SPATIAL CHANGE IN TREE UTILIZATION ON THE NORTHEASTERN SLOPE OF MOUNT KENYA

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Abstract Spatial change in tree utilization in the Central Meru District, which is located on the northeastern slopes at the foot of Mt. Kenya, was investigated. This paper outlines the distribution and utilization of various indigenous trees. Muringa (*Cordia africana*) was found to be the most useful tree in this region. Its habitat had the widest range of humidity, and it was used for the widest range of purposes. The diversity of indigenous trees utilized did not increase with humidity. A wider variety of indigenous trees were used on the dry, lower slopes than on the humid, upper slopes. A sacred tree, Mutero (*Olea europaes* spp. *africana*) was the second most useful tree. It was used for charcoal and firewood. Most inhabitants held no traditional respect for the sacred tree, suggesting that traditional values and practices with respect to some trees have changed.

Key words: local knowledge, Meru, Mount Kenya, useful trees

1. Introduction

Trees and shrubs play essential roles in land use, especially in rural areas of tropical and sub-tropical regions. They provide farmers with wood, fuel, food, fodder, a good environment for farming, and so on. Several studies on tree utilization have been conducted from the viewpoint of plant ecology and ethnology. Indigenous knowledge of useful trees has been described in detail (Carlowitz 1991; ICRAF 1992), and quantitative physiological studies have evaluated the role and benefits of agroforestry in sustainable agriculture (Ong and Huxley 1996). Moreover, the scientific results of these studies have been applied in farming and natural resource management in some rural areas (Young 1989; Wood and Burley 1991).

However, little attention has been paid to the spatial and temporal change of tree utilization in a region. The usefulness of a tree may depend on the natural environment of the site where the tree grows, for physio-ecological reasons. For example, the form, propagation manner, and phenology of a tree differ with climatic and edaphic conditions. Its usefulness may also depend on the personal history of local farmers, since the uses, and frequency of utilization, of a tree may vary among persons with different backgrounds. Thus, spatial and temporal changes in the roles of useful trees should be examined to understand the relationships between humans and trees.

This study was undertaken to provide basic data on the spatial heterogeneity and

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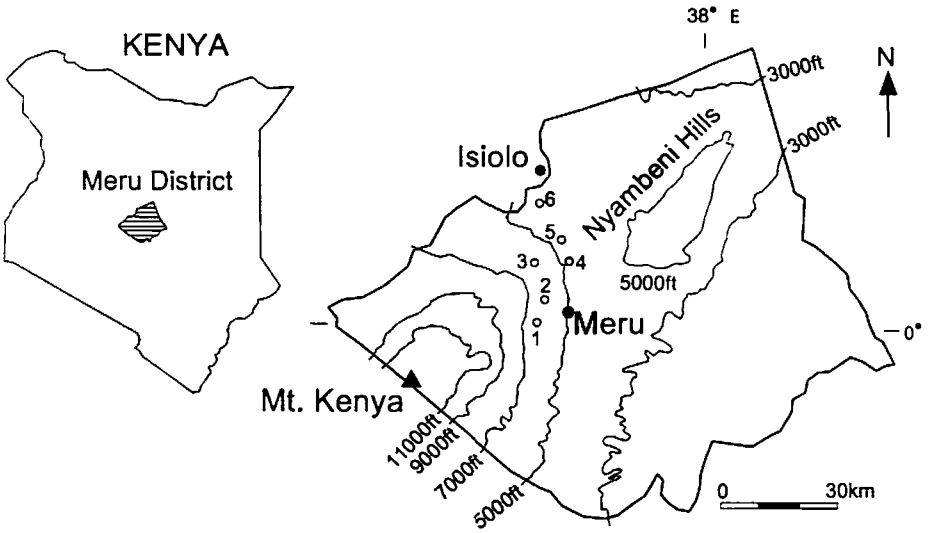

Fig. 1 Topography of the former Meru District and the location of the villages studied.
1: Katheri, 2: Naari, 3: Kiirua, 4: Ruiri, 5: Rwarera, 5: Mugae. The former Meru District is subdivided into 4 districts: Meru North, Meru Central, Meru South, and Tharaka Nithi.

historical changes in tree utilization in a mountainous region of Kenya. Of the countries in the tropics and sub-tropics, Kenya stands out as one that has a rich variety of agroforestry activities and an interest in growing and using trees in rural areas (ICRAF 1992). This paper is a revision of a paper reporting useful trees in Meru District, Eastern Province, Kenya (Takaoka 1999). Some descriptions and discussions are new to this paper.

