

Mobilizing agro-biodiversity and social networks to cope with adverse effects of climate and social changes: Experiences from Kitui, Kenya.

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Study site

The research site, Waluku and Kwaw' o villages, is located in Kitui District, about 160 km east of Nairobi and 10 Km north-east from Kitui town (Figure 1).

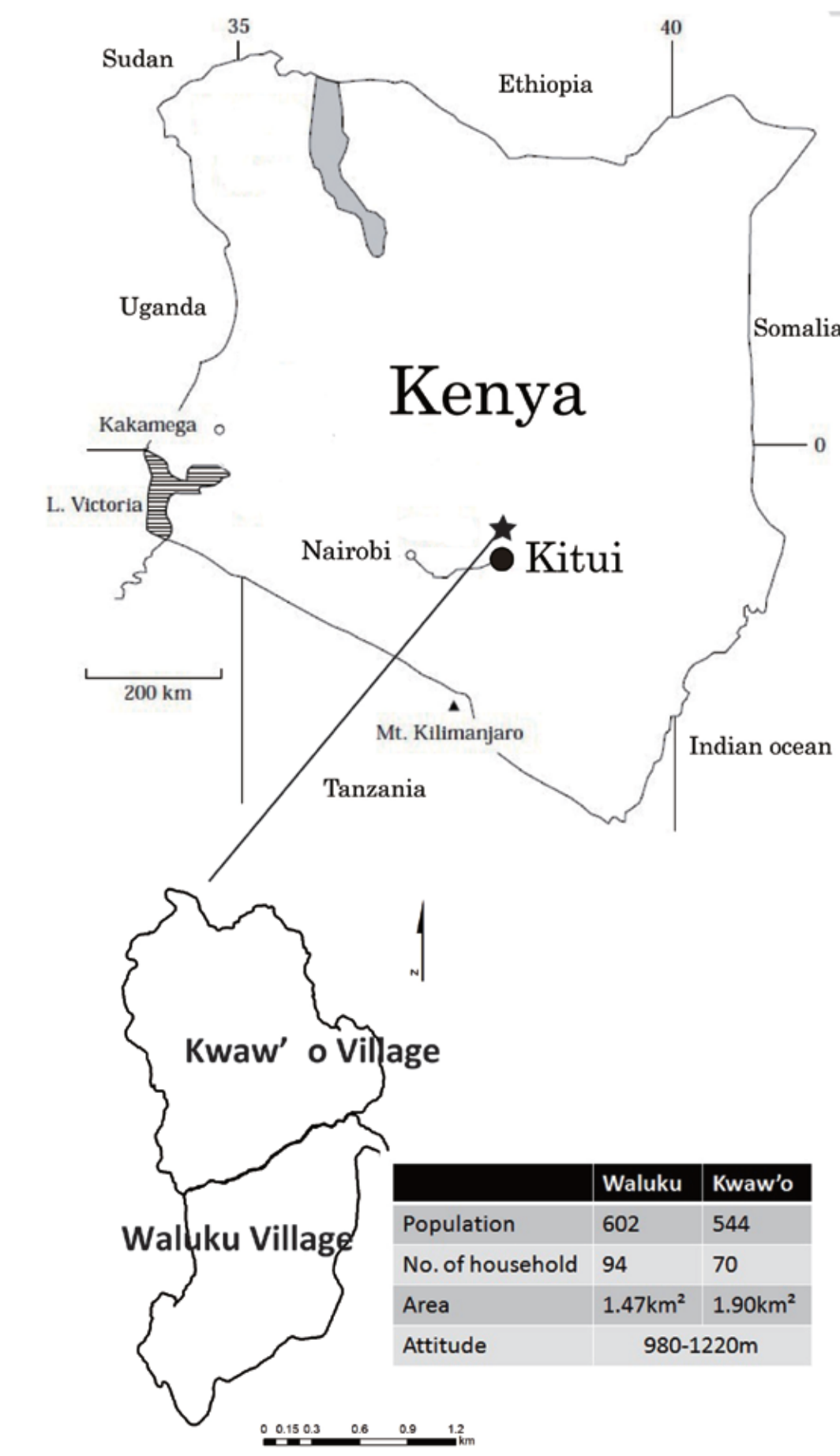


Figure 1: Study site location. Left map: Refer to Ichiroku Hayashi (1996). Right map: Drawn by author with the GPS.

This area has two rainy seasons. The long rainy season (nzwa) is during Oct.–Dec. the short one (uua) is during Mar.–Apr. (Figure 2).

