	75
10	1974	0.53	1980	101
11	1974	0.50	1980	72
12	1974	0.53	1984	129
13	1974	0.24	1985	59
14	1974	0.43	1988	57
15	1977	0.30	1977	46
16	1977	0.24	1977	32
17	1977	0.31	1978	132
18	1977	0.30	1978	108
19	1977	0.23	1979	124
20	1977	0.53	1984	125
21	1979	0.19	1981	44
22	1980	0.17	1983	45
23	1980	0.50	1985	34
24	1982	0.16	1982	68
25	1984	0.28	1984	104
26	1984	0.24	1986	119
27	1985	0.24	1986	105
28	1986	0.31	1987	81
29	1986	0.24	1988	85
30	1987	0.56	1989	68

* Arranged by the year of obtaining homestead farm.
** 1974～1981 Period of villagization.
*** Household No. 26 planted trees in and around the whole area of homestead (1.2ha), in which there are more than 500 planted trees.

gives us good overview of the Babati area. The following description is a summary of what is written about the characteristics of the district in that paper (Talle, 1991).

Babati district is located in the northern part of central Tanzania, which the Great Rift Valley passes through from north to south. It covers approximately 6,000 km^2, including highland and lowland areas. The altitude ranges from about 1,000 m in the northern and eastern parts of the district to above 2,000 m in the western and central parts. Average annual rainfall in Babati township is 790 millimeters, although it differs greatly with altitude. There are four forest reserves in the Babati district (Ufiomi, Nou, Bereko and Haraa) which cover 12% of the total area. The cultivation and grazing areas cover 65%, and the remaining 23% is the area of lakes and townships, etc. Babati district is administratively divided into four divisions, 21 wards, and about 85 villages of different sizes.

According to the 1988 census, Babati district had approximately 208,000 people,

giving the area an average population density of 35 inhabitants per km^2. Immigration into the Babati district from densely populated areas such as Arusha and Moshi, and from drier areas of central regions as Dodoma and Singida, has been increasing in the last few decades. Immigration in the 1970's was especially remarkable, and as a result the population is expected to reach 350,000 by the year of 2000.

Various ethnic groups of differing culture and language are living in the Babati district. The majority of the population, the Iraqw and Gorowa, speak a Cushitic language; the pastoral Maasai and Barabaig speak two different Nilotic languages; the Sandawe have a click language; and Bantu languages are spoken by the Mbugwe, Chagga, Rangi, and Nyaturu. There are also some hundred families of Somali and Indian origin living in the district, and European missionaries.

In addition to linguistic and cultural diversity, these ethnic groups also practice different systems of production ranging from nomadic livestock keeping to mechanized farming. The most prevalent system among the small-scale households in the district is agro-pastoralism, practiced in different forms. The farmers combine the cultivation of food crops, such as maize and millet, with livestock keeping. Most of them also cultivate some kind of cash crop. Approximately 70% of cultivated area in the district is plowed by tractor, making Babati one of the most mechanized farming areas of the country.

II. Bonga Village

1. Villagization in Bonga

Bonga village is located 18km south of Babati town. The road from Arusha to Kondoa passes through the center of Bonga. On the east side of the road, the homesteads and small-scale farms are located on the gentle slopes of small hills stretching from north to south. On the west side, the households farmlands are cultivated in maize, pigeon pea, finger millet, and so on (Fig. 2 [2]).

The major changes of land use practiced in Bonga were brought about by villagization in 1974, which stimulated the introduction and expansion of tree planting. Before the villagization, the Bonga area was a frontier for the Gorowa people, who immigrated from north with their cattle, and for the Rangi people from the south Kondoa district. Land in the Bonga area was abundant as well as fertile for their settlement. At that time any settlers were able to occupy land for their holdings almost freely, without particular restrictions by the rural authority. Each homestead and farmland was mainly scattered in the areas of "A," "B," and "C1" indicated in Fig. 2 [1], which formed a completely different landscape from that of today's Bonga. The prevalent system of production was agro-pastoral, which combined staple crop cultivation of sorghum, millet, and maize with the grazing of large amounts of livestock. As the population density was much lower than the present and land was abundant, the problems concerning land use and forest resources in this area, such as boundary disputes, soil degradation, erosion, and fuelwood shortage did not arise during this period.

Villagization aimed to built a "village" which could be an unit for conducting the Tanzanian "Ujamaa village" policy. Although its ultimate purpose was to build an "Ujamaa village" which had a system of communal agricultural production in it, the

actual necessity and background to build a "village" were largely different in each region and district. For example, in the Dodoma region, where people had suffered frequently from drought and famine for a long time, the villagization mainly aimed to increase food production by facilitating "communal" cultivation. On the other hand, the villagization in Iringa and the southern part of the Arusha region aimed at