2. Physical and Human Settings of the Study Area

Field research was conducted in Meru Central District on the northeastern slopes of Mount Kenya (Fig. 1). Mt. Kenya is an oasis of natural resources, such as water and fertile soils, for agriculture and forestry within a semi-arid savanna (Liniger 1992). However, several studies indicate a growing conflict between humans and the natural environment in this region. The rapidly growing population (Ayiemba 1991), land-use change from large- to small-scale farming (Kohler 1987; Flury 1990; Wiesmann 1992; Kiteme 1998), and inappropriate water conservation measures (Liniger 1992; Krhoda 1990) have caused environmental degradation on the lower slopes of Mt. Kenya. These problems may also have caused changes in human-tree relationships.

The Meru people are traditionally very attached to the natural environment, especially to trees. They once had intimate knowledge of local plants and their wider ecological concomitants (Bernard 1972). The respect and reverence of Meru people for trees has not changed, although only a few elders and herbalists still have a detailed traditional knowledge of trees.

According to meteorological observations, the mean annual precipitation in the towns of Meru and Isiolo is 1259 and 639 mm, respectively (Fig. 2). Total rainfall differs considerably

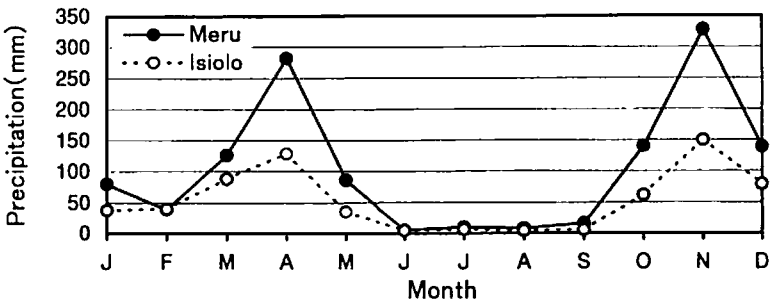

Fig. 2 Rainfall at Meru and Isiolo. Source: Kenya Meteorological Department.

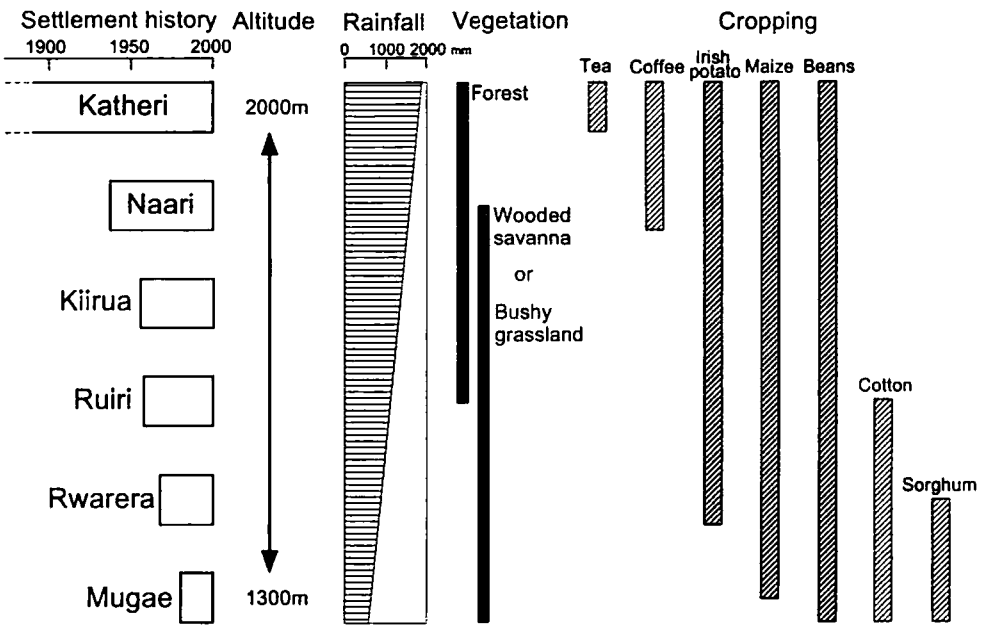

Fig. 3 Settlement history and agro-ecological environment of the villages studied.

throughout the study area. There are two rainy seasons: the long (late March to May) and short (mid October to December) rainy seasons. The variety of vegetation in this area is controlled by rainfall. Vegetation ranges from forests on the upper slopes, which receive more rainfall, to wooded savanna or bushy grasslands on the lower slopes, with less rainfall.

Around Meru Town, the Meru people belong to three ethnic groups: the Imenti, Tigania, and Igenbe. The Imenti live on the northeastern slopes at the foot of Mount Kenya, and the other two groups live in the Nyambeni Hills.