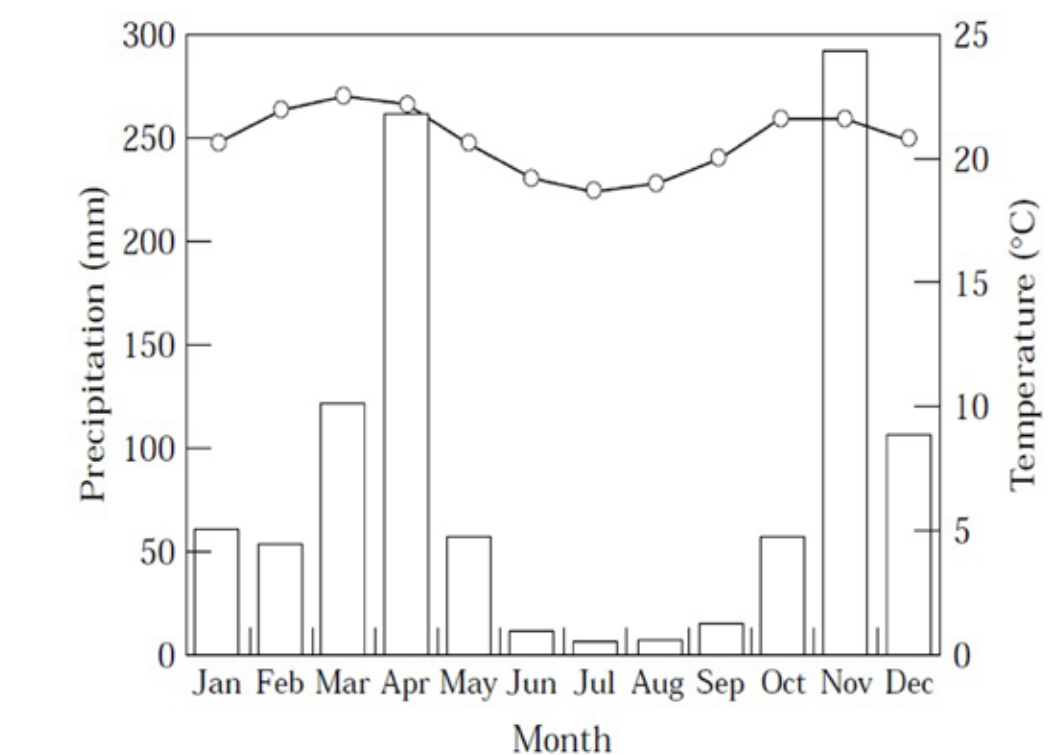


Figure 2: Temperature and precipitation of the study site (Ichiroku Hayashi, 1996).

Target households

Using simple wealth ranking method with 18 representative farmers from two target villages, three wealth categories were identified (Table 1).

Table 1: Wealth Category

Category	House	Livestock	Farmland	Income
Category 1 (96 / 61%)	Poor housing, mud wall and roof with iron sheet.	A few goats and chickens.	A few or small own farms. Harvest is almost or not adequately sustaining family.	Low income like only small amount of wages.
Category 2 (26 / 16%)	House looks good, built with concrete.	A few cows, 3-5 goats and more than 5 chickens.	Harvest is enough to sustain family for either permanent or temporary job, occasionally selling farm product.	Earning some money from either permanent or temporary job.
Category 3 (12 / 8%)	Good house, built with concrete and painted, roofing with good material.	Many livestock.	Many and large farmlands, commercial farming, selling farm product.	Permanent work like in government offices, running shop, restaurant or business.

N=157, including 23 N/A

In the simple wealth ranking, local people's perception of what "Wealth" is consists of combinations of four elements such as "House conditions", "Livestock", "Farm lands" and "Income status" (Table 1).

Except for seven households that have moved or died, all the other 157 households in the village compiled by Bioversity International in 2008 were categorized into the three classes. A total of 18 households, three from category 1, six from category 2 and nine from category 3, were randomly selected.



Photo 1: Doing the simple wealth ranking.



Photo 2: Participants at the group meeting.

Introduction

The semi-arid area of Kenya, which covers 43% of the total land area, receives low rainfall, 612.5–857.5mm/year (Ikeno, 1980). However, the population in this area as well as the amount of cultivated land increased because of migration from other parts searching for survival mechanism. Farmers of Kitui District of Kenya mainly depend on subsistence farming and local environmental resources for their livelihood. However, because of the climate, farming alone does not provide their total annual subsistence requirement, especially in the dry season. Therefore, they might develop strategies not only for agriculture, but also for all aspects of their livelihood to adapt to the dry climate over a long period of time.

A community-based risk management system against the risk of natural disasters such as drought is an important strategy that provides options like having multiple livelihoods and growing a variety of crops and so on. It is also said that the system consists of two relationships, "human-environment" and "human-human" relationship (Suga 2006). It means that it is also important for the adaptation to consider social networks among the people.