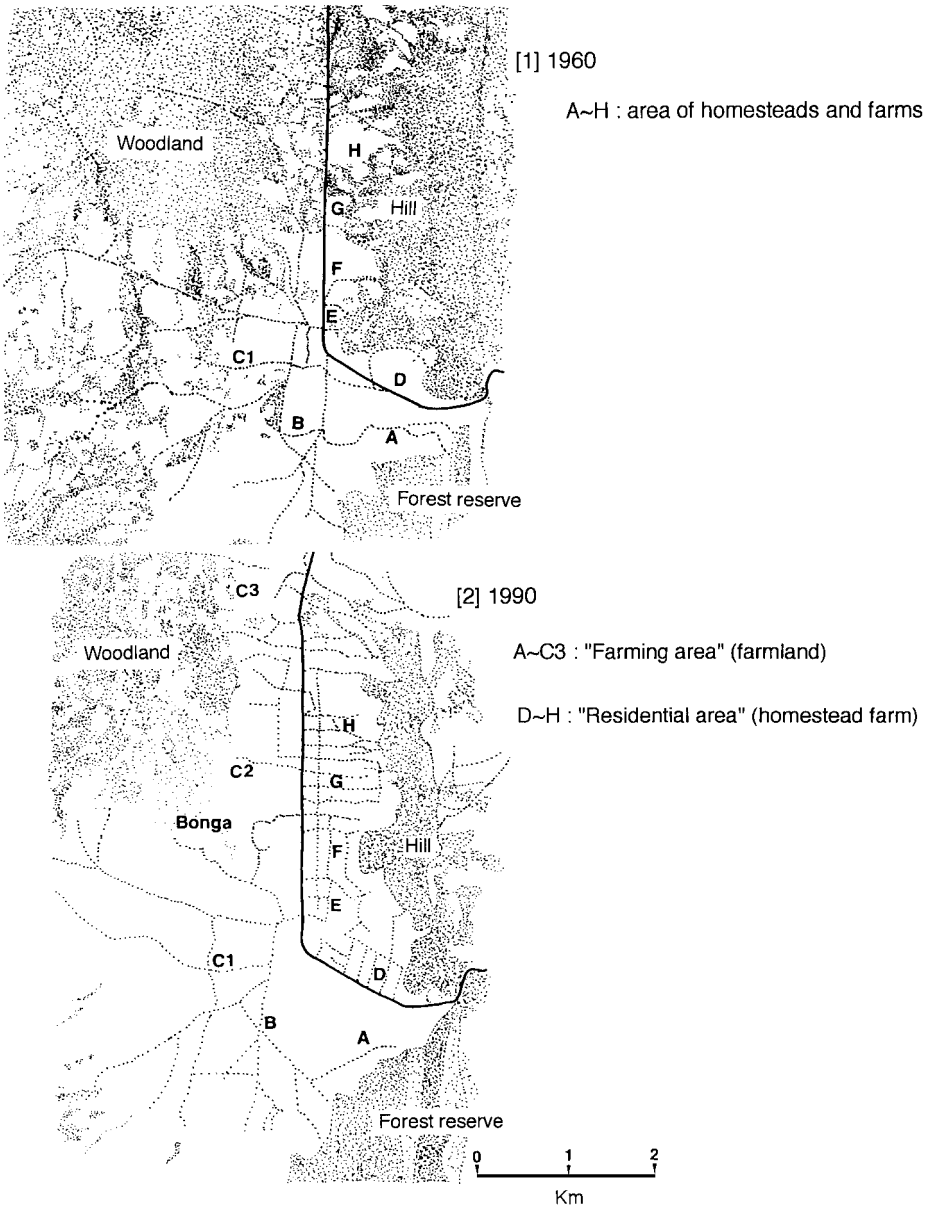

Fig. 2. The Bonga area (traced from an aerial photograph)
[1] abobe: 1960 [2] below: 1990

land consolidation to confiscate large-scale farmlands which had been accumulated by rich peasantry, and to redistribute them to small-scale cultivators. Thus the villagization in these areas has largely changed the existing pattern of residence and holdings (Government of Tanzania, 1994).

In the Bonga area the villagization was carried out in 1974. In the process, the degree of governmental intervention was different in each village. As Bonga is located in the center of local administration of a ward ("kata ya Bonga") and division ("tarafa la Gorowa") in southern part of Babati district, the intervention was far more thorough than that of other villages located in the remote areas. Some 500 households and their people were brought together from neighboring small communities into an area of approximately 15km^2 (Table 1). According to the new land use planning, the village area was divided into two parts, "residential" and "farming" (Fig. 2 [2]). Each household was given by the village authority the right of occupancy of homestead in the residential area, and of farmland in the farming area. Homesteads consisted of small plots for residence and neighboring farms (hereafter this type of farm is called a "homestead farm" in contrast with "farmland" in the farming area).

2. Consequences of villagization

During and after the villagization program, the immigration into Bonga continued from the northern regions of Arusha and Kilimanjaro which were densely populated areas, and from the southern districts of Kondoa and Dodoma, which frequently suffered from soil erosion, dry weather, and food shortages. As a result, the population of Bonga has been increasing strikingly since 1980, amounting to over 2,500 in 1993. Population density reached 176 inhabitants per km^2 in the same year, which is definitely higher than that of less concentrated villages neighboring Bonga. Although there are no census records with regards to ethnic groups, it is generally said that the percentage of Gorowa and Rangi people are 30% and 40% respectively, and remaining 30% is made up of other smaller groups who immigrated from various regions.

"Ujamaa and Ujamaa village policy" (1975) officially gave the village council the authority to control resource use such as land clearing, gathering, grazing, and cutting in the woodlands and bush, and drawing water from natural springs. According to the "policy," the rules to control utilization of these resources should be determined under the authority of village council. Actually, in most cases it depended on the existing customary rules in the community. In the Bonga area, these were basically access free. Under this regime, the principle of "uwezo" ("ability" in Swahili) was prevalent, which allowed one to occupy whatever size of land and use it in whichever way he liked, according to his own ability (Talle, 1991). However, owing to the concentration of residence and farmland after the villagization, the access-free regime was completely restricted, especially in the residential area. Besides this, as livestock keeping was restricted after the villagization program, the prevalent system of production become the cultivation of staple crops such as maize and pigeon pea. Maize is the main domestic food crop for "ugali," while pigeon pea is produced as a commercial crop exported to India. After the expansion of pigeon pea, the temporary cultivation in farmlands became permanent. After 1990, most of the farm-

lands have come to be cultivated by the tractor. These changing situation of land tenure and cultivation situations are thought to relate closely to the introduction and expansion of tree planting by the households. This will be examined in the following chapters.

THE PRACTICE OF TREE PLANTING AND ITS DIFFUSION PROCESS

I. The Practice of Tree Planting

In Bonga, planting of trees by individual households started to diffuse immediately after the villagization program. In this section the practices of planting and tending trees in the homestead farms are described.

1. Species and scale of tree planting

A remarkable feature of the tree planting in Bonga is the planting of *G. robusta. Grevillea robusta* A. CUNN., of east Australian origin, was brought to the Bonga

Table 3. Total number of trees planted on the homestead farm

(n=29)**

Tree species	Number of planted trees (%)			
	Boundary	On the farm	Around the house	Total
Grevillea robusta	1,189 (64.6)	503 (27.3)	149 (8.1)	1,841 (100)
Cassia siamea	124 (87.9)	13 (9.2)	4 (2.9)	141 (100)
*Cordia africana**	22	19	2	43
*Commiphora africana**	35	—	—	35
Gmelina arbolea	11	12	—	23
Leucaena leucocephala	5	10	3	18
Jakaranda mimosifolia	12	—	6	18
■*Psidium guajava*	2	8	4	14
■*Mangifera indica*	4	5	5	14
Eucalyptus camaldulensis	10	—	2	12
■*Citrus sinensis*	—	8	4	12
Widdringtonia whytei	—	5	6	11
■*Persea americana*	—	4	6	10
■*Morus sp.*	3	2	2	7
■*Annona squamosa*	2	1	2	5
■*Artocarpus sp.*	—	4	—	4
■*Syzygium cuminii*	1	1	2	4
Azadirachta indica	1	—	2	3
■*Citrus lemon*	—	—	2	2
Peltpholum pterocarpum	—	—	1	1
Total	1,421 (64.1)	595 (26.8)	202 (9.1)	2,218 (100)

■Fruit tree * Indigenous tree ** This table excludes household No. 26 which planted more than 500 trees in homestead farm.

Number of planted trees per household

	max.	min.	mean
total	132	27	76
G. robusta	127	25	63

area by the immigrant farmers from the Kilimanjaro area in the 1950s, as a shade tree for coffee growing. Because it is adaptive to a wide range of natural conditions, and its regeneration and tending is easier than those of other indigenous trees, seedling production of *G. robusta* was already started in the Babati forestry office for sale in the 1960s. In Bonga tree planting by individual households has expanded only in and around the homestead farm in the residential areas, while there are few trees in the farming area. Table 3 summarizes the species and total number of planted trees. As is common in other rural areas, a few fruit and ornamental trees are planted around the house. Also there are hedgerows of indigenous trees, such as Euphorbia and Commiphora in some homesteads. The indigenous *Cordia africana* suitable for carving furnitures, is planted on the corner or inside of homestead farm (Fig. 3 [1]). These practices were common also before the villagization program.

A new practice which spread after the villagization is boundary planting of *G. robusta*, *Cassia siamea*, and other fast-growing species in the homestead farms. Among these species, the number of planted *G. robusta* was far larger than others. Although the total number of planted trees in individual households varies from 20 to 130, more than 70% of the planted trees in a household are *G. robusta*. In some households with over 100 *G. robusta*, the trees are concentrated on the boundaries with spacing of two or three meters, which forms a hedgerow surrounding the whole area of the homestead (Fig. 3 [2], Fig. 4 [1] [2]).

