A STUDY ON THE SHIFTING CULTIVATION SYSTEM IN KALAHARI WOODLAND, WESTERN ZAMBIA, WITH SPECIAL REFERENCE TO CASSAVA MANAGEMENT

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ABSTRACT The Kalahari Sands found all over southern Africa have been described as not being suitable for agriculture. However, Kalahari woodland developed on the same Kalahari sands of western Zambia and Angolan immigrants who escaped the war settled on the woodland. Their livelihoods are dependent on growing cassava, their staple and cash crop.

The cassava grown by the Angolan immigrants on the Kalahari Sands depends on the natural nutrients in the sandy soils. The cultivation system established by the immigrants on rather poor soils is closely related to the social organization of the immigrants. This paper thus examines not only the cultivation system, but also their social organization supporting the system by reciprocal help in the poor environment.

Key Words: Kalahari Sands; Kalahari woodland; Angolan immigrants; Cassava cuttings; Social organization.

INTRODUCTION

The Kalahari Sands are spread inland over Central and Southern Africa (Thomas & Shaw, 1991). They cover more than 2.5 million km^2, from Gabon to South Africa, and form one of the largest continuous sand belts. Kalahari sand is quartz and the depth of the sediment is estimated to be over 400m at its deepest. Though the Sands are poor in nutrient, vegetation peculiar to the Kalahari Sands and climatic conditions is found in the belt. Though agriculture is carried out on the Kalahari Sands, previous studies have found agricultural productivity on the sands to be very low (Province Planning Unit, 1985; Fresco, 1986).

In Zambia, the Kalahari Sands are found in the Western Province and are covered by the Kalahari woodland (Fig. 1). This woodland was not, however, used for cultivation until the arrival of the Angolan immigrants in the 19th century (Gluckman, 1941).

Infrastructure has since been extended to the Kalahari Sands belt of Western Province reaching an increased population within the Kalahari woodland (Okamoto, 2000). The arrival of the Angolan immigrants not only increased the population, but also extended agricultural activities onto the woodland. The woodland has also assumed increased importance for residents as it provides their livelihoods. However, little is known about how the Angolan immigrants have established their cultivation system.

This paper seeks to analyze the shifting cultivation practiced by the Angolan

Fig. 1. Kalahari Woodland

immigrants in the Kalahari woodland area through the following three points: first, the social environment that has driven them to cultivate the woodland; second, features of the shifting cultivation system; and third, the relationship between the shifting cultivation system and the social organization.

RESEARCH AREA

In western Zambia, the Zambezi River, which is the fourth longest river in Africa, flows from north to south (Fig. 2). The Zambezi Floodplain spreads to both sides of the river and is almost 50 km wide (Ernest, 1998). The Floodplain is the actual place where the Lozi kingdom was built. The border between Angola and Zambia is only 100 km from the Floodplain.

There are two seasons in a year: a rainy season and a dry season (Fig. 3). The mean temperatures are high in the rainy season, which falls between October and March. The flood period of the Zambezi River is from February to June. The annual rainfall is about 800 mm.

The vegetation of the Floodplain and its surrounding upland area is characterized by two kinds of vegetation. One is the Kalahari woodland, where CAESALPINIOIDEAE trees such as *Brachystegia spiciformis, Guibourtia coleosperma, Burkea africana* and *Erythrophleum africanum* dominate on the upland, which is described as deciduous (White, 1983; Storrs *et al*., 1995). The other is grassland on the Floodplain. The research village is located on the upland about 500 m distance from the Floodplain.

Field research was conducted from October 2001 to April 2002 in Linyuku village in Senanga District of Western province. The population of the village was 362 people in 32 households. Most of the villagers were Angolan immigrants. Data were collected through interviews and participant observation.