Objective

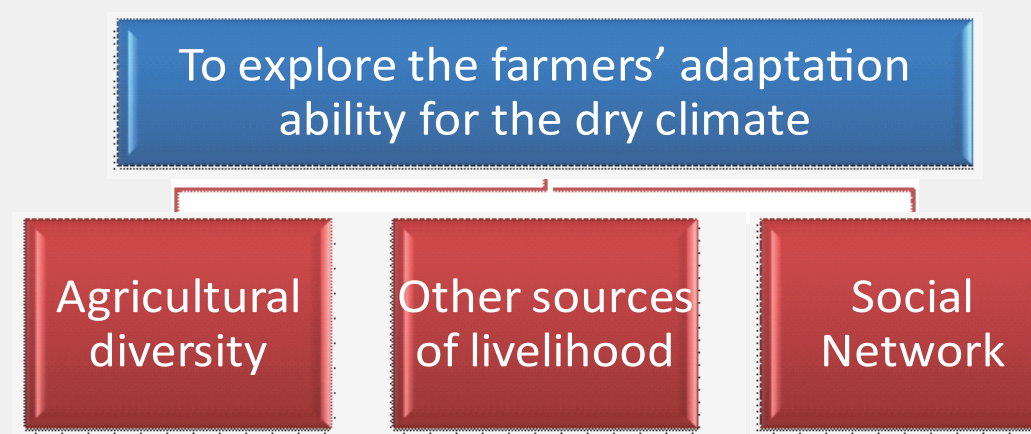
The objective of this research is to explore the farmers' adaptation ability for the dry climate with emphasis on role of agricultural biodiversity, social network and other sources of livelihood.

Data collection

The data collection methods are open-ended and semi-structured questionnaire interviews and participatory observation.

Farmers' activities were monitored for a total of 80 days during November to December 2011 and March to April 2012 (Study site and target households are described in the left column).

Research objectives and analytical views



Results

1. Agricultural diversity

Crop species and variety diversity landscapes

The first mechanism of adaptation is use of mixed crop farming. A total of 34 crops and 102 varieties including "Unknown" and "Recycle" varieties were identified. They also have 26 varieties of fruit trees including 14 local varieties (Table 2 and Table 3). The common crops cultivated are different varieties of Kidney beans, Cowpea, Maize and Pigeonpea. The cash crops which they sometimes sell are Banana, Sugarcane, Taro, Cassava and some fruits like Orange and Avocado.

Table 2: List of planted crops and their seed sources in long rain season, 2011.

No.	Crop category	Common name	Kamba name	Scientific name	No of landraces	Own ¹⁾	Paracha ced ²⁾	Given ³⁾
Single rain annual crops								
1	Cereal	Maize	mbemba	<i>Zea mays</i>	13*	4	10	8
2	Legume/Vegetable	Cowpea	nzooko	<i>Vigna unguiculata</i>	9*	1	6	7
3	Cereal	Sorghum	muuya	<i>Sorghum bicolor</i>	7*		1	7
4	Legume	Kidney beans	mboso	<i>Phaseolus vulgaris</i>	6*	3	5	1
5	Vegetable	Tomato	manyanya	<i>Solanum lycopersicum</i>	3*		2	1
6	Cereal	Pearl Millet	mwee	<i>Pennisetum glaucum</i>	2*			2
7	Cereal	Finger Millet	uimbi	<i>Eleusine coracana</i>	2*			2
8	Vegetable	Okra	binda	<i>Abelmoschus esculentus</i>	1*			1
9	Vegetable	Watermelon	matikiti	<i>Citrullus lanatus</i>	1*			1
10	Vegetable/Other	Container gourd	kitete	<i>Lagenaria siceraria</i>	1*			1
11	Leafy Vegetable	Amaranth	muchiha	<i>Amaranthus sp.</i>	1*			1
12	Leafy Vegetable	Kale	sukuma	<i>Brassica oleracea</i>	1*			1
13	Oil crop	Sunflower	ilaa/maveka	<i>Helianthus annuus</i>	1*			1
Two rain annual crops								
1	Legume	Pigeonpea	nzuu	<i>Cajanus cajan</i>	8*	3	3	5
2	Vegetable	Edible gourd	mongu	<i>Lagenaria siceraria</i>	5*	4	2	2
3	Vegetable	Pumpkin	malenge	<i>Cucurbita pepo</i>	4*	3	4	4
4	Legume	Climbing bean	ngelenge	<i>Phaseolus lanatus</i>	4*	3	4	3
5	Legume	Lablabbean	mbumbu	<i>Lablab purpureus</i>	3*	2	3	4
6	Tuber	Irish Potato	maluu	<i>Solanum tuberosum</i>	1*			1
Perennial Crop								
1	Fruit	Sugarcane	kiwa	<i>Saccharum arundinaceum</i>	7*	6	6	6
2	Fruit	Banana	maiyyu	<i>Musa sp.</i>	5*	5	4	4
3	Tuber	Cassava	manga	<i>Manihot esculenta</i>	3*	3	2	2
4	Tuber	Sweet Potato	makwasi	<i>Ipomoea batatas</i>	3*	3	3	3
5	Legume	Greengram	ndengu	<i>Vigna radiata</i>	1*		1	1
6	Tuber	Taro	nduma	<i>Colocasia esculenta</i>	1*	1	1	1
7	Fruit	Pineapple	mananasi	<i>Ananas comosus</i>	1*		1	1
8	Medicinal plant	Aloe	kiluma	<i>Aloe secundiflora</i>	1*			1
9	Spice	Chile Pepper	nyaika/ndulu	<i>Capsicum annum</i>	1*			1

*Including "Unknown" variety. **Including "Recycle" variety: Maize has 3 varieties and Tomato has 1 variety. 1): Existence of "unknown" variety. 2): No of recycled hybrid varieties. 3), 4) and 5): indicates source of seeds. The number shows number of varieties.

