VEGETATION CHANGES AND USE OF PALMS AS A BUILDING MATERIAL BY OVAMBO AGRO-PASTORALISTS IN NORTH-CENTRAL NAMIBIA

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ABSTRACT This paper focuses on the mutual transition between vegetation and timber use by the Ovambo people in north-central Namibia and their use of palms for timber in recent years.
The vegetation around the research area was characterized as Mopane savanna, dominated by *Colophospermum mopane*. Historically, the Ovambo used mainly Mopane trunks for timber. However, as bush encroachment advanced in some parts of north-central Namibia, residents were forced to collect Mopane timber from the south. Since the 1970s, however, collecting Mopane has become difficult, and the inhabitants have therefore begun to use palm petioles for timber. Because the use of this resource requires many palm petioles, an environment conducive to grow many palms is required to make this option feasible. The vegetation configuration of this environment was formed mainly by three factors: (1) the unique flood terrain initially dispersed palm seeds over a wide area, (2) humans involuntarily dispersed seeds after eating, (3) palms were conserved by the residents. Thus, the increased use of palms emerged at a point of intersection between a change in vegetation patterns and a change in plant use by humans. The critical points of this use are its sustainability and the maintenance of traditional building complexity.

Key Words: Ovambo; Palm use; Mopane savanna; Vegetation change; Namibia.

INTRODUCTION

The vegetation environment in southern Africa has changed rapidly in recent decades, particularly in response to human impacts. In the Republic of Namibia, deforestation and bush encroachment are considered serious problems (Erkkilä & Siiskonen, 1992). In particular, the north-central region of the country has a high population density, and vegetation has been considerably disturbed in this area.

The local vegetation was once classified as Mopane savanna (Giess, 1971), which was dominated by *Colophospermum mopane*, a member of the family *Caesalpiniaceae*. However, Mendelsohn *et al*. (2000) discovered several patches of vegetation that were dominated by *Acacia arenalia*, which belongs to the family *Mimosaceae*. Previous work has demonstrated that this vegetation has formed as a result of bush encroachment (Mendelsohn *et al*., 2000; Strohbach, 2000).

Ovambo agro-pastoralists primarily inhabit this region, and they use several tree species for various purposes, similar to other southern African societies.

Rodin (1985) conducted an ethno-botanical research study of the Ovambo and reported their tree utilization methods in detail. For example, the Ovambo use trees for food, medicine, timber, firewood, and instruments. Rodin (1985) pointed out that they used many trees for building materials, and this method of timber use has led to changes in the vegetation configuration of this region (Erkkilä & Siiskonen, 1992; Erkkilä, 2001).

On the other hand, changing of vegetation itself has influenced the tree utilization methods of the Ovambo. Particularly near towns, where deforestation and bush encroachment have increased rapidly, the local population has had difficulties collecting timber. At the same time, the socioeconomic conditions in this area have also been changing rapidly within the last few decades; for example, the country gained independence in 1990. The socioeconomic changes have therefore altered the vegetation both directly and indirectly.

In the area of near town, a new method of timber utilization using palm petioles has emerged in recent years. It is considered that palm use for timber is important as it enables sustainable timber use and maintains traditional method of house construction.

The use of palm petioles for timber has been reported by Marsh & Seely (1992) and Sullivan *et al*. (1995). They pointed out that Ovambo people use palm petioles for timber in these days.

However, it has not reported about historical change between their palm use for timber and vegetation change, especially bush encroachment. And it also has not discussed the meaning of palm use for timber in recent Ovambo society. So to examine the palm use for timber in the recent years, we need to clarify the historical change in timber use and compare the timber utilizations of people who live in different vegetation types. This paper focuses on the mutual transition between vegetation and timber utilization by the Ovambo and their use of palms as a building material in recent years. The research was conducted in two villages located in areas characterized by different vegetation types, Mopane savanna and patch vegetation that were dominated by *A. arenalia*, to compare the differences in timber utilization.

RESEARCH AREA

I. Study Site

The study was conducted in the villages of Onkani and Uukwangula. Onkani lies approximately 60 km southwest of the town of Oshakati, the center of the Oshana region in north-central Namibia (Fig. 1). Uukwangula is approximately 10 km west of Oshakati. The study was conducted over 7 months, from September 2002 to March 2003.