There were many villages composed of many ethnic groups including the Lozi[(1)] and other immigrant ethnic groups. Access to land was based on the eth-

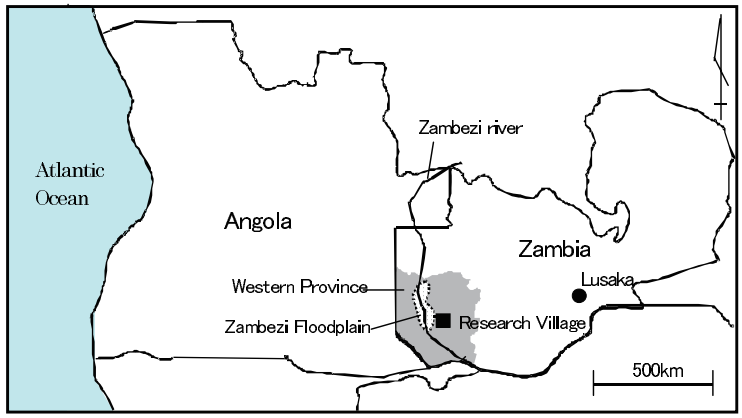

Fig. 2. Location of Research Village

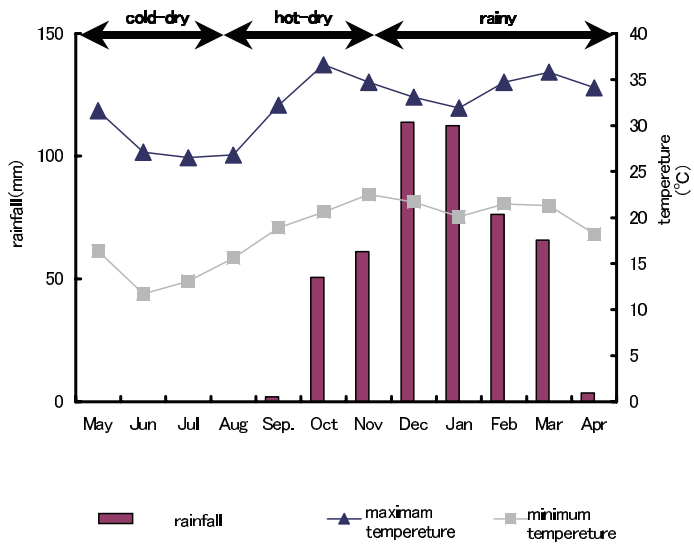

Fig. 3. The Average Temperature and Rainfall
The data is based on statistics of Senanga meteorological Station from May 2001 to April 2002. Senanga town is located ten kilometers south of the research village.

nic group. While they live in the same place together, their fields are sited separately, like the Lozi having their fields on the Zambezi Floodplain and the immigrants' fields being on the Kalahari woodland. This situation is also found in other places within Western Province, because the Lozi claimed the Floodplain for themselves and do not want the immigrants to cultivate there.

HISTORICAL BACKGROUND OF ANGOLAN IMMIGRANTS

This paper focuses on Angolan immigrants, who immigrated to the Western Province in the middle of the 20th century after the war of independence became more intensive.

Before the war occurred, people began to escape from Angola, and settle in Western Province occupied by the Lozi during the colonial era of the Portuguese in the 19th century (Gluckman, 1941). The immigrants assimilated Lozi customs gradually. The Angolans who immigrated in the middle of the 20th century, before and after Angolan independence, including those in the research village, have not assimilated Lozi customs. After Zambian independence, the government gave Zambia nationality to the immigrants who came before 1968, but not after 1968. After 1969, when the Zambian government signed the OAU refugee protocol, many refugees hid themselves not in refugee camps, but illegally in local villages (Hansen, 1979; Kitagawa, 1996).

However, after Angolan independence in 1975, the refugee population increased further because of the civil war (Hansen, 1979; Kitagawa, 1996). Nowadays, many of these immigrants and refugees still live in Zambia, even though the war ended in Angola in 2002.

LIFE IN KALAHARI WOODLAND

Kalahari woodland has only poor biomass and is composed of deciduous trees and short grasses. According to the result of a vegetation survey conducted in the natural forest of the woodland, the density was 25 stems per 500 m^2 and dominated by trees of the legume family (Table 1). The result also shows that most are trees whose height is lower than 10 m and whose diameter is smaller than 10 cm within 500 m^2.