Table 3: List of observed non-planted crops and their reproduction status in long rain season, 2011.

No.	Crop category	Common name	Kamba name	Scientific name	No of landraces	Regener ating ¹⁾	Regermi nating ²⁾	Wild ³⁾	With wild care ⁴⁾
1	Cereal	Sorghum	muuya	<i>Sorghum bicolor</i>	7*	12	1		
2	Cereal	Pearl Millet	mwee	<i>Pennisetum glaucum</i>	1*	1			
3	Cereal	Finger Millet	uimbi	<i>Eleusine coracana</i>	1*		1		
4	Legume	Pigeonpea	nzuu	<i>Cajanus cajan</i>	5*	36	2		
5	Legume	Kidney beans	mboso	<i>Phaseolus vulgaris</i>	6*	3	10		
6	Legume	Climbing bean	ngelenge	<i>Phaseolus lanatus</i>	3*	3	2		
7	Legume	Greengram	ndengu	<i>Vigna radiata</i>	1*	1	3		
8	Legume	Lablabbean	mbumbu	<i>Lablab purpureus</i>	1*	1	2		
9	Legume/Vegetable	Cowpea	nzooko	<i>Vigna unguiculata</i>	7*	9	13		
10	Vegetable	Amaranth	muchiha	<i>Amaranthus sp.</i>	1*	1	1	9	24
11	Vegetable	Tomato	manyanya	<i>Solanum lycopersicum</i>	2*	1	2	1	37
12	Vegetable	Pumpkin	malenge	<i>Cucurbita pepo</i>	1*		1		
13	Vegetable	African nightshades	managu	<i>Solanum sp.</i>	1*		1		
14	Vegetable	Yellow commelina	kikoe	<i>Commelina africana</i>	1*		9		
15	Vegetable/Other	Hedgehog Gourd	isuti	<i>Cucumis dipsaceus</i>	1*		1		
16	Tuber	Cassava	manga	<i>Manihot esculenta</i>	3*	39			
17	Tuber	Sweet potato	makwasi	<i>Ipomoea batatas</i>	4*	8			
18	Tuber	Taro	nduma	<i>Colocasia esculenta</i>	1*	6			
19	Spice	Hot Pepper	nyaika	<i>Capsicum annum</i>	2*	5	3		
20	Spice	Lemongrass	niki ya mayani	<i>Cymbopogon citratus</i>	1*	1			
21	Nut	Groundnut	nzuu Kalanga	<i>Arachis villosulcarpa</i>	1*	1			
22	Other	Tobacco	tumbaku	<i>Nicotiana tabacum</i>	1*	1			
23	Fruit	Sugarcane	kiwa	<i>Saccharum arundinaceum</i>	8	50			
24	Fruit	Banana	maiyyu	<i>Musa sp.</i>	6*	49			
25	Fruit	Watermelon	matikiti	<i>Citrullus lanatus</i>	1*		1		
26	Fruit	Avocado	makolovia	<i>Persea americana</i>	1				
27	Fruit	Custard apple	tomoko	<i>Annona cherimola</i>	1				
28	Fruit	Guava	mavela	<i>Psidium guajava</i>	1				
29	Fruit	Lemon	matimu	<i>Citrus limon</i>	1				
30	Fruit	Mango	maembe	<i>Mangifera indica</i>	1				
31	Fruit	Orange	masungwa	<i>Citrus sinensis</i>	1				
32	Fruit	Passion Fruit	makundi	<i>Passiflora edulis</i>	1				
33	Fruit	Pawpaw	mavavai	<i>Carica papaya</i>	1				
34	Fruit	Tamalind	nzumula	<i>Tamarindus Indica</i>	1				
35	Fruit	Tangerine	kyenza	<i>Citrus tangerina</i>	1				
36	Fruit	White mulberry	ndae	<i>Morus alba</i>	1				
37	Fruit	White sapote	sapota	<i>Casimiroa edulis</i>	1				
38	Fruit	-	mae	<i>Strychnos spinosa</i>	1				
39	Fruit	-	makulo	<i>Annona senegalensis</i>	1				
40	Fruit	-	matoo	<i>Azania garckeana</i>	1				
41	Fruit	-	matote	<i>Carissa edulis</i>	1				
42	Fruit	-	mauw'a	<i>Sclerocarya birrea</i>	1				
43	Fruit	-	mgomoa	<i>Vangueria infausta</i>	1				
44	Fruit	-	mukoo	<i>Diospyros mespiliformis</i>	1				
45	Fruit	-	mukuluu	<i>Flueggea virosa</i>	1				
46	Fruit	-	mutheu	<i>Rhus natalensis</i>	1				
47	Fruit	-	mutoo	<i>Azania garckeana</i>	1				
48	Fruit	-	muu	<i>Vitex payson</i>	1				
49	Fruit	-	ngalwa	<i>Grewia bicolor</i>	1				
50	Fruit	-	ngolokolo	<i>Piliostigma thonningii</i>	1				
51	Fruit	-	ngukuma	<i>Uvaria scheffleri</i>	1				

*Including "Unknown" variety. 1): Existence of "unknown" variety. 2), 3), 4) and 5): The number shows how many farms we observed that crop in that reproductive status.