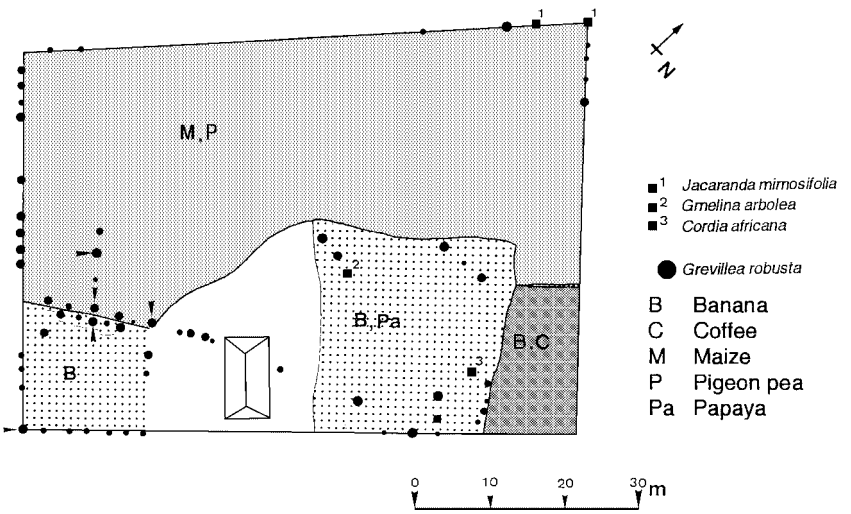

Fig. 3. [1] An example, of tree planting on a homestead farm (Household No. 1)

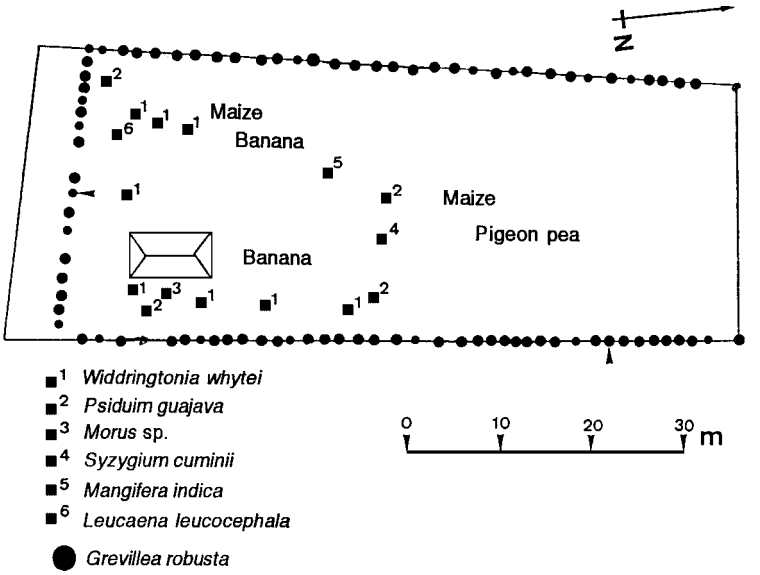

Fig. 3. [2] An example of tree planting on a homestead farm (Household No. 27)

Fig. 4. [1] *G.robusta.* (7-8 Years)

Fig. 4. [2] Planting of *G. robusta* on a boundary of homestead farm. (Household No. 27)

2. Growing seedling, planting, and tending of G. robusta

Management and utilization techniques of *G. robusta*, such as growing naturally generated seedlings, planting, tending, and utilization has been established in Bonga during past twenty years. *G. robusta* starts to blossom and bear fruit from the seventh or eighth year after planting. When the rainy season ends, the seedlings naturally regenerate. In June, they are transplanted in a polyethylene tube to be cultured until the following rainy season (Fig. 5). Seedlings are normally planted in the mid rainy season, when it comes to rain continuously. The time of planting should not be too early or late because the sapling must utilize the maximum rainfall for its initial growth, in order to survive the following longer term of the dry season.

For a few years after the planting, weeding in the rainy season and watering and fencing in the dry season are often necessary. From the seventh or eighth year after planting, *G. robusta* needs pruning every two or three years, when the average height reaches between 12 and 15 m (Fig. 4 [3]). In the tenth year, the tops of *G. robusta* are cut off to make the stem pudgy enough to be felled for timber. Although it depends on the growth of the individual tree, it is suited for felling from the fifteenth year on average. After the felling, the roots are dug up and new seedlings are planted.

II. Households' Motivations and Their Backgrounds for Adopting *G. robusta* in Different Diffusion Stages

From a practical viewpoint, households probably plant *G. robusta* to provide timber for their needs, a normal reason for planting trees. Now we will consider how their need for *G. robusta* timber arose, and what kind of incentives and local backgrounds affected its adoption by the households. As Arnold points out, the practice