The immigrants use many resources from the woodland to meet their subsistence needs. Men conduct forestry by cutting trees such as *Brachystegia spiciformis*, *Cryptosepalum pseudotaxus*, and *Pterocarpus angolensis*. Women conduct gathering by collecting mushrooms, and wild fruits from *Strychnos cocculoides*, *S. pungens*, and *Diospyros batocana* and make local beer called *kacasu*. While poultry keeping and fishing are also their subsistence activities, agriculture in the woodland is their main subsistence activity.

Crops are cultivated in two kinds of fields: one is the kitchen garden near the house called *chitungu*, and the other is the shifting cultivation field called *lihya* in the woodland. As shown in Table 2, the varieties of crops are very few. Cassava is very significant for the villagers not only as a staple crop but also as a cash crop. It is cultivated only in the shifting cultivation fields. The other crops such as maize, pearl millet, bambara groundnuts, pumpkins and *Chindambe* (*Hybiscus meeusei, H. cannabinus*) are only grown when the field is first cultivated.

A meal is composed of *Chibundu* (a thick porridge) and *mubelela* (relish).

Table 1. Trees in the Kalahari Woodland

Family	Spicies
LEGUMINOSAE*(CAESALPINIOIDEAE)	*Copaifera baumiana*
	Bauhinia petersiana
	Dialium englerianum
	Erythrophleum africanum
	Burkea africana
	Guibourtia coleosperma
	Guibourtia coleosperma
	Brachystegia spiciformis
	Cryptosepalum pseudotaxus
(MIMOSASEAE)	*Albizia antunesiana*
	Amblygonocarpus andongensis
(PAPILIONACEAE)	*Baphia massaiensis*
	Pterocarpus angolensis
EUPHORBIACEAE	*Ricinodendron rautanenii*
	Pseudolachnostylis deckendti
	Ricinus communis
LOGANIACEAE	*Strychnos cocculoides*
	Strychnos pungens
ANACARDIACEAE	*Sclerocarya caffra*
ANNONACEAE	*Xylopia odoratissima*
APOCYNACEAE	*Diplorhynchus condylocarpon*
CHRYSOBALANACEAE	*Parinari curatellifolia*
COMBRETACEAE	*Combretum zeyheri*
COMBRETACEAE	*Combretum hereroense*
DIPTEROCARPACEAE	*Monotes spp.*
EBENACEAE	*Diospyros batocana*
OCHNACEAE	*Ochna pulchra*
PASSIFLORACEAE	*Paropsia brazzeana*
?	*Napoleona gossweileri*

*Only LEGUMINOSAE is described subfamily in parentheses.

Table 2. Crops in the Two Fields

		Kitchen garden	Shifting cultivation field
Cassava	*Manihot esculenta*	×	●
Maize	*Zea mays*	●	○
Pearl millet	*Pennisetum glaucum*	●	○
Bambara nut	*Voandzeia subterranea*	●	○
Ground nut	*Arachis hypogaea*	●	○
Cow pea	*Vigna unguiculata*	●	○
Pumpkin	*Cucurbita sp.*	●	○
chindambe	*Hibiscus meeusei*	●	○
chindambe	*Hibiscus cannabinus*	●	○
Tomato	*Lycopersicum esculentum*	△	○
Onion	*Allium cepa*	△	×

● =Cultivated, ○ =Cultivated only in 1st year fields, △ =Cultivated (few), × =Not cultivated

Food consumption was analyzed for 96 days and the result shows that cassava made up almost 90% of the staple food; followed by maize and pearl millet. The side dishes were largely made up of edible herbs like *Chindambe* and cassava leaves from the fields. Animal protein, such as fish and beef were also eaten quite frequently. Animal protein was purchased mostly by cash.