The other mechanism of adaptation is to use varieties that can differentiate the timing of harvest and yield maximum output. For example, Duma43 maize is one of the late-maturing and high-yielding varieties. DHO1 and DHO2 were the early-maturing and low-yielding maize varieties. The former is used in quite large amount in many households. On the other hand, DHO2 is used in comparably small amounts.

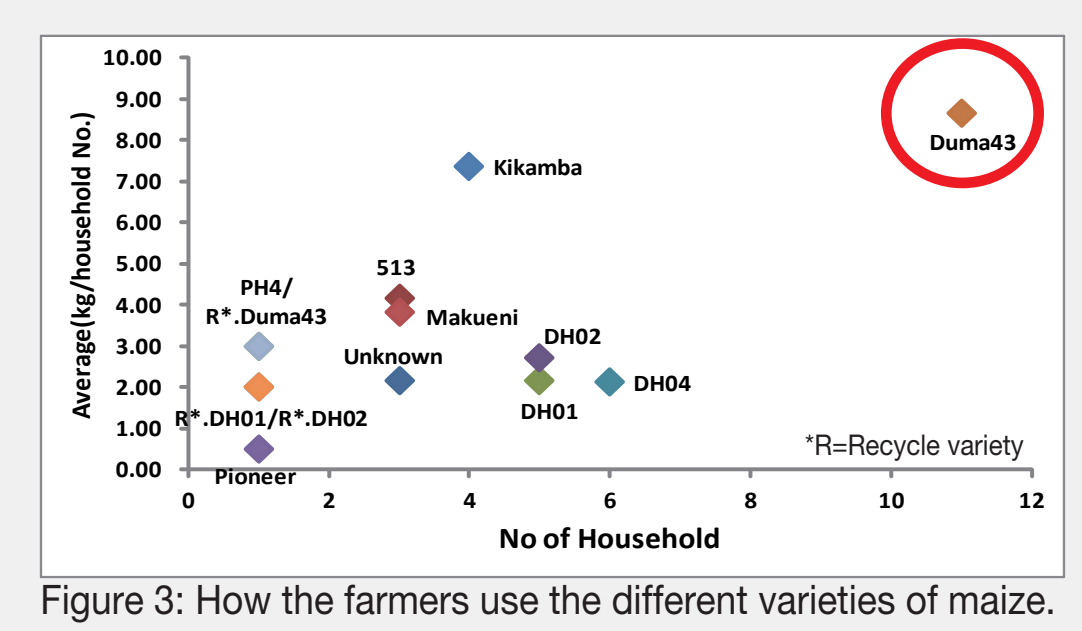


Figure 3: How the farmers use the different varieties of maize.

Landscape management practices and diversification of land on different landscapes.

The third mechanism is farming crops with divers of harvesting time as well as consumption of immature crops.