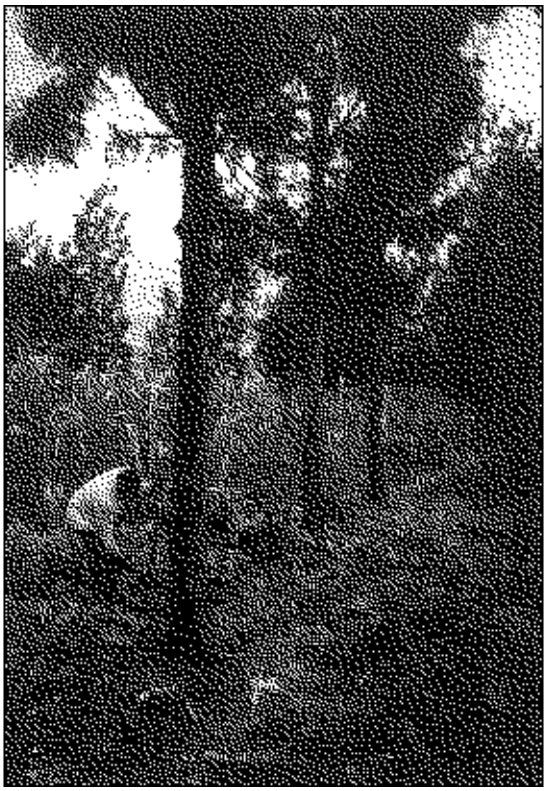

Fig. 4. [3] Pruning of *G.robusta.*

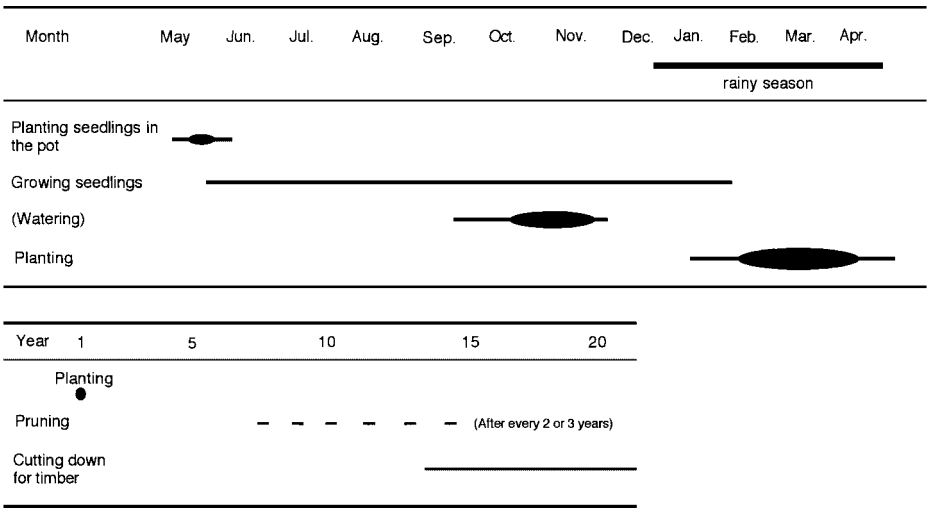

Fig. 5. Growing seedlings, planting, and cutting of *G. robusta.*

of adopting tree planting relates not only to the changes of forest product availability and development of the wood market, but also to the changing situations of rural life, such as labor availability, land tenure, annual income, food security, and so on (Arnold, 1995). In a wide sense, to introduce trees on their holdings increases their living security. In this section, the whole diffusion process of *G. robusta* planting is traced, and its general background and socioeconomic incentives are pointed out.

1. Different stages of the diffusion process

Seeing the *G. robusta* stands in Bonga, most of them seem to be under twenty years since planting. The practice started to diffuse at the time of villagization and rapidly expanded after 1980. Fig. 6 shows a change of the cumulative number of households which settled and started planting trees in Bonga. The number of settled households is indicated by the left curve. It increased rapidly since the villagization program started in 1974. The diffusion of tree planting is indicated by the right curve. It started taking off in the mid 1970s and proceeded further in the 1980s. The curve indicated by the black rhombic mark which lies below the former two curves shows a change of annual number of households which newly adopted *G. robusta*. It has two peaks, one at the end of the 1970s and the other in the mid 1980s. According to this tendency, the diffusion curve of tree planting can be divided into three stages; the initial stage, the takeoff stage of the first peak, and the expansion stage of the second peak. As is indicated in the curve, the takeoff stage began in 1974 when the number of adopters started to increase, and continued until the end of first peak around 1980. The expansion stage started after the first peak and continued around the second peak in the mid 1980s. The initial stage began with the early introduction of *G. robusta* in the 1960s and continued until the start of the takeoff stage. In each stage there were particular backgrounds and incentives to stimulate

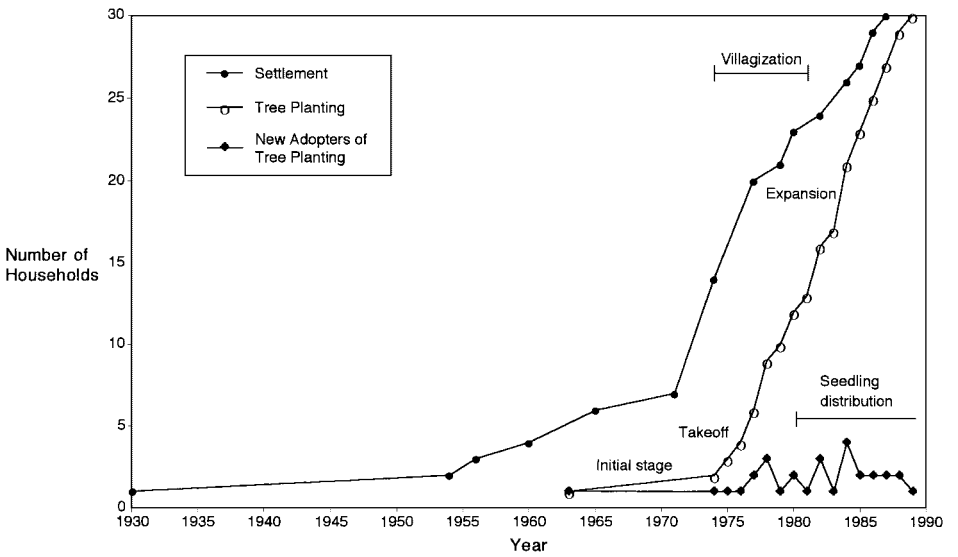

Fig. 6. The cumulative number of households which settled and started tree planting and the number of its new adopters each year.

the Bonga people to plant trees.

2. Initial stage

In the late 1950s *G. robusta* was introduced into some parts of the Bonga area with coffee growing. It was brought about by the farmers who immigrated from the Kilimanjaro area, according to a request from the subchief of Gorowa. The farmers established coffee gardens and taught the Bonga people how to grow coffee (Talle, 1991). The family of Gorowa's subchief and his relatives started coffee growing in Haraa village, which is located in the mountains east of Bonga. They also introduced *G. robusta* as a shade tree for coffee in the garden. One of the 30 households surveyed in the research already built a new type of house, using its timber for beams in the early 1970s. The seedlings of *G. robusta* were already produced in the nursery of the forestry department and sold to the inhabitants of the Babati township. The usage and economic value of *G. robusta* were generally known to the Bonga people since before the villagization program.

3. Takeoff stage late in the 1970s

In the takeoff stage, the land redistribution program of villagization stimulated some of the householders spontaneously to plant trees in their holdings. The adoption of *G. robusta* in the form of boundary planting in homestead farms was a countermeasure for avoiding land confiscation by the government. The motivation of planting *G. robusta* was rather to utilize it as a symbol to claim one's land right of occupancy on the farm in that situation than to provide wood resources for themselves (Yasu, 1999).

In the initial stage, *G. robusta* was planted only in the coffee garden, providing shade for coffee. It was never seen in the field of annual crops such as maize and finger millet, which means it had not been a part of the cultivation of annual crops. Planting trees on a farm as a new practice frequently causes competition between trees and crops or cattle in east Africa (Warner, 1995). In this sense, the boundary planting on the homestead farm which was initiated during this stage was the first model in Bonga of planting trees in the annual crop to demarcate the boundaries for securing right on land, without causing any competition between crops and planted trees.

4. Expansion stage in the 1980s

The number of new adopters increased further in this stage and reached the second peak in 1984. Eleven of 23 households which settled until the end of villagization, and all seven households settled after the villagization started tree planting in this stage. In the background there were several factors which promoted their adoptions.

Among them, the termination of the villagization program can be noted as a fundamental factor. According to the context described in the former chapter, it implies that the government stopped intervening in the existing landholding of villagers, and ended the compulsory confiscation and redistribution of holdings. This means that the boundaries of each holding, which were once fixed by the authority during the villagization program, had to be maintained hereafter by the holders themselves.

Table 4. Seedling species produced in the project nursery.