According to the official census, around the time of the study 590 people in 103 households lived in Onkani, and 590 people in 97 households lived in Uukwangula (Census Office, 2001). Although the populations of the two villages

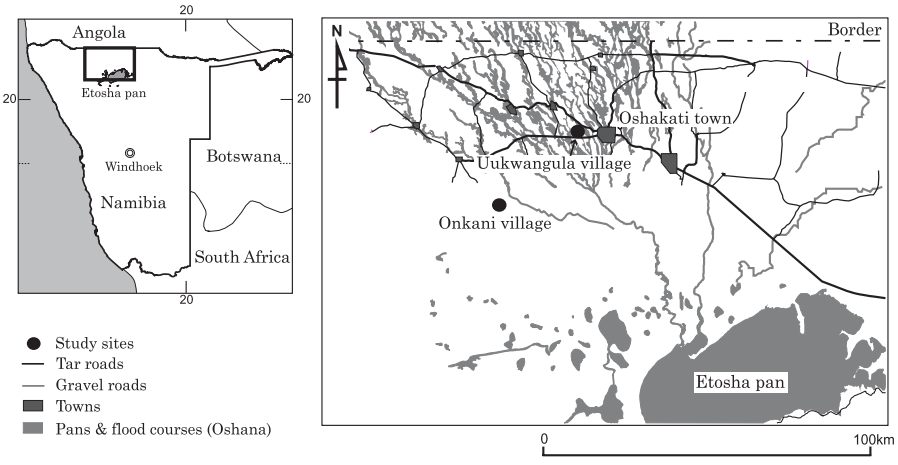

Fig. 1. Study site.

were the same, the population densities differed: 18.02 people/km^2 in Onkani and 40.11 people/km^2 in Uukwangula.

II. Climate and Environment

The research area is located on a vast plain at an elevation between 1090 m and 1110 m above sea level. The plain descends in a gradual slope from north to south, and many ephemeral flood courses extend from the Sierra Encoco Mountains in southern Angola to the Etosha pan in Northern Namibia; these flood courses are called "oshana" in the Ovambo language(1). In north-central Namibia, many oshana are densely distributed and collectively form a "flood area"(2).

The mean annual rainfall of this region is 400–500 mm, and the rainy season lasts from December to April. When the rains in southern Angola are heavy,

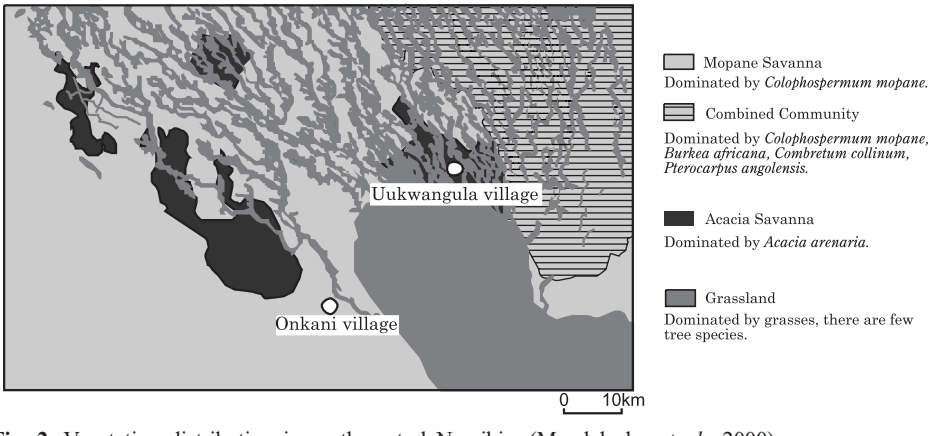

Fig. 2. Vegetation distribution in north-central Namibia. (Mendelsohn *et al*., 2000)

floodwater moves to the south; this happens on average twice every 3 years (Clarke, 1999). Onkani is located outside the flood area, and there are no oshana near the village. On the other hand, Uukwangula is located in the center of the flood area and lies between two oshana.

The vegetation around Onkani is Mopane savanna, which is dominated by *C. mopane* (Mopane). Uukwangula lies in the Acacia savanna, which is dominated by *A. arenaria* (Acacia); this is an area where bush encroachment has advanced (Fig. 2). In the oshana, the primary vegetation is grasses, and few trees grow there.

III. History and Subsistence System

"Ovambo" is a generic name that describes several tribes, and nine Ovambo tribes are found in this country (Mendelsohn *et al*., 2000). The two study villages are inhabited primarily by Kwambi people, who belong to one of these tribes. The Ovambo immigrated into north-central Namibia in the 16th century and separated into different groups on the basis of tribal affiliations (Williams, 1991). The Kwambi immigrated into the center of the flood area and inhabited the area near Uukwangula in the 19th century (Siiskonen, 1990). Therefore, Uukwangula is considered to have been founded at that time. In contrast, Onkani was established in the 1970s.

The Ovambo practice a multisubsistence system, i.e., agriculture, grazing, fishing, and gathering. They do not build houses in areas with oshana, nor do they cultivate fields there (Fig. 3). At the beginning of December, when the rainy season begins, the people cultivate fields that are located near their houses and sow pearl millet, sorghum, cowpea, and groundnut. Harvesting begins in May, at the end of the rainy season.