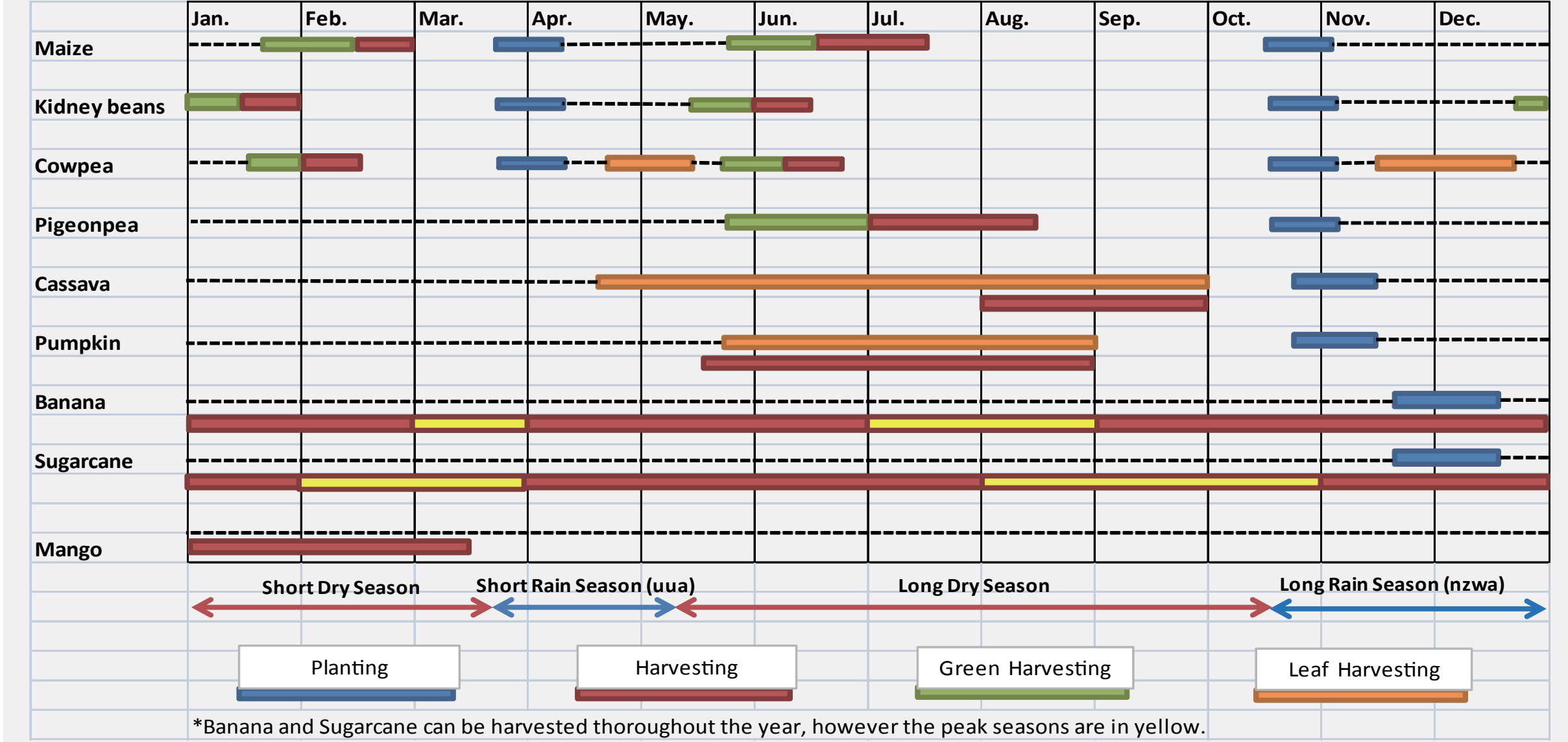


Figure 4: Farming calendar. The long rains usually start from the end of Oct. therefore, farmers start planting as soon as it has rained, particularly for major crops. However, harvest time is different which may help them complement each other in times of shortage of food. Farmers also consume immature fruits and the leaves as a side dish apart from the crop itself are also important means for food self-sufficiency.

The Kamba people also developed their own agro-ecological classification (Figure 5 and 6) that considered the landscape features.

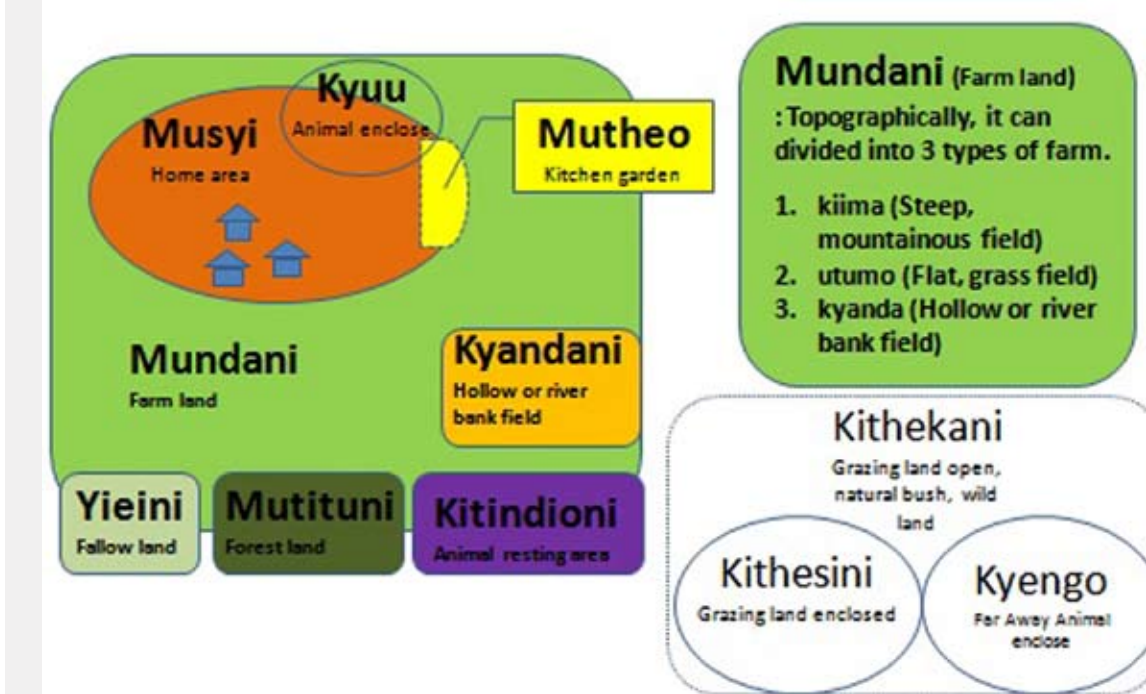


Figure 5: Kamba's classification of agricultural land use.



Figure 6: Landscape of village and classification.

Table 4: Physical characterizations of the classified landscapes.