Acacia sp. (I)	*Eucalyptus*
Azadirachta indica	*Gmelina arborea*
Carica papaya (F)	*Grevillea robusta*
Cassia siamea	*Leucaena leucocephala*
Cassia spectabilis	*Khaya nyasica* (1)
Cassuarina montana	*Mangifera indica* (F)
Citrus cinensis (F)	*Psidium guajava* (F)
Cordia africana (I)	*Syzygium cuminii* (F)
Deronix regia	

(I); Indigenous species (F); Fruit tree

Simultaneously, as is indicated in Fig. 6, the immigration into Bonga and new allocations of homestead farms continued in the 1980s. In this situation it became important for all households to demarcate boundaries and to claim one's right on the farm to the neighborhood. Boundary planting of *G. robusta*, which originated during the villagization program, was entirely fit for the households' need of securing their rights to land in the post-villagization period (Yasu, 1999).

The second factor was the New Agricultural Policy of 1982. Contrary to the previous policies, this Policy emphasized the agricultural production of individual households (Government of Tanzania, 1983). In the initial stage, a few households depended upon the income earned from coffee growing to cover the expenses in purchasing materials and building a new house using *G. robusta* timber (Yasu, 1998). The Policy opened the way for the majority of households for investing, adopting new practices to increase production, and developing cultivation of cash crops such as maize, pigeon pea, and finger millet, based on the individual household production, to enable them to build a new house using *G. robusta*.

In addition these factors, free distribution of seedlings from the project nursery acted most effectively in stimulating households to adopt *G. robusta* planting. The seedlings of *G. robusta* with other exotic tree species were produced in the nursery in Bonga (Table 4). They were used for planting in the "village woodlot" before, but the project started to distribute them free for charge directly to the households and institutions after 1980. In its process the project let villagers choose which species and how many seedlings to take from the nursery and to plant in their holdings (Kerkhof, 1990). There were no incentive subsidies or penalty regulations for taking seedlings and planting, so the intervention from the project was limited only to the supply of seedlings. If Table 4 is compared with the realities of the people's selection of seedlings and planting as shown in Table 3, it can be easily understood how they prefered *G. robusta* to all other species for planting. The value of *G. robusta* as timber, the need for securing land right on a homestead farm, the opening of the way for cash income, and the free distribution of seedlings piled together in the stage after 1980 and stimulated the majority of households to adopt planting *G. robusta* in the homestead farms.

THE PRACTICES OF UTILIZING *G. robusta* AS A WOOD RESOURCE

I. The "Last" Stage of the Diffusion Process Cutting Down *G. robusta* for Timber

As pointed out in the former chapter, the felling age of *G. robusta* is around 15 years in Bonga. The trees planted in the 1970s have been coming to the cutting period in the 1990s. From 1995 to 1997 when I carried out field research, 12 of 30 households were building new houses roofed with corrugated iron sheets, laying baked brick and using miombo wood for doors and windows, and beam timber of *G. robusta* (Table 5). There was a kind of boom to build new houses using *G. robusta* among the Bonga people (Fig. 7 [1] [2]).

Table 5. Cutting of *G. robusta*

No of household	Year of planting	No of trees cut down	Diameter of stump (cm)					Use		Tree age at cutting (years)
			20～30	30～40	40～50	50～60	60～	Domestic use for house construction	Sale to others	
1	1963	5		4			1		●	30, 10
8	1974	1				1		●		20
9	1976	3			3			●		17～19
17	1978	2		1	1				●	16
19	1979	16		6	10			●(13)	●(3)	14～16
10	1980	3		1	2				●	13～14
11	1980	8	4	2				●		14
24	1982	8	3	2	2	1		●		12
6	1984	3		3				●		10～12
12	1984	1		1				●		10
13	1985	8	1	7				●		10
23	1985	4	1	2	1			●(3)	●(1)	10～11

Recorded in 1995

Fig. 7. [1] House construction using beams of *G. robusta.*

Fig. 7. [2] New house (right) and old house (left).

There were 18 households which started to plant trees in the expansion stage. Among them, 5 households (Nos. 24, 6, 12, 13, and 23) have built new houses in mid-1990s, as indicated in Table 5. Four households which planted trees in the take-off stage (Nos. 8, 9, 19, and 11) have built new houses. The remaining two households, Nos.10 and 17 sold timbers to other households. Besides this, it was observed during the research that other households which settled and planted trees in the 1980s were ready to cut down *G. robusta* for house construction. That is, regardless of the starting time to plant trees, *G. robusta* began to serve all households with timber for building in the mid 1990s. Thus, the process can be said to reach the "last" stage of diffusion; cutting down and logging *G. robusta* for timber. In this chapter, the practice of utilizing *G. robusta* in house construction and domestic fuel consumption is described. By making clear the nature of this practice, it is possible to understand the entire significance of planting *G. robusta* for the people of Bonga's livelihood.

II. The Practice of Using *G. robusta* for Beams in House Construction

G. robusta is mainly used as a beam wood in house construction. It is ready to be cut down ten to twelve years after planting. Usually about twenty pieces of ten feet beams are necessary for building a new type of house. Among all the households in Table 5, No. 19 cut down twice as many *G. robusta* trees than other households. The householder of No. 19 immigrated from the Kilimanjaro region and has been working for more than twenty years in the forest reserves. He is a "pioneer" in Bonga as a woodcutter as well as a logger since the 1970s and is the only one who planted *G. robusta* in his homestead farm on "commercial basis", selling them to the Bonga people.

Examining the seven cases in Table 5 which cut *G. robusta* for domestic use only,

some tendencies are noted as follows: usually about twenty pieces of ten-feet beams are necessary for building a new type of house, of a normal size with three rooms. To get such timbers, *G. robusta* trees with a stump diameter of more than 40 cm are necessary, as in cases Nos. 8 and 9. They planted in the takeoff stage and the felling age is from 17 to 20 years. Other households, Nos. 11, 24, 6, 12, 13, and 23 cut down one to eight *G. robusta* trees with a smaller stump diameter, from 20 to 40cm. They started planting after 1980 and the felling age is from 10 to 14 years, which is shorter than that in the former two cases. They tended to cut down *G. robusta* directly after it reached the felling age.

There is a cash value recognized in individual *G. robusta* trees. The price of one tree twelve to fifteen years after planting was 4,000/- in 1995 and it has been increasing year by year, reaching 5,000/- in 1997. This is due to the increasing demand on timbers for house construction. In this situation, the selling of *G. robusta* to other households has become more frequent than before. *G. robusta* trees were sold to other householders, as in the cases of Nos. 1, 17, 10, and 23. But this does not imply that a general market of *G. robusta* exists; even in these cases, a buyer in Bonga is limited to relatives or close acquaintances.

Although *G. robusta* beam wood is only a part of the total wood necessary in house construction, it helps to reduce total cost to purchase timber wood. Because the new type of house is built with baked brick and corrugated iron sheets, and uses some miombo woods for doors and windows, it costs about ten times as much for materials as the old type of thatched house built with sun-dried bricks (Table 6). As is shown in the Table, *G. robusta* timber planted on one's own homestead helped to cut the total cost of house construction approximately 13% in 1995. Also, the cost of logging is sometimes paid by an equal volume of *G. robusta* timber (see cases

Table 6. Expenses of main construction materials

Case of new type (Tanzanian shillings)

Part of house	Materials	Unit price	Necessary volume	Total price	Sub total	Total expense
Beam	Wood of *G. robusta*	4,000/- (one stand)	4 stands	16,000/-	16,000/- (13%)	127,000/- (100%)
Door	"Miombo" wood	12,000/-	1 piece	12,000/-	111,000/- (87%)	
Window	"Miombo" wood	7,000/-	5 pieces	35,000/-		
Roof	Corrugated iron sheet	3,200/-	20 pieces	64,000/-		

Case of old type

Part of house	Materials	Unit price	Necessary volume	Total price	Total expense
Door	"Miombo" wood	2,000/-	1 piece	2,000/-	14,000/-
Window	"Miombo" wood	4,000/-	3 pieces	12,000/-	

Prices for the year of 1995 are shown. 1US dollar＝625 Tanzanian shillings

Nos. 24 and 13 in Table 5), which would reduce further the whole cost of house construction.