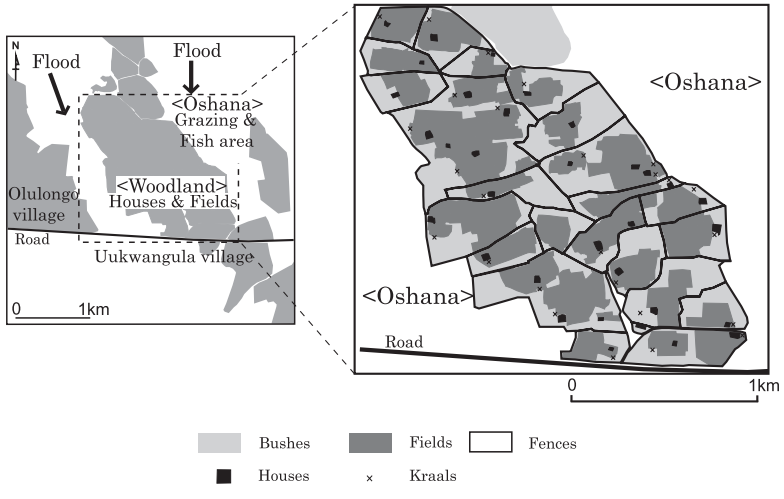

Fig. 3. Land use in the village of Uukwangula.
* This figure was drawn using GPS.

RESEARCH METHODS

To evaluate the vegetation configuration, I established study sites on land owned by two households in each village. The study sites included fields and bush, and adjustments were made to allow for equal areas between the two villages (about 4.6 ha of bush and about 4.8 ha of fields per village). At these study sites, all trees >20 cm tall were counted and measured. The heights of palms were measured from the ground to the terminal shoot, excluding the leaves. In Uukwangula, all trees >4 m in height were counted and measured on the land belonging to 32 households to analyze the tree structure of the canopy layer (about 90.3 ha of fields and about 91.0 ha of bush). In the same area, all palms were counted and measured.

To evaluate timber use, I counted the number of 10-m-long logs used for the construction of outer palisades of 20 houses in Onkani and 32 houses in Uukwangula. I also interviewed the owners about their use of timber and how it had changed over time.

VEGETATION STRUCTURE IN ONKANI AND UUKWANGULA

I. Onkani

The history of Onkani is not as long as that of other Kwambi village, thus it is considered that the original vegetation is remained relatively. The vegetation around Onkani was classified as fields or bush. The vegetation on each parcel of land was surrounded by fences, but this village did not have a high population density; therefore, the communal area was not surrounded by fences and was located in the bush. In this village, Mopane trees accounted for more than

Table 1. Number of trees by height class in Onkani.

Tree species	Tree height (cm)							
	20–99	100–199	200–299	300–399	400–500	500<	Total	(%)
Bush								
Colophospermum mopane	1783	3400	586	8	1	1	5779	99.5
Hyphaene petersiana	0	0	0	0	0	0	0	0.0
Acacia arenaria	2	11	2	0	0	0	15	0.3
Others (3 species)	2	1	4	3	0	2	12	0.2
Total	1787	3412	592	11	1	3	5806	100.0
Field								
Colophospermum mopane	116	4	5	1	0	0	126	90.6
Hyphaene petersiana	7	1	1	0	1	0	10	7.2
Others (3 species)	0	1	1	1	0	0	3	2.2
Total	123	6	7	2	1	0	139	100.0

* Site area=ca. 4.6 ha of bush and ca. 4.8 ha of fields.

90% of all trees, both in the fields and the bush (Table 1). It was considerable that there were few other species in this village. *A. arenaria* that is the typical species in the bush encroachment area emerged only 15 trees in the bush. The palms (*Hyphaene petersiana*) were also few, only ten palms were observed in the fields. This palm is an indigenous species that is distributed throughout parts of Southern Africa (Palgrave, 1993).

Short Mopane trees <3 m tall accounted for more than 90% in both bush and fields (Table 1), even though Mopane usually grow to approximately 10 m in height. However, these trees had been cut at the main trunk and had attained a shrubby stature as a result of many shoot branches. Presumably, tall Mopane had been growing in this area when people first immigrated into the village.

II. Uukwangula

Around Uukwangula, vegetation was classified as either grasslands in areas with oshana or woodlands in other areas. Residents constructed houses and cultivated fields in the woodlands and erected fences around their land (Fig. 3). The vegetation on each parcel of land was surrounded by fences and was classified as either fields or bush. Bush was dominated by *A. arenaria* (61.5%) and *H. petersiana* (33.1%: Table 2). The palms were dominant in the fields (75.8%), followed by *Sclerocarya birrea* (20.9%; Table 2). This finding represents one of the main differences in terms of vegetation between the two villages. The total number of trees was lower in the fields than in the bush, but the number of tall trees was higher in the fields. We focused on the tree structure of the canopy layer and found that the palm and *S. birrea* accounted for 91.4% of all tall trees (Table 3), followed by *Berchemia discolor* (3.0%). These tall trees are

Table 2. Number of trees by height class in Uukwangula.