	Kiima (Farm in mountain)	Utumo (Farm in plain)	Kyanda (Hollow or river bank field)
Definition	Steep and hilly place, long slope.	Comparably flat, not steep, short slope.	Place near from water stream.
Soil fertility	Low	Middle	High
Soil erosion	High	Middle	Low
Sunlight effect	Low	High	High
Water/moisture	Low	Low	High
Heavy rain/flood effect	N/A	N/A	High

2. Other sources of livelihood

As shown in Figure 7, villagers earn income from different sources other than farming. In particular, salary and remittance were observed as major contributions. Because of this, more than 60% of male adults stay in town and send money to their family. However, almost half of them are searching for jobs or engaged in a temporary contract job.

In addition, the villagers often ask for their wage or salary in advance in terms of money or food when they have financial problems like paying school fees or buying food during the dry seasons.

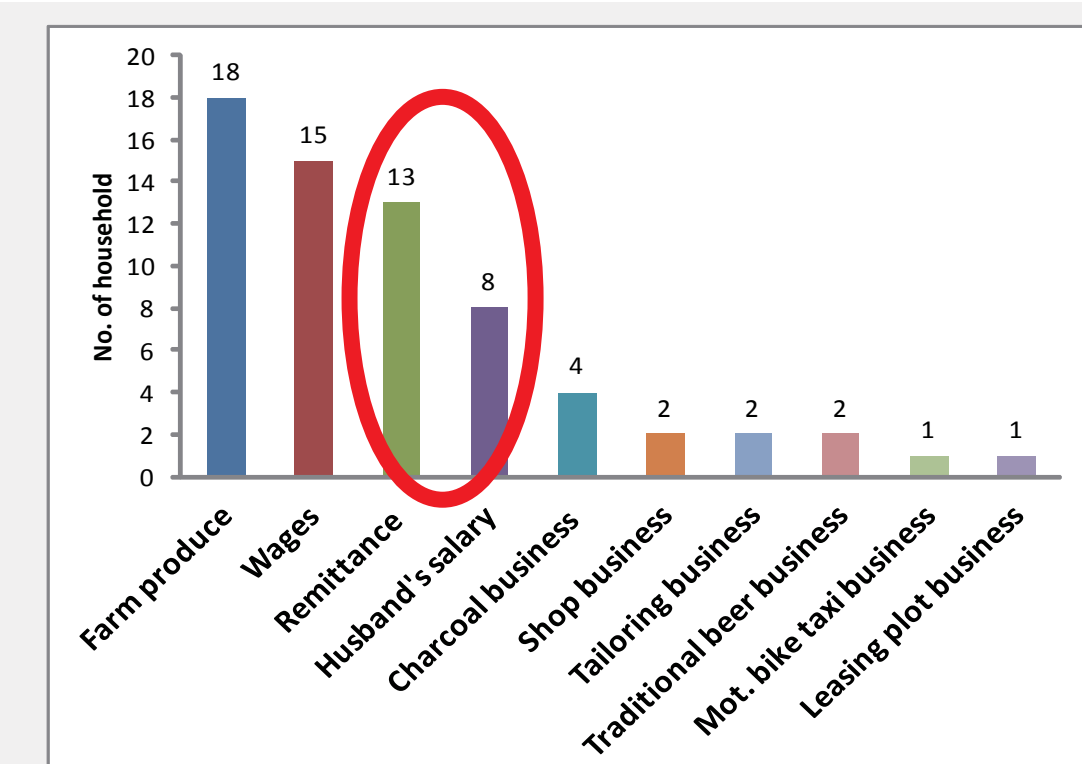


Figure 7: Income from different livelihoods.