SHIFTING CULTIVATION

I. Land Preparation and Soil Nutrient

Fields are cleared once every few years, so that they can harvest all year round, and then continue to cultivate for 10 to 15 years. Cultivation begins at the end of the dry season. Plowing is generally carried out with a hoe, and cutting trees is done with an axe in natural forest. Then they collect the cut trunks and branches and heap them near the stumps. After a few weeks or months, these heaps are burned.

The field soils of 1st year, 2nd year, 5th year and 11th year were analyzed to examine the burning effect and the results are shown in Fig. 4. The figure shows seasonal changes in electric conductivity, called EC,[(2)] of each field soil. EC values of 1st year fields are high, especially at the surface. This is due to the supply from the ash of trees and organic matter in the surface soils. The 2nd year decrease was almost the same in value as the 11th year. It shows that the soil nutrient of the natural forest cannot be kept for more than one year after burning, in spite of a great deal of effort to clear the woodland.

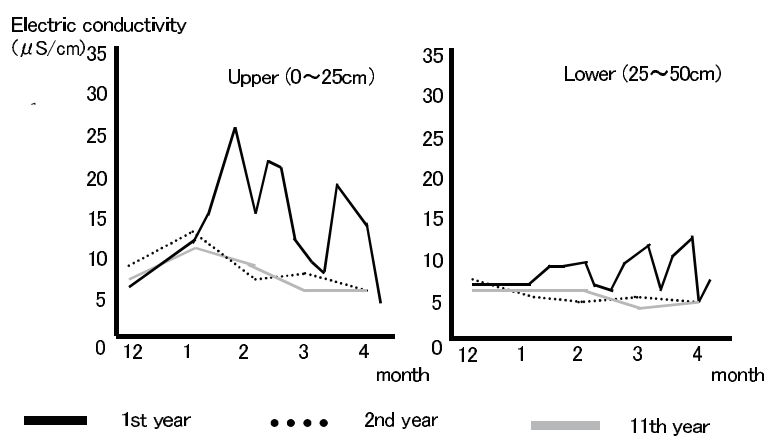

Fig. 4. Electric Conductivity (EC) of Each Field Soil
The vertical lines show months and horizontal axes mean EC. Left figure shows the soil from 0 to 25 cm and right is 25 to 50 cm in 1st year, 2nd year, and 11th year fields.

II. Crop Calendar and Management of Cassava Cuttings

After cassava is planted in the end of the dry season, the first harvest is started 16 months after planting (Fig. 5). Though one plant of cassava produces some tubers, the people harvest partially, which means harvesting only tubers that are developed enough. After this first harvest, the tubers, which remain underground, continue to grow. The second harvest is started 30 months after planting. In this second harvest, the people harvest all the tubers.

1st year and 2nd year after planting, they perform a unique method for managing the cassava whereby the stems are cut about 5 cm above the ground and planted. It is certain that cutting the stems reduces the yield from the growing cassava, although a new stem can regenerate from the cassava plant again after a stem is cut.

In the research area, cassava planting means sticking a cutting vertically in the ground. Actually, these cuttings planted in a 1st year field are the stems themselves cut from a 3rd year field. One of the reasons for getting the cuttings from growing cassava is that it is thought to maintain the number of cuttings.

Generally, in places where cassava is grown, people cut a stem and make some short stems (Sato, 1984; Itani, 1995; Hirose, 1998). On the other hand, in the research area, where stems can't develop thickly because of poor environment, a cutting is needed for planting. This is the actual factor limiting the cultivation system in this area.