Tree species	Tree height (cm)							
	20–99	100–199	200–299	300–399	400–500	500<	Total	(%)
Bush								
Acacia arenaria	188	397	64	0	0	0	649	61.5
Dichrostachys cinerea	11	31	1	1	0	0	44	4.2
Hyphaene petersiana	339	4	3	1	2	1	350	33.1
Sclerocarya birrea	0	0	0	0	0	10	10	0.9
Others (2 species)	1	0	0	0	0	2	3	0.3
Total	539	432	68	2	2	13	1056	100.0
Field								
Acacia arenaria	2	1	0	0	0	0	3	1.6
Dichrostachys cinerea	0	0	0	0	0	0	0	0.0
Hyphaene petersiana	108	2	5	4	8	11	138	75.8
Sclerocarya birrea	11	7	2	1	4	13	38	20.9
Others (2 species)	0	0	0	0	0	3	3	1.6
Total	121	10	7	5	12	28	182	100.0

* Site area=ca. 4.6 ha of bush and ca. 4.8 ha of fields.

Table 3. Number of tall trees in Uukwangula.

Species	Field	Bush	Total	(%)
Acacia sp.	2	2	4	0.6
Berchemia discolor	16	3	19	3.0
Colophospermum mopane	1		1	0.2
Combretum sp.	8	1	9	1.4
Commiphora sp.		1	1	0.2
Diospyros mespiliformis	1	1	2	0.3
Ficus sycomorus	6	2	8	1.3
Hyphaene petersiana	228	191	419	66.7
Lonchocarpus nelsii	1	3	4	0.6
Prosopis glandulosa	1		1	0.2
Salix sp.	1		1	0.2
Sclerocarya birrea	115	40	155	24.7
Terminalia sericea	1		1	0.2
Others	2	1	3	0.5
Total	118	41	628	100.0

* Site area=ca. 90.3 ha of fields and ca. 91.0 ha of bush.
** Tall trees were defined as being >4 m in height.
*** Tree species with underline bear edible fruits.

edible fruit–bearing species, and the number of these species in the fields was larger than in the bush. Mopane trees were represented by only one individual in the fields (Table 3).

FACTORS AFFECTING PALM DISTRIBUTION

In an earlier chapter, the differences in the number of palms between Onkani and Uukwangula were illustrated. The reason for the differences is two-fold: ecological environments and human impacts. Figure 4 shows the locations of palm trees in a village within the flood area. According to this figure, the palms were distributed primarily near or in the oshana. One of the reasons for this is that this palm can grow in areas with sufficient water supply. As the groundwater aquifer lies at a shallow depth in the oshana (Marsh & Seely, 1992), sufficient groundwater is available. The other reason influencing the distribution of palm trees is the seed-dispersing capability of this species. This type of palm has male and female plants, and the latter bear many round seeds 4–6 cm in diameter. Seeds of this size are not readily dispersed by wind. Instead, animals, in particular baboons and elephants, disperse the seeds (Codd, 1972); however, these animals are rare in the flood area. However, because the seeds float on water, they are easily dispersed by flooding. Through this route of seed dispersal, palm seeds drift ashore and then germinate. This seed-dispersal system is an important factor for palm distribution within the vast flood area of north-central Namibia.

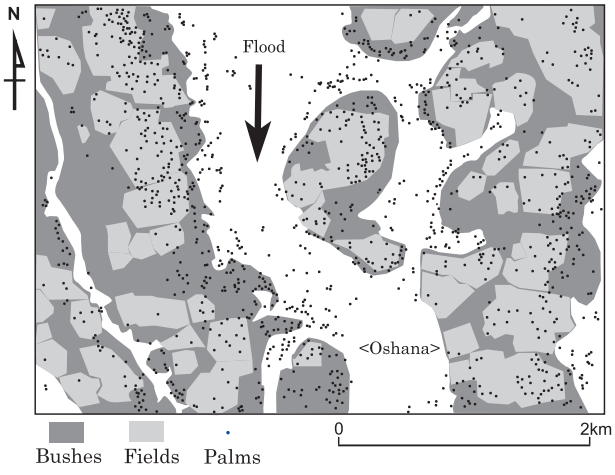

Fig. 4. Distribution of palms in one village in north-central Namibia.
* This figure was drawn using an aerial photo taken in 1996.

In addition to this factor, anthropogenic activities also influence seed dispersal. The Ovambo deliberately plant few seeds of indigenous trees. However, they often eat this palm fruit near the end of the dry season, and after they eat the fruit, they discard the seeds; this results in the involuntarily dispersal of many seeds throughout the village. Figure 4 also illustrates that there are many palms inside the fields, which are located near the houses, where many palm seeds are often dispersed.