3. Social relationship

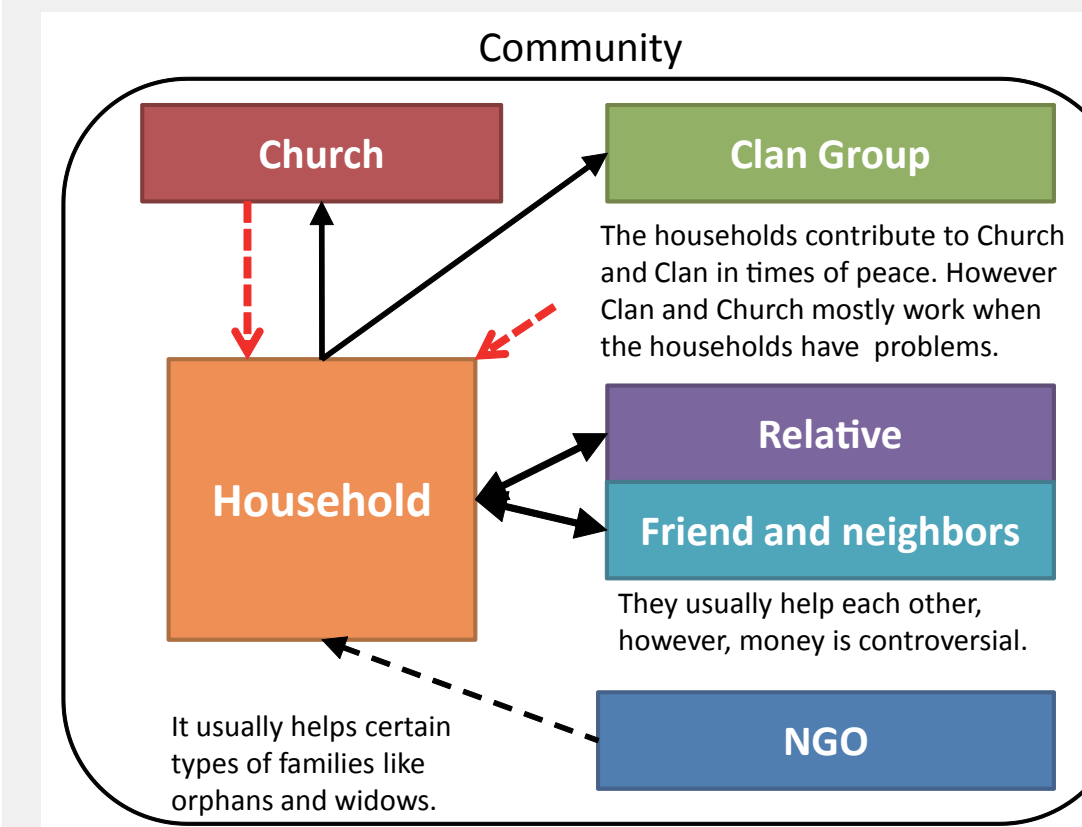


Figure 8: Community relation map.

The villagers usually give and borrow items among each other freely. In addition, they also have their own long lasting networks such as Clan, Church. These networks are utilized as insurance especially during accidents.

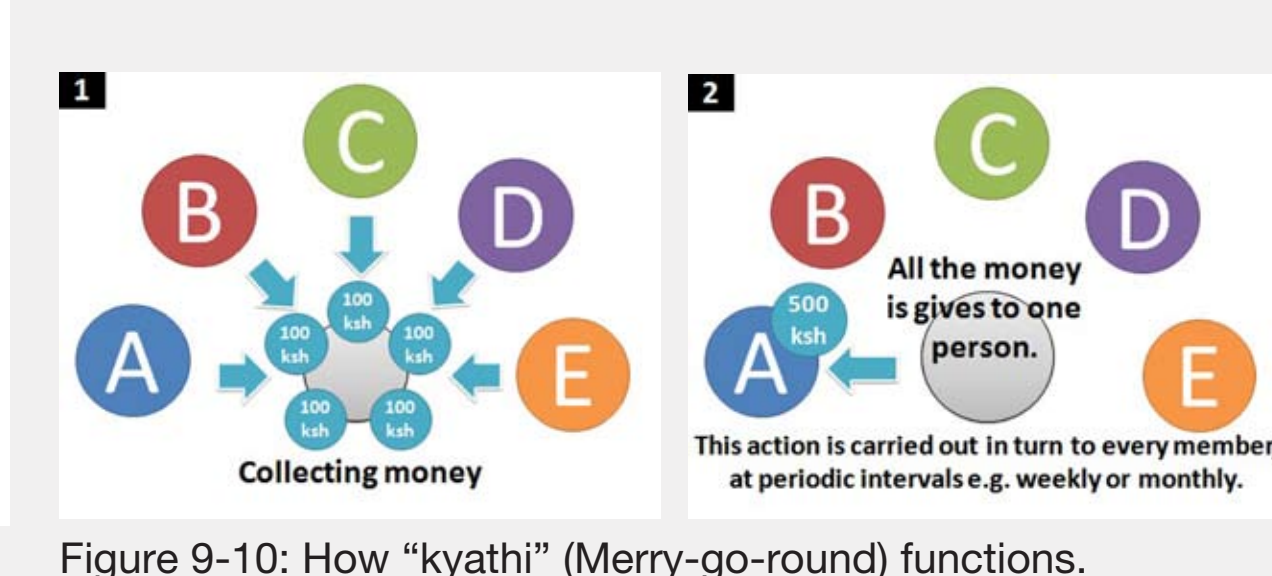


Figure 9-10: How "kyathi" (Merry-go-round) functions.

However, the credit and saving service is becoming very vital for the local people in recent times. There are many private help-groups in the village, named "kyathi" (Merry-go-round) that helps villagers by providing money saving and borrowing service. The sampled households joined an average of 2.11 of "kyathi" except for three households.

Conclusion

Cultivating diverse crops, differentiating the timing of harvest, having different types of farm, diversifying income sources as well as utilizing social networks are important adaptation mechanisms of villagers living in semi arid areas of Kenya.

- Cultivating diverse crops and differentiating the timing of harvest helped villagers to get as much food as possible from farms.
- Using varieties in one crop and differentiating the timing of harvest helped to maximize output yield.
- Having different types of farms might be a mechanism to decrease risk of total crop failure.
- Villagers earn income from different sources other than farming. In particular, salary and remittance have a big influence on the household economy in the village.
- Having the long lasting networks such as Clan, Church are utilized as insurance
- Many private help-groups, named "kyathi" (Merry-go-round) that give money saving and borrowing services are becoming very vital for the local people.

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