The villages studied were Katheri, Naari, Kiirua, Ruiri, Rwarera, and Mugae (Fig. 1). The environments of these villages differ. Katheri is one of the oldest villages, and receives sufficient rainfall. This village was once in the agricultural zone most favored by the Imenti (Bernard 1972), but the area was planted with tea and coffee in the 1960s. Since there was a shortage of land for shambas (*i.e.*, crop fields), the Imenti began moving to the lower slopes,

which receive less rainfall. People moved from the humid, upper mountain slopes to Naari, Kiirua, Ruiri, Rwarera, and Mugae in the last century (Fig. 3). For the settlers, this was a drastic change in their natural environment. Consequently, they have formed new relationships with the species of trees growing in the new villages.

Present-day variation in the crops grown in the villages reflects rainfall and temperature differences (Fig. 3). Maize and beans are major crops in all villages. Tea and coffee trees are planted in Katheri and Naari, which have sufficient rainfall, while cotton and sorghum are grown in Rwarera and Mugae, which have less rainfall. Some of the shamba owners have no permanent dwellings in Mugae. They make daily trips from their homesteads in the more humid areas to Mugae to plant and harvest crops.

3. Major Tree Species and their Uses

During field surveys in 1997, 1999, and 2000, sixty-seven shambas in the six Imenti villages were visited. Natural and planted trees in each shamba were described, and semi-structured interviews were conducted to collect local knowledge of trees. A total of 117 tree species were described, including 19 exotic species. Some indigenous trees inside the shambas had been planted or had invaded after the shambas were established, and others had been left standing when the shamba was cleared.

Indigenous trees observed in shambas and their uses are shown in Table 1. Most of the trees were used as firewood and charcoal, suggesting that the Meru people rely on trees as domestic fuel. Most villages obtained fuel wood from nearby forests or brush with the permission of the Forest Department, but this was supplemented by trees in the shambas. In addition, many trees had agricultural uses as sources of fodder, shade, and manure.

The distributions of the 13 major indigenous tree species are shown in Table 2. Muuru (*Vitex keniensis*), Mutuntu (*Croton macrostachyus*), and Mutero (*Olea europaes* spp. *africana*) dominated the humid, upper-slope areas, while Murera (*Acacia xanthophloea*), Mukururiti (*Acacia nilotica*), and Muchabiti (*Acacia tortolis*) were found on dry, lower slopes. Two species of tree were called Mutoo: *Dombeya rotundifolia* and *Azanza garckeana*. Although they have different flowers and leaves, the Meru use the same name.

Muringa (*Cordia africana*) was the most useful tree in this region. Muringa is a broad-leaved deciduous tree that reaches up to 10 m in height, but occasionally achieves 25 m. It grows in high-rainfall areas, and occurs in forest and savanna from 1200 to 2000 m (Noad and Birnie 1989). The Imenti people used Muringa trees in 42 shambas in Katheri, Naari, Kiirua, Ruiri, and Rwarera. Its habitat had the widest range of humidity. Farmers even tried to grow Muringa in Mugae, although it is very difficult to grow in dryer sites. Some succeeded in establishing young Muringa trees after the record-breaking heavy rain due to El Niño in 1997-1998.

Muringa is a multipurpose tree: trunks are used to make furniture, beehives, mortars, and poles for buildings: branches are used for firewood and charcoal: leaves are used for manure and fodder: bark is used for string and traditional medicine: and the fruit are used for glue. The tree provides good shade for shambas, and the flowers attract bees. Of the species investigated, Muringa had the greatest number of uses (Table 2).