In a 3rd year field, although all tubers of one cassava plant are harvested during the dry season, stems harvested early in the dry season are unable to be used as cuttings, because those stems are dry. Only stems harvested at the end of the dry season are available for planting. If people depend only on stems harvested in the second harvest, they can't get the same number of cuttings as the previous year. This is one reason why they take cuttings from growing cas-

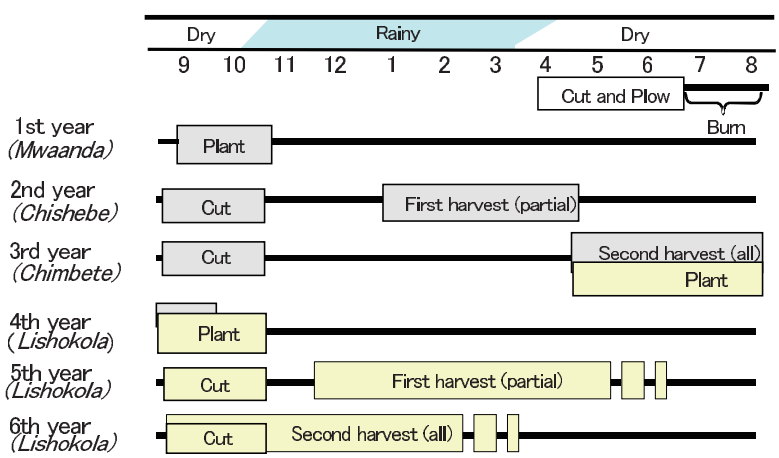

Fig. 5. Crop Calendar (Cassava)

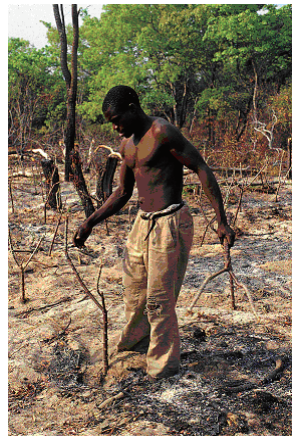

Fig. 6. Planting the Long Cassava Cuttings Ntoya in 1st Year Field

sava; otherwise a lack of cuttings may result.

There is another reason for taking cuttings from growing cassava, which is related to the quality of cassava cuttings. A cassava stem can grow 1 m in height after 4 months. People consider it as being of good quality. The villagers expect a high yield by planting this good cutting in a 1st year field, which is the most fertile field (Fig. 6). They call this good cutting as *ntoya*, which has grown from stumps after being once cut, and the other as *sengwa*, grown from a cutting (Fig. 7). They recognize *ntoya* can make larger tubers than *sengwa*.

In a 4th year field, *ntoya* is taken and planted there again. After the 4th year, cassava cultivation is continued the same as above. People expand new fields leaving the older fields unplanted.

While people make an effort to prepare the best conditions for cultivation, what they can harvest are only small tubers whose diameter is about 5 cm. They need vast fields of 3 ha per household on average to achieve annual self-sufficiency.

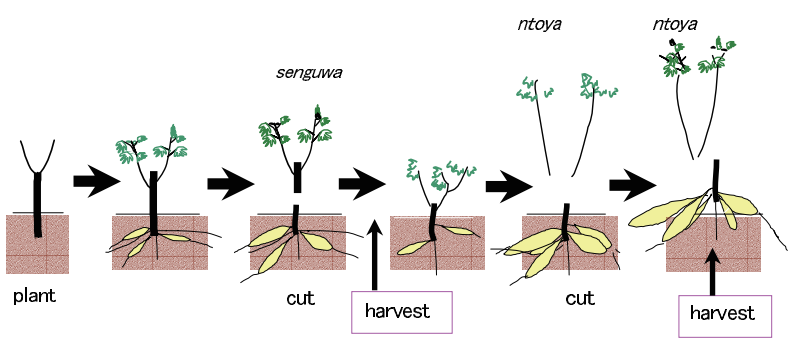

Fig. 7. Cassava Management

SOCIAL ORGANIZATION AND SHIFTING CULTIVATION

In the immigrants' village, there are units not only as spatial or residential, but also as groups of kin residing together, called *limbo* (Oppen, 1993), and each *limbo* has a headman. In the research village, 25 units of *limbo* were counted. Typical structure of *limbo* shows some houses surrounded by a kitchen garden. Around these *limbo*, since the natural forest had already been cleared, shifting cultivation fields were located in the woodland which takes 1 or 2 hours from their home on foot.