III. Expansion of Pigeon Pea Production as an Economic Incentive for the House Building Boom of the 1990s

As described in the former section, new house building costs much more than to build a traditional house. Thus behind the boom there must be an economic incentive to enable households to start cutting down *G. robusta* and to cover the expenses of various construction works. A few households which had already built houses using *G. robusta* in the early 1970s depended on cash income earned by coffee growing.

As is indicated in Table 7, the main income from households' agricultural production was earned by selling maize and pigeon pea. About ten sacks of maize are enough for domestic consumption of an average size household with two adults and three children for one year. The remainder is sold, as well as pigeon pea, to the outside market. Maize is sold to the broker from the time of harvest in July until the preharvest months of the next year. The households Nos. 4, 21, 23, and 26 left over 22, 17, 32, 18 sacks of maize at home respectively. This maize is sold gradually in the later months, when its price will rise two or three times that in the postharvest season. Households can secure part of the necessary cash income until the next harvest. Contrary to this, the time to sell pigeon pea is limited to the shorter period from September to October, only in the postharvest months. Usually building works

Table 7. Household income by selling maize and pigeon pea

No. of household	Total harvest		Amount of sold crop	Cash income	Total income (Tanzanian shillings)
4	maize	30	8	24,000-	84,000-
	pigeon pea	4	4	60,000-	
10	maize	13	—	—	45,000-
	pigeon pea	6	3	45,000-	
14	maize	19	10	30,000-	45,000-
	pigeon pea	1	1	15,000-	
21	maize	37	20	6,000-	165,000-
	pigeon pea	9	7	105,000-	
23	maize	32	—	—	112,500-
	pigeon pea	7.5	7.5	112,500-	
26	maize	18	—	—	120,000-
	pigeon pea	8	8	120,000-	
27	maize	9	5	15,000-	22,500-
	pigeon pea	0.5	0.5	7,500-	
30	maize	6	—	—	30,000-
	pigeon pea	2	2	30,000-	

Surveyed in October in 1995. 1US dollar＝625 Tanzanian shillings.
The amount is shown by the number of flax sacks.
One sack can pack 90kg of maize or 120kg of pigeon pea.
The prices for one sack of maize and pigeon pea are 3,000- and 15,000- respectively.

are concentrated after the harvest in the dry season, when large amounts of money are needed to pay for the materials and the costs of laborers, who are employed as sawyers and loggers in building works. The income earned from pigeon pea is convenient for carrying out several works of house construction at the same time.

Pigeon pea production started to expand after the enforcement of New Agricultural Policy of 1982. After the Indian brokers started to buy peas directly from the villagers in 1990, it spread immediately to the households. These days in Bonga, it is said that if a householder saves pigeon pea cultivation money for three years, he can purchase all of the materials needed for house building. For the households which planted *G. robusta*, the expansion of pigeon pea production acted as a strong economic incentive on their decision to cut down their *G. robusta* and to built a new type of house using its timber.

IV. Use of Planted Trees as a Source of Supplying Fuel under the "Firewood Shortage"

Although planting *G. robusta* has spread based on the needs for providing timber, its pruned branches are also used as a cooking fuel in some households. In Bonga before villagization, firewood was collected on the hill and forest reserves east and south of the village and in the woodland west of the main road (Fig. 2 [1]). Forest ordinance (1957) and the by-laws of Bonga were applied to the management of forest reserve and village woodland, respectively, which permitted villagers to collect only firewood, and prohibited cuttings of live trees. After the villagization program, the hillside in residential areas was thoroughly exploited while in the forest reserve all human activities were prohibited by the ordinance. In addition, the woodland west of the main road was rapidly cleared since pigeon pea cultivation expanded around 1990 (Fig. 2 [2]). These changes have made the work of collecting firewood more difficult because the area where people could walk and gather firewood decreased or was enclosed by the government. Against these, the people take various countermeasures to satisfy their demand for wood products. One of them is to utilize planted trees in their homestead farms or crop residues as substitutes for firewood.

As indicated in Table 8, Bonga people distinguish major kinds of fuels for their heating power. The fuel with strongest power is firewood collected in the woodland. Although it becomes more difficult to get firewood, it is still most popular to the householders in Bonga. Branches pruned from planted trees are recognized to have medium heating power. In many households they are used as a secondary fuel for cooking. Crop residues, such as cores of maize and stalks of pigeon pea are used mainly as fire lighters, because their power of heating is much weaker than the wood fuels. Fig. 8 indicates two typical examples of fuel varieties used in households'

Table 8. Characteristics of major cooking fuels

Fuel	Heating power	Use
Firewood	strong	main fire
Stalk of pigeon pea	weak	firelighter/main fire
Core of maize	weak	firelighter
Branch of *G. robusta*	medium	main fire
Branch of *C. siamea*	medium	main fire

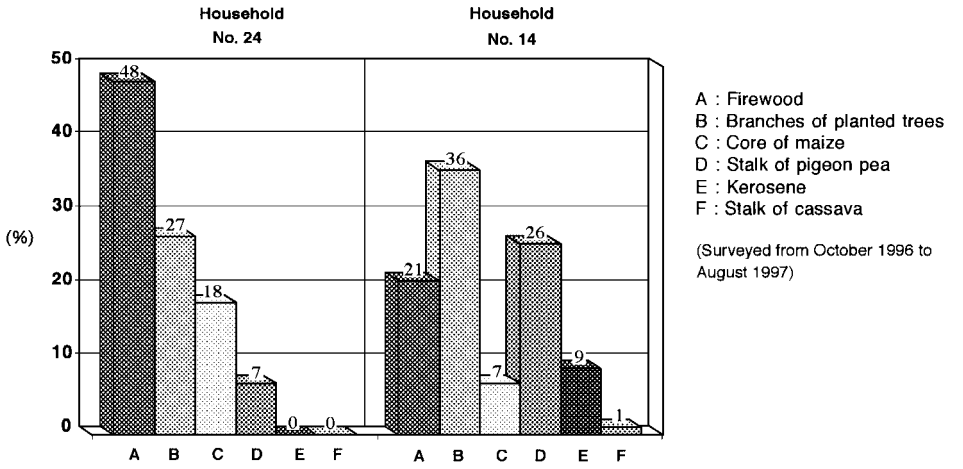

Fig. 8. Fuel varieties used in household cooking and their ratios to total consumption.

cooking. Because household No. 24 is located in the area of "D" in Figure 2 [2], nearest the national forest reserve of the 30 households, and firewood is more available all the time, it depends on firewood for almost half of its total consumption. If it includes the branches of *G. robusta*, the use of wood fuel reaches 75%. This household depends mainly on the "original" fuel for cooking, which is thought to be the usual consumption of cooking fuel before the stage of "firewood shortage."