In addition to seed dispersal, the conservation of fruiting trees has also been an important factor in increasing the number of palms (Cunningham, 1997). One reason for their conservation is that palm fruits are an important part of the food supply during the dry season. Another reason is that fruit trees were traditionally managed by a village headman (Kreike, 1995), and villagers were not allowed to fell fruit trees without the permission of the headman. In recent years, this system has changed, and the house owner now manages the fruit trees that grow on his own land, which is fenced in. Despite this change, the people still conserve edible fruit–bearing trees, and they manage seedlings of these species. In recent years, residents have used tractors to plough their fields. Despite this, small palms still grow in the fields because the villagers avoid cutting them down while ploughing. Approximately 30% of small palms (<1 m in height) grew in the fields (Fig. 5).

Another reason for not harvesting the palms is that the people earn money by selling palm products, such as palm liquor (“okanyome”) and palm baskets (“oshimbali”). The Ovambo produce okanyome from palm fruits and weave oshimbali with palm leaves. They regularly drink okanyome and use oshimbali to store food and other items, and they have sold these palm-based products in the city. In particular, since the country gained independence, palm products have been sold to tourists as souvenirs and to Ovambo workers in the city.

The villagers of Onkani make okanyome and oshimbali, despite the scarcity

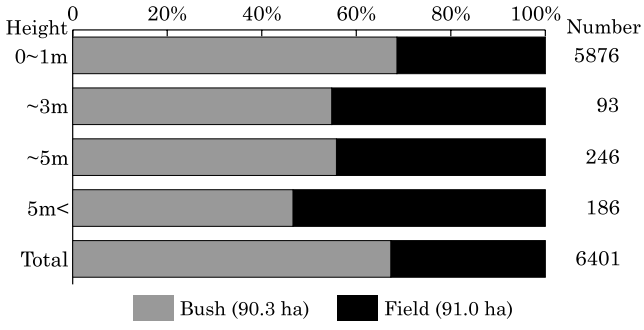

Fig. 5. Habitat of Palm tree.

of palms in their area. In fact, all households made oshimbali because it is essential for their daily lives, and it is easy to carry the material (palm leaf) from other places. Ten people (50%) sold oshimbali during the last year (2002). In contrast, only five households made okanyome, because of the difficulty of collecting enough palm fruits.

On the other hand, in Uukwangula, 21 households (66%) make and sell okanyome. The okanyome is often sold in small shops in the center of the village, where shop owners sell to traders from the city, and some people sell their products directly to traders. Thirty households (93%) make oshimbali, and 12 households sold them during the last year.

In summary, because the palms are important in the daily lives of villagers and can be used to generate revenue, they have been conserved for a long time. At the same time, palms have also become an important source of timber in recent years.

TIMBER USE IN ONKANI

I. Use of Timber in House Construction

The Ovambo use timber to build houses, kraals, and fences. The house is called “egumbo” and has a complex structure composed of outer palisades, several huts, and inner palisades (Fig. 6). This complexity is an important feature of the houses. The traditional outer palisade requires many logs, ranging from 2–3 m in length. When a new house is built, the size and location of the house are selected and a ditch is excavated around the area to create the outer palisade. Logs are then densely arranged in the ditch and several huts are constructed within the outer palisade. Finally, several sections are divided by constructing the inner palisade, which is made in the same way as the outer palisade. Usually, Mopane logs are used for timber, along with stems of *Combretum hereroens* and *Terminalia sericea* (Rodin, 1985), which are strong and resistant to termites. House construction requires many logs; for example, 1380 logs were used in building a house (Fig. 6).

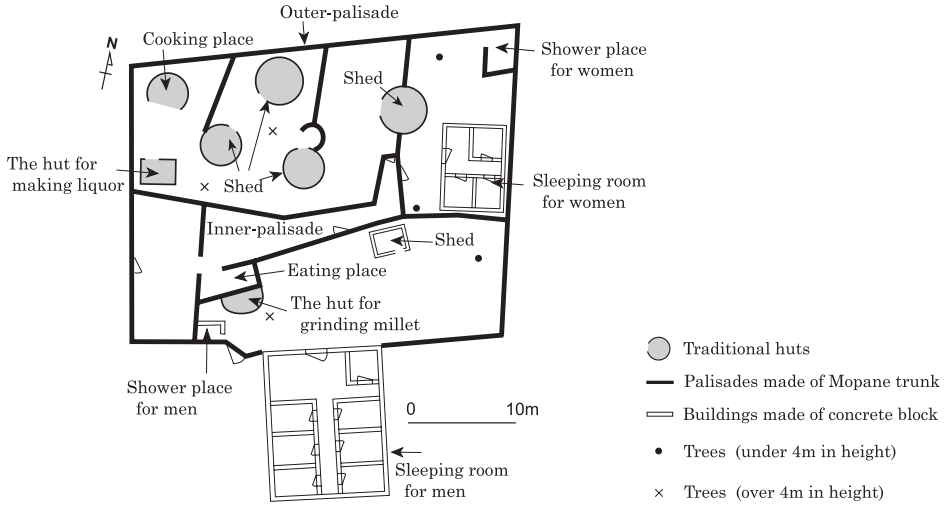

Fig. 6. Typical house structure.
* This figure was drawn based on one house measured in Uukwangula.