Limbo has functions in terms of shifting cultivation. First, it serves as a land-holding unit. The apportioned woodland for cultivation is managed by each *limbo*. A village headman has the authority to apportion woodland to each *limbo* headman. Likewise, a *limbo* headman has to distribute the given woodland to each *limbo* member, not to a household but to a person. Each person cuts and burns the given woodland. In the case of someone dying, the partner and children succeed to his field. On the other hand, the possession right to the woodland is returned to the *limbo* headman. The *limbo* headman redistributes it to each person again, and then each person starts to clear the woodland. When they clear all the area of the given woodland, the headman asks the village headman to distribute new woodland. Consequently, this may lead to control bias in land allocation, and reserve the over-cutting of the woodland.

There is another function of *limbo* as a reciprocal help unit, which is concerned with cassava management. Fig. 8 is the family tree of one *limbo*. When they clear a new field, they need cuttings to plant. If there is a lack of cuttings, they transfer them for free to each other. If they try to get cuttings from out of their own *limbo*, they have to buy them using cash.

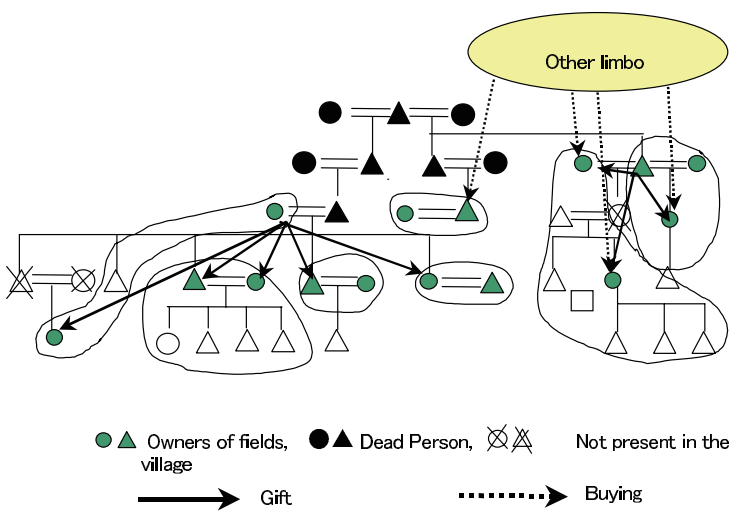

Fig. 8. Transfer of Cassava Cuttings within a *Limbo* (1997-2001)

In one *limbo*, a person who has a surplus of cuttings gives them to others who are short of cuttings. In return, a person may receive the labor service of others. The reciprocal help in terms of the transfer of materials from one to the others is found daily in village life, which plays an important role in not only agriculture but also in non-agricultural spheres.

CONCLUSION AND DISCUSSION

In the Kalahari woodland, Angolan immigrants have to use only the woodland for cultivation because the Lozi people have occupied the fertile Zambezi Floodplain. The Lozi don't consider it acceptable for the immigrants to use the Floodplain for their fields, although they live in the same area.

The shifting cultivation system in the woodland is characterized by the peculiar cassava management based on the natural forest nutrient. In the shifting cultivation system in the Democratic Republic of the Congo, it is reported that people cultivate more crops than in the research area, combining fields of Kalahari sand deposit with other deposit (Fresco, 1986). In the case of western Zambia, the immigrants use only fields on the sand for cultivation. They depend on low cassava production economically and for self-sufficiency, so that their cultivation technique is developed as essential for the secure production of the main crop.

Furthermore, the system is supported by the social organization called *limbo* through land distribution and reciprocal help. This paper analyzes how the social organization takes an important role in the continuous cultivation of the main crop of the immigrants. Also, it is assumed that, consequently, the organization functions as a managing unit of the woodland to prevent over-cutting. The immigrants live in a poor environment with their unique cultivation techniques and units based on their social organization.

NOTES

(1) In this paper, the Lozi definition was followed as 'Luyana group' defined by Gluckman (1941).
(2) EC is used as an index of total water-soluble bases.

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