Table 1 Trees found in shambas and their uses

Local name	Scientific name	Wood					Food					Fod-der	Environ-mental		Other Uses							
		Firewood	Charcoal	Posts/Poles	Timber	Furniture/Utensils	Fruit	Tea/Soup	Traditional drink	Medicine (human)	Medicine (veterinarian)	Fodder	Bee forage	Shade	Manure	Ornamental	Glue	Fiber	Ceremonial	Fencing	Tooth brush	Fermentation/Flavoring	Yam support	Poison	Oil
Miraa	*Catha edulis*						+																		
Morogorogo/Muengera	*Cussonia holstii*	●			+					+	+	●		+	+										
Muariki	*Jatropha curcas*	+								+	+	+			+										+
Mubiiri	*Gardenia volkensii*	+					+					+								+					
Mubiru	*Vangueria madagascariensis*	●	+	+		+	●								+					+					
Muchabiti	*Acacia tortilis*	●	●	+	+					+		●		+						+					
Mugandu	*Acacia stuhlmannii*	+								+		+								+					
Mugumo	*Ficus thonningii*	+								+	+	+						+							
Muhuti	*Erythrina abyssinica*	●			●	+				+	+	+	+	+	+					+					
Mujara	*Hibiscus* sp.	+								+										+					
Mukamuria	*Carissa edulis*						+	+		+															
Mukinduri	*Croton megalocarpus*	●	●	+	+					+	+			+						+					
Mukirinyei	*Euclea divinorum*	●	●	+						+	+	+		+							+				
Mukiroroti	*Acacia nilotica*	●	●	+	+			●		+		●		+						●					
Mukoo/Muknu	*Ficus glumosa*	●	+									●		+											
Mukurobai	*Commiphora* sp.	+						+				+					+			●	+				
Mukuura (1)	*Acacia mellifera*	●	●	+	+							●	+							●					
Mukuura (2)/Murukuai	*Balanites aegyptiaca*	●	●	+	+			+		+		●								●					
Mumangwa/Mukaramatu	*Melia volkensii*	+		+	+	+	+			+	+														
Mung'ua	*Sclerocarya birrea* ssp. *caffra*	+					+																		
Mungwani/Mukongoro	*Lovoa swynnertonii*	+	+	+	+							+		+											
Munorianthenge/Muthathambi	*Turraea robusta*	+	+									+													
Muraithithi	*Acacia albida* (*Faidherbia albida*)		+		+	+						+		+											
Murama	*Combretum molle*	●	●	+								+		+	+					+					
Murana	*Juniperus procera*	●		+	●					+										+					
Murantina	*Kigelia africana*	●							●		+	+	+												
Murebe	*Acacia senegal*	●	●		+			+		+		●								+					
Muremangige	*Dodonaea angustifolia*	+		+								+									+				
Muremanjogu	–	+	+																						
Murenda	*Grewia bicolor*	●	●	+		+	+				+	●	+		+			●							
Murera	*Acacia xanthophloea*	●	●	+						+	+	+		+						+					
Murima	*Ozoroa insignis*	●	●	+	+																				
Muringa	*Cordia africana*	●	+		●	●	+					●	●	●	●		+	●				+			
Muroronto	*Acacia seyal var. fistula*	+	+	+								+					+			+					
Muruai	*Acacia drepanolobium*	●	●									+								+					
Muruiri	–									+															
Mururu	*Acokanthera schimperi*	+					+																	+	
Mutandanderi	*Ziziphus abyssinica*	●	+		+	+	+					+													
Mutero	*Olea europaea* ssp. *Africana*	●	+	+	+	+		+		●	+	+	+	+		+			+	+	+	●			
Muthandathande	*Bersama abyssinica*	+																					+		
Muthanduku	*Acacia mearnsii*	●	●	+																+					
Muthiai	*Cordia monoica*	●	+	●		+	+					+			+		+			●					
Muthingiri	*Maytenus senegalensis*	●	+	+	+					+	+	+		+							+				
Muthithiu	*Rhus natalensis*	+	+				+	+				+									+				
Muthumiki	*Zanha africana*	+					+	+						+	+		+								
Muthunguu	–	+		+								+								+			+		
Mutirankongu	*Pappea capensis*	●	●	+			+				+		+								+				
Mutongu	*Solanum renschii*				+		+			+		+								+			●		
Mutoo (1)	*Dombeya rotundifolia*	●	●	+	+							●			+					+					
Mutoo (2)	*Azanza garckeana*	●	●	+	+	+	+					●		+	+			+		+					
Mutungugu	*Commiphora schimperi*	+										+								+					
Mutunguu	*Commiphora eminii* ssp. *Zimmermannii*	+			+						+	●		+						+			●		
Mutuntu	*Croton macrostachyus*	●			+					●	+			+	+										
Muunati	*Schrebera alata*	+	+	+	+							+													
Muuru	*Vitex keniensis*	●	+		●	+						+			+					+					
Mwangua	*Millettia dura*	+	+	+	+	+						+													
Mweria	*Prunus africana*	●	+	+	●	+		+			+														
Mwinyu	*Lannea* sp.	+								+												+			
–	*Maerua angolensis*	+	+				+	+				+													