II. Use of Mopane for Timber

One of the earliest records of Ovambo life was written by the explorer Francis Galton, who reported on the structure of typical Ovambo houses when he visited this flood area in 1851 (Galton, 1889). Galton described the complex houses as labyrinths made of many logs.

In Onkani, people use mainly Mopane trunks as their building material. The outer palisade is classified into four types on the basis of the materials used: Mopane type, palm type, block type, and combined type (which consists of Mopane timbers and palm petioles). In this village, most of outer palisades are of the Mopane type (95%), and there are no palm-type or combined-type outer palisades (Table 4). Although many Mopane-type outer palisades are present, the ratio of thick Mopane stems (upper part at least 5 cm in diameter) that can be used is regulated by law, and many villagers used small Mopane branches (Table 5).

Palm petioles are seldom used in this village because the palms are sparsely distributed and few tall palms are available. On the other hand, many shrubby Mopane trees grow in dense stands, and people can use many small branches of these Mopanes. They also use the stems of pearl millet as a building material, especially for the inner palisades.

TRANSITION OF TIMBER USE IN UUKWANGULA

I. Use of Mopane for Timber

When the Kwambi people immigrated into Uukwangula, the vegetation in the

Table 4. Number of outer palisades by type in Uukwangula and Onkani.

Village name	Palm type number (%)	Combined type number (%)	Mopane type number (%)	Block type number (%)	Total number (%)
Uukwangula village	14 (44)	4 (12)	8 (25)	6 (19)	32 (100)
Onkani village	0 (0)	0 (0)	19 (95)	1 (5)	20 (100)

* The outer-palisade type was defined by the ratio of palm petioles used. Types that used palm petioles >80% were considered the palm type, types that used palm petioles <20% were considered the Mopane type, and types that used palm petioles between 20% and 80% were considered the combined type. Palisades constructed of concrete blocks were considered the block type.

Table 5. Average number of logs used for each outer-palisade type per 10 m length.

Type of Outer-palisade	Mopane trunks (cm)					Palm petioles (cm)		others
	0–5	5–10	10–15	15–20	20<	0–5	5<	
Uukwangula village								
Palm type (14)	6	9	4	1	0	178	131	2
Combined type (4)	26	23	10	3	0	24	40	0
Mopane type (8)	27	58	20	4	0	1	4	0
Onkani village								
Mopane type (19)	126	49	8	1	0	0	4	0

area was Mopane savanna, and the people used the Mopane around the village for timber. However, bush encroachment increased owing to harvesting of Mopane and overgrazing, and the Mopane savanna was replaced by Acacia savanna. When this vegetation transition exactly occurred is unknown. An elderly villager reported that there had been very few Mopane trees around the village during his childhood.

Consequently, finding Mopane for timber near the village has become challenging. The villagers do not use Acacia trees for timber because the stems are too short and are easily broken. Therefore, people collect Mopane from other areas. For example, almost all households (88%) in Uukwangula collected Mopane from the southern area, especially around Onkani (Fig. 7). In the past, villagers were not allowed to freely cut down Mopane trees in other areas, because the areas in which natural resources could be collected were predetermined among the Ovambo tribes. For the Kwambi, this designated area was to the south, in a region that corresponded with the cattle grazing area during the dry season. Thus, the people collected Mopane timber in the south, and chose a location where many Mopane trees grew.

II. The Decline of Mopane Timber Use

Since the 1970s, it has been difficult to collect Mopane timber in the south. One reason is that the number of Mopane trees with thick stems decreased as a result of overharvesting. Mopane trees produce many new branches, resulting in a shrubby stature, and many years are required for the trees to achieve sufficient height and diameter for use as timber. Currently, almost all the Mopane