The case of household No. 14 shows a new tendency of fuel variety used in cooking. This household is located in the area of "H" in Fig. 2 [2], the northern part of the residential area. The access to the west woodland is more difficult than for household No. 24. The ratio of firewood used in cooking is lower than in the former case. With this change, the branches of planted trees and stalks of pigeon pea are used more frequently. Kerosene is also used as a substitute fuel. Residues such as cores of maize and stalks of pigeon pea are got from the crop harvest. But their availabilities change every year, which is not a suitable substitute for cooking fuel, and its heating power is weak. Unlike the residues, the availabilities of tree branches and also kerosene are more stable. The branches of *G. robusta* and *Cassia siamea* are widely used as cooking fuel, while kerosene is limited to minor households at present. If the "firewood shortage" gets serious in the future, planted trees are expected to play a more important role to supply domestic fuel for cooking.

DISCUSSION

I. Multilateral Perspective to View the Whole Diffusion Process

In the previous chapters, the factors which led to expanded planting of *G. robusta* among the rural households was clarified. In the analysis, concepts such as motivation, incentive, background, and needs were used, to explain the situation surrounding household tree planting. Fig. 9 indicates the whole diffusion process and the

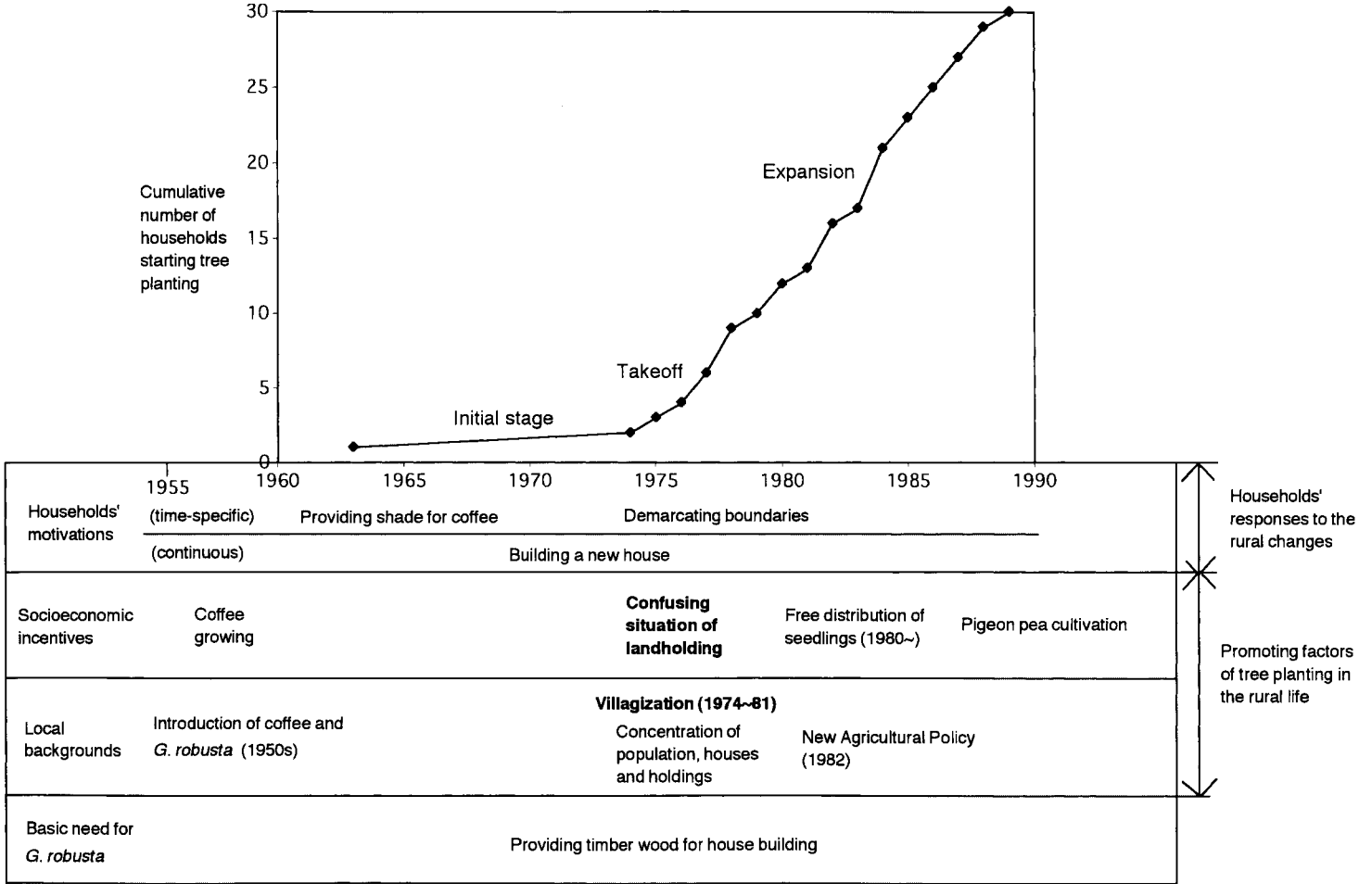

Fig. 9. Local backgrounds and factors to promote the diffusion process of planting *G. robusta*.

"multi-layer" structure which these concepts formed in the process. The basic need for *G. robusta* to provide timber for house building lies at the bottom of entire diffusion process. It was formed during the period when *G. robusta* was introduced with coffee growing to the Bonga area in the 1950s, and a few villagers built houses using its timber in the early 1970s.

Introduction of coffee and *G. robusta* in the 1950s was the starting point of the diffusion process. Villagization and the New Agricultural Policy changed largely the people's practices of land tenure and cultivation. Influences coming from outside formed various incentives to promote *G. robusta* planting among the Bonga people. Early introduction of coffee simultaneously brought about the new practice of planting and tending *G. robusta* as a shade tree. Villagization caused a confusing situation of land tenure through compulsory confiscation of holdings, which stimulated some people to adopt tree planting. The New Agricultural Policy opened the way for cash income, which enabled the majority of households to build a new type of house using *G. robusta*. Of course free distribution of seedlings acted as an incentive to satisfy their need for planting *G. robusta*.

The main stream of the diffusion process is formed by the basic needs for providing timber and motivation of building a new house. It proceeded based on the people's wish: "We want to live in a fine house roofed with corrugated iron sheets". Such a process is thought to be quite general in the diffusion of tree planting in the rural areas, and examples are easily given in the cases of other tropical countries. Is this all that has been clarified about the diffusion process in Bonga? Definitely, not. In order to understand the significance of adopting tree planting, it is essential to make clear the real motivations of adopters under local backgrounds and incentives. In this sense, the time-specific motivations and their interactions with the local situations are thought to be the keys to know the essential features of the whole diffusion process. In Fig. 9, there are two time-specific motivations in the process, as well as continuous one. These are "providing shade for coffee" and "demarcating boundaries," which are related to the tree value of non-wood uses such as "shade" and "landmarks." In the takeoff stage, the cause of introducing *G. robusta* was the sudden changes of land tenure which were brought about by the villagization program. In that situation, to plant trees having high cash value such as *G. robusta* was effective means of protecting one's holdings against its compulsory confiscation by the government, and to secure the right of occupancy on the customary basis (Yasu, 1999). Their decision and practice to introduce tree planting did not relate directly to their intention of producing timber or firewood.