Trees found in two or more shambas are shown. ●: Major use, +: Secondary use

Table 2 Distribution of major useful trees

Village	Shamba No.	Local and scientific name												
		Muuru *Vitex keniensis*	Mutuntu *Croton macrostachyus*	Mutero *Olea europaea* ssp. *africana*	Muringa *Cordia africana*	Muhuti *Erythrina abyssinica*	Mukinyei *Euclea divinorum*	Mutoo (1) *Dombeya rotundifolia*	Mutoo1 (2) *Azanza garckeana*	Murama *Combretum molle*	Murenda *Grewia bicolor*	Murera *Acacia xanthophloea*	Mukururiti *Acacia nilotica*	Muchabiti *Acacia tortilis*
Katheri	1	2		6	2									
	2	2	1		3									
	3				6									
	4	3	1		5									
	5	1			3									
	6				6									
	7	4		3	5									
	8	3	4	4	6		2							
	9	4			5									
	10	2		3	4									
	11				5									
	12				7									
Naari	1	1												
	2		4	5	6	4					4			
	3			2	7									
	4		1	2	8									
	5	2	1	3		2	2							
	6			1		1	1		1					
	7		2	7						3				
	8			4	8	3		3						
	9			2										
	10			5										
Kiirua	1				8	1	2							
	2													
	3						1							
	4			2	4	1		3						
	5						1							
	6			2			2					2		
	7			1			2							
	8				9	8	3	3	3					
	9			7										
	10			4	2	3	1							
	11					1					2			
	12					4								
	13			2			3			3			2	
	14											3		
Ruiri	1			4					1		4			
	2			1		2			2					
	3			2	3					2	2			
	4		2	5						2	2			
	5			3	7			5	3	4				
	6				4			3		3				
	7			3	3				4	2	3			
	8			5	7				7					
	9		4		7		4		4		3			
	10			5	9		2	5	5	5	4			
	11			2				3	4	3			6	
Rwarera	1											4	2	
	2													2
	3				4									
	4										3	2	5	
	5						3		4			3	4	
	6				4							3	5	
	7				12		2					3	5	
	8				10							3	3	3
	9				8				3	2	5		4	
	10				6									
	11				6							2	4	
Mugae	1													1
	2											2		6
	3													5
	4												4	5
	5													3
	6											5		4
	7													
	8											3	6	4
	9													4
Number of shambas		14	11	30	42	12	17	12	14	12	10	15	16	10
Number of uses*		2.4	2.2	3.4	5.7	2.5	2.1	3.6	3.4	2.9	3.2	2.9	4.2	3.7

Trees found in ten or more shambas are shown.

[5] means that the tree occurred in the shamba and the owner used it for 5 purposes.

*: Average number of uses in each shamba.

Table 3 Frequency distribution of utilized indigenous trees in each shamba

	Number of utilized trees in shamba													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Katheri	1	1	1	4	-	-	2	1	-	-	1	1	-	-
Naari	1	-	1	3	1	1	1	1	-	1	-	-	-	-
Kiirua	-	2	1	3	1	3	1	-	-	-	1	-	2	-
Ruiri	-	-	1	-	-	-	-	1	4	-	-	1	1	3
Rwarera	-	-	1	-	-	3	3	1	2	-	-	1	-	-
Mugae	-	-	3	-	-	2	1	2	-	-	1	-	-	-

4. Changes in Tree Utilization

The diversity of indigenous trees utilized did not increase with humidity. On the contrary, the Imenti people used a wider variety of indigenous trees on the dry lower slopes (Ruiri and Rwarera) than they used on the humid upper slopes (Katheri and Naari) (Table 3). The Imenti on the upper slopes grew many exotic fruit trees, such as orange and mango, instead of indigenous fruit trees. Rwarera villagers transplanted seedlings of indigenous trees that they had utilized on the upper slopes in their former homestead areas, although it was difficult for them to become established in the drier conditions. Useful trees growing on the humid upper slopes could not be transplanted to the driest village, Mugae. Pods and leaves from naturally invading *Acacia* trees were used for fodder and manure. In Mugae, there were no Mutero, Muringa (except those that grew after the El Niño rain), or Mutoo trees from which to make traditional medicines. However, some medicines were made from *Acacia* trees.

Mutero, a broad-leaved evergreen tree, was the second most utilized tree in the study area. It was used in 30 shambas in Katheri, Naari, Kiirua, and Ruiri (Table 2). The Imenti never used to cut the Mutero, because they considered it a sacred tree. However, they now use it for high-quality charcoal and firewood, and only a few elders retain the traditional respect for the sacred tree. This suggests that traditional values and practices with respect to some trees are changing. Although Nzioka (1991) pointed out that many plant species in this region were endangered as a result of over-exploitation, local knowledge of traditional tree utilization is also declining. Local knowledge of the traditional uses of trees seems to have been lost with the socio-economic changes in this region.

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