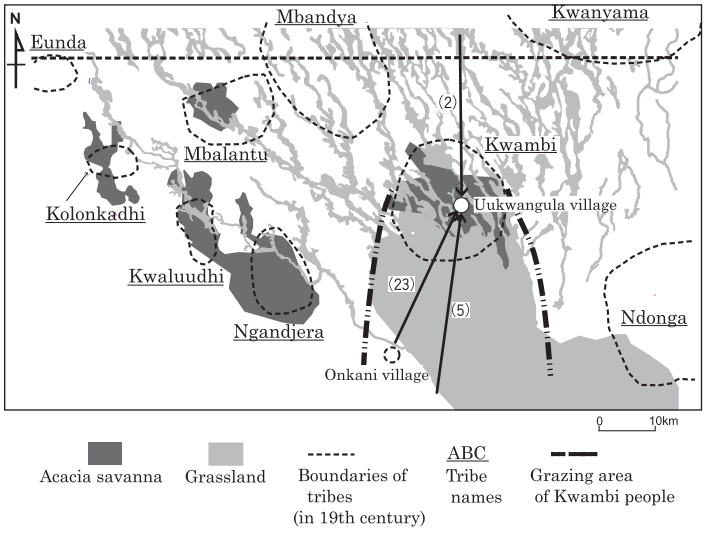

Fig. 7. Area in which Mopane timber is collected by Uukwangula villagers.
* The number of households is shown in parentheses.
** The tribe boundary is based on Siiskonen (1990); vegetation distribution is based on Mendelsohn *et al*. (2000).

trees around Onkani are <3 m in height[3] (Table 1). The Uukwangula villagers indicated that the number of tall Mopane trees has been in decline since about the 1970s.

Another reason for the decline is the population migration, which was prompted in part by a scarcity of land. Some Kwambi people migrated from the flood plain to the southern area, which historically had a low population density; Onkani was formed by those people. The Ovambo population was 300,000 in 1970, 450,000 in 1980, 630,000 in 1991 (Mendelsohn *et al*., 2000; Census Office, 1991); thus, the population increased over 2.1-fold in 21 years, from 1970 to 1991.

In addition, the war for independence intensified at that time; thus, the people took refuge from the central area to rural areas or to other countries, and some Kwambi people migrated to the south. Because of this migration, the number of Mopane trees with thick stems was rapidly reduced, and it became difficult for other villagers to collect timber.

Still another difficulty in using Mopane timber was legal prohibition. In 1968, the Forest Act was established, which prohibited the harvest of tall trees without permission. However, this measure was not effective in preventing the people from felling tall trees, because it was a chaotic period owing to the ongoing war of independence. The Uukwangula villagers indicated that the regulations became stricter once the country gained independence.

III. Land Use Changes in Uukwangula

For the reasons discussed above, the villagers of Uukwangula began to collect timber around their own village. However, land use has also changed in Uukwangula since the 1980s. One of these changes was that the residents erected fences around their land to protect their fields from domestic animals. Fuller *et al*. (1996) pointed out that people erected fences around their lands after government farms were fenced. Presumably, the people were anxious about the amount of land, which was decreasing as the number of houses increased.

The practice of erecting fences influenced the patterns of tree use. Historically, a village headman managed the village lands and assigned land to a house owner until the death of that owner; villagers returned the land after the death of the house owner. As mentioned earlier, the headman also managed tall trees. However, the system gradually changed such that the house owner managed his own land, including all trees growing on it. Erecting fences accelerated this tendency.

IV. Use of Palm Petioles for Timber

Because of these changes, the villagers of Uukwangula have changed their construction methods. Specifically, they now use concrete blocks and tin sheets, i.e., they have devised a new type of building using these new materials. However, only a few people use these materials to construct the outer and inner palisades, whereas many people now use palm petioles as a building material.

The villagers usually use long, thick palm petioles, called "iipokolo", as a building material. These petioles are collected from tall palm trees (>2–3 m in height), called "omulunga." At the end of the dry season, a villager climbs the omulunga and cuts down several iipokolo and fruits. The palm fruit is used for making okanyome. In 1 year, one omulunga produces 12–20 leaves on average (Fanshawe, 1967). The iipokolo is used for making the outer palisade, inner palisade, rooves of the huts, and kraal. The stems of pearl millet are also used as a building material, particularly for the inner palisade and the interior of the outer palisade.

In Uukwangula, most of the outer palisades were of the palm type (44%), followed by the Mopane type (25%; Table 4). On average, the palm type required 309 palm petioles and 20 Mopane logs (10 m long) for the outer palisade (Table 5). The Mopane type required five palm petioles and 109 Mopane timbers (Table 5). Thus, the palm-type outer palisade substituted 89 Mopane timbers for 304 iipokolo per 10-m length of outer palisade. The average length of the outer palisade was 98.5 m; thus, 2994 iipokolo replaced 876 Mopane timbers. Although the Ovambo people have historically used iipokolo for various purposes, using this many iipokolo as a building material is a recent trend.

DISCUSSION

I. Factors Enabling the Use of Many Palm Petioles in Uukwangula

As indicated above, the timber use has changed because of vegetation and social conditions, and the villagers of Uukwangula used mostly palm petioles for timber. The main reason why they were able to build palm-type outer palisades was that palm petioles were readily available. Because palm petioles are thinner and weaker than Mopane timber, many petioles must be used together, and some petioles must be removed and repaired every year owing to decay and breakage. Moreover, palm petioles are used not only for the outer palisade but also for several other purposes. Therefore, many palm petioles are needed, and the use of palm trees depends on an environment that is conducive to the growth of numerous palms.