In the villages of north-central Tanzania, planting trees of exotic species was introduced at most two or three decades ago, which means it is perceived by the rural people as an innovation, "a new idea or pattern of behavior" (Rogers, 1995). It is thus an essential matter for its diffusion, how the practice of tree planting was recognized and transferred to the rural society. Trees are perennial and they grow every year, which means that the practice can appeal easily to the neighborhood. In this sense a few cases practiced in the initial and takeoff stages are thought to have been important in promoting the whole diffusion process. The essential feature in the case of Bonga is that the incentive was the land matter which related to the sociopolitical features of the people's life peculiar to the period of villagization. This "unex-

pected" chance is thought to form a basis to diffuse tree planting to most of the households.

The preceding reports and studies focusing on the institutional and technical issues of tree planting are premised on an assumption that "firewood shortage," rising new demand on wood, and development of an external wood market would be direct incentives to stimulate rural people to plant more trees. That is partly in the case of Bonga, but what needs emphasizing through this case is that the condition which lies outside of this assumption can be a critical incentive for the people to initiate by themselves planting trees as an innovation. This suggests further that when considering the issue of tree planting, it is essential to understand the multi-sided significance of tree planting by the rural people, based not only on the supply of wood products, but also on the wider perspective to relate the adoption of tree planting to the micro-level socioeconomic backgrounds.

II. Implications to the Extension Project of Tree Planting in Semi-Arid Rural Area

The governmental forestry sections which carry out extension projects of tree planting in semi-arid rural area was based on the idea that the "deforestation and incidental 'firewood shortage' can stimulate rural people to plant trees in their holdings", which this paper has indicated was a groundless belief against reality. The firewood viewpoint did not consider what local conditions could really promote the adoption of tree planting by the rural people. As shown in Fig. 9, the free distribution of seedlings in the 1980's gave a positive impact to spreading tree planting in the households. However, we should not overlook that the initial and takeoff stages of the diffusion process proceeded by themselves without the impact of project intervention, as described in the previous chapters. In those stages, the practice of planting *G. robusta* in the homestead farms had been created by a few householders through trial and error: what species, by which scale, and where trees were to be planted, etc. In this process, the local technique of planting *G. robusta* which could be adopted by other householders was made and fitted for the landholding of each household after the villagization program.

Many projects which aim to extend tree planting in the semi-arid rural areas try to educate people to be more "conscious" about environmental conservation through opening seminars and offering services such as seedling supply and technical guidances (Kerkhof, 1990). However, these activities can not be essential factors for the people's adoption of planting trees, as is indicated in the case of Bonga. Rather, the case suggests that it is a critical condition whether there is an incentive to stimulate people to adopt planting trees, in a sense to maintain and secure their livelihood in the changing process of rural life. It is no matter even if the incentive is an "unexpected" factor or event, viewing from the conventional "firewood shortage" approach.

CONCLUDING REMARKS

As is indicated in this paper, the diffusion process of tree planting is affected by

sociopolitical and economic factors at each stage. The issue of planting trees should be discussed as a part of the changing process of rural life. Only such a study can be linked to the further discussions on the effects and possibilities on planting trees as a countermeasure against the "fuelwood shortage" which is said to prevail in the semi-arid rural area.

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REFERENCES

Arnold, J.E.M. 1995. Framing the issues. In (J.E.M. Arnold & P.A. Dewees, eds.) *Tree Management in Farmer Strategies—Responses to Agricultural Intensification—*, pp. 3-17. Oxford University Press, London.

Government of Tanzania 1977. *The Threat of Desertification in Central Tanzania*. A technical paper prepared for the United Nations conference on desertification 29th August-9th September 1977.

————1983. *The Agricultural Policy of Tanzania*. Ministry of Agriculture, Dar es Salaam, Tanzania.

————1989. *Tanzania Forestry Action Plan 1990/91-2007/08*. Ministry of Lands, Natural Resources and Tourism. Dar es Salaam, Tanzania.

————1994. *Report of the Presidential Commission of Inquiry into Land Matters—Volume 1 Land Policy and Land Tenure Structure—*. Published by the Ministry of Lands, Housing and Urban Development in cooperation with the Scandinavian Institute of

African Studies, Uppsala, Sweden.
Johansson, L. & P. Westman, 1992. *The Forests, Trees and People Project in Babati District, Tanzania: Experiences from Field Work and Studies, 1987-1990*. Working paper 204, International Rural Development Center, Swedish University of Agricultural Sciences, Uppsala, Sweden.
Kerkhof, P. 1990. *Agroforestry in a Survey of Project Experience*. SIDA, pp. 97-104. Commission of the European Communities and CTA.
Kihiyo, V.B.M.S. 1991. Village afforestaion setbacks in the ujamaa framework of Tanzania: A critical analysis. *Tanzanian Journal of Development Studies*, Vol. 1 No. 1.
Kilahama, F.B. 1988. *Community Forestry Programs in Tanzania—Organization, Philosophies, Implementation and Experiences Gained—*. Forestry & Beekeeping Division, Headquarters, Dar es Salaam, Tanzania.
Mbuya, L.P. & H.P. Msanga, C.K. Ruffo, A. Birnie & B. Tengnaes, 1994. *Useful Trees and Shrubs for Tanzania—Identification, Propagation and Management for Agricultural and Pastoral Communities—*, Regional Soil Conservation Unit (RSCU), Swedish International Development Authority, Sweden.
Mnzava, E.M. 1983. *Tree Planting in Tanzania : A Voice from Villagers*, Forest Division, Dar es Salaam, Tanzania.
Miti, K. 1982. Ujamaa Vijijini : Policy and Implementation. in "*Taamuli*", A Political Science Forum, vol. 12, pp. 47-61. University of Dar es Salaam, Tanzania.
Nilsson, P. 1986. Wood-the other energy crisis. In (J. Boesen, K.J. Havnevik, J. Koponen & R. Odgaard eds.) *Tanzania-Crisis and Struggle for Survival*, pp. 159-173. Motala, Sweden.
Rogers, E.M. 1995. *Diffusion of Innovation* (Fourth Edition). The Free Press, New York.
Talle, A. 1991. *Land and Tree Tenure in Babati District, Tanzania: An Anthropological Perspective*. Working paper 194, International Rural Development Center, Swedish University of Agricultural Sciences, Uppsala, Sweden.
Warner, K. 1995. Patterns of tree growing by farmers in Eastern Africa. In (J.E.M. Arnold and P.A. Dewees, eds.) *Tree Management in Farmer Strategies—Responses to Agricultural Intensification—*, pp. 90-137. Oxford University Press, London.
Yasu, H. 1998. Development of farmers' tree planting after villagization—a case of central Tanzania— (in Japanese). *Journal of Forest Economics*, 44 (1).
————1999. The practice of planting exotic trees: An invented way to maintain land right of occupancy during the Villagization in Central Tanzania (in Japanese with English Abstract), *AFRIKA-KENKYU (Journal of African Studies)*, 54.

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