

CHAPTER IV.

PRESENT CONDITIONS OF THE STUDY AREA

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4.1 Outlook of the Study Area

4.1.1 General Features

Location and Area

The Study Area is composed of seven Districts around Mt. Kenya, which is located about 150 km northeast of Nairobi, the capital of Kenya. Of these seven Districts, Nyeri and Kirinyaga Districts belong to Central Province, and Embu, Mbeere, Tharaka Nithi, Meru and Nyambene belong to Eastern Province. These area have a total area of about 16,040 sq.km and a total population of about tree million, as shown below;

Location, Area and Population in the Study Area

province	District	Area (sq.km)	Farm Land (sq.km)	Population	
				Total (person)	Density (person/sq.km)
Central Province	Nyeri	3,266	2,606	729,595	186
	Kirinyaga	1,437	1,025	492,942	264
Eastern Province	Embu	708	496	298,342	132
	Mbeere	2,097	1,610	175,219	89
	Tharaka Nithi	2,295	1,561	325,770	112
	Meru	3,012	2,165	540,166	116
	Nyambene	3,224	1,842	591,760	143
Total		16,039	11,305	3,153,794	149

Source ; Area : District Development Plan, 1995
Population : Welfare monitoring Survey II, 1996

General Features of the Area

The area contains a wide variety of Agro-Ecological Zones, ranging from the high to medium potential slopes of Mount Kenya to the low potential, arid and semi-arid zones (ASAL), extending from the lower parts of Mount Kenya into the adjacent plateaus.

4.1.2 Regional Economy

1) Dependence on Agricultural Sector in Economy

Agriculture is the main economic activity in the Study Area. Both large and small scale farming are practiced in the different parts of the Area. Most of the households and economically active population have been working in this sector by planting food crops, cash crops and keeping livestock.

In the Study Area, crop production contributes 64.8 percent to the total agricultural income and livestock farming 35.2 percent, respectively. However, the share of both sectors in the seven (7) districts varies depending on the district condition. For example, Embu and Nyambene could be characterized as crop producing districts compared to other five (5) districts. On the contrary, share of livestock is higher

than crop share in Nyeri.

2) Total Land and Cultivable Areas

The total land area of the Study Area is estimated at 16,039 sq.km, which is equivalent to 2.75 percent of the national land of 582,646 sq.km. Among seven (7) districts in the Study Area, Nyeri is the largest at 3,266 sq.km and the smallest is Embu at 708 sq.km. The total cultivable areas for farming activities is also estimated at 1,130,479 ha, accounting for 70.8 percent of the total land of the Study Area. The ratio of the cultivable area is highest in Nyeri at 79.8 percent and lowest in Nyambene at 57.13 percent.

Planted area for various crops in 1995 was estimated at 707,771 ha based on DAO statistics. If comparing this figure