The main factors affecting palm distribution are geographical conditions and human impacts. This flood plain exhibits a particular geographical condition with a unique palm distribution pattern. In general, the palms grow along ephemeral or perennial rivers in arid regions. Namibian palms are distributed mainly along the Hoarusib and Kunene Rivers in northwestern Namibia and the Okavango and Kuwando Rivers in northeastern Namibia. However, palm growth is confined to riparian habitats, and the population of this species is not very large. Despite the low prevalence of this species, people use this palm for multiple purposes in these areas (Malan & Owen-Smith, 1974; Davelid & Hast, 1998), although they use fewer palm leaves than the villagers of Uukwangula. On the other hand, this flood area is subjected to many ephemeral flood courses, and the palms are therefore distributed over a vast area.

Anthropogenic impacts on vegetation were evaluated by comparing the vegetation of Uukwangula to that of Onkani. Human activities have led to a reduction in the number of Mopane trees and to bush encroachment as well as to an increase in the number of some edible fruit bearing species, especially palms. This change has caused an increase in the availability of palm petioles. The critical point of these ecohistorical changes is the mutual relationship between vegetation distribution and plant use by the people. Of course, other factors are associated with this transition, but the increase in palm populations is the most important factor that facilitates the use of many palm petioles. However, human activities are also important for increasing the number of palms. Thus, the palm-type outer palisade emerged because of the confluence of vegetation change and changes in plant use by the people.

In addition, this mutual transition has continued into modern times. In recent years, the villagers of Onkani have actively planted palm seeds, and the number of small palms in the fields has gradually increased. This trend is important for collecting building materials in the future, when the number of Mopane trees will be further reduced.

II. Palm Petioles and Recent Trends in the Use of New Materials

In recent years, most people have begun to use concrete blocks and tin sheets purchased in the city. Because Uukwangula is located near a larger town, bringing such items to the village is easy. All houses in Uukwangula have some components made of concrete blocks, and the outer palisades of six houses were constructed with concrete blocks (Table 4). These outer palisades were built within the last few years, and one house under construction also had an outer palisade made of concrete blocks.

However, people who lived in these block-type houses also cut down palm petioles during the dry season and used them to repair the inner palisades, fences, kraals, and huts. Petioles were collected not only from female palms but also from male palms. Therefore, people who live in houses made of new materials also require palm petioles; thus, palm petioles rank among the most important building materials currently in use.

III. Sustainability of Palm Use

The cycle of palm petiole use is renewable because the petioles reproduce every year. This renewable nature is an important concept for the use of natural resources, but this concept has some inherent problems.

One problem is that there are currently few medium-sized palms, i.e., 1–3 m in height (Fig. 5). The number of small palms, 0–1 m, was 13.6 times greater than trees >3 m (Fig. 5), and these small palms are considered to have increased in number. However, intermediate-sized palms represented only 1.5% of the population. Sullivan *et al*. (1995) analyzed these findings and pointed out the relationship between this palm population structure and the use of palm leaves by people and domestic animals. People sometimes eat the terminal shoots of the palm, especially in years of drought.

Another problem was caused by the division of land according to the increase in the number of houses. People used palms of their land, which were fenced in. However, the land area of each household was different. The palm density also differed according to the ecological conditions where people lived. The owners of houses with few tall palms faced difficulty in collecting enough petioles to maintain a palm-type outer palisade.

This paper aimed to clarify the transition of vegetation and the timber use by the Ovambo and focused on palm use in recent years. Through comparison of two villages in different vegetations, it was clarified that palm petioles have been an important material for the Ovambo who live in the area where bush encroachment has advanced in recent years, during which the vegetation and social environment have changed rapidly. It is especially important for them to preserve the “complexity” of their traditional houses (i.e., outer and inner palisades and many huts). To clarify the relationship between the Ovambo and plants in recent years, the changing vegetation and human lifestyle should be evaluated based not only on the natural environment or social conditions but

also on their subsistence, economic activities, and political condition. Methods of palm population management and the effect on palm populations should also be evaluated in detail.

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NOTES

(1) The Ovambo language is called Oshivambo, but it includes several dialects. In this paper, I refer to Oshikwambi, one of the Oshivambo dialects.
(2) In this area, the flood waters move along the ephemeral river course (oshana), and it seldom occurs that water overflows from this ephemeral river. This condition is different from other floodplains.
(3) Werger & Coetzee (1978) reported that Mopane trees distributed in the southern part of this flood area are shrubby. However, elderly Onkani villagers claimed that tall Mopane trees had grown around Onkani in the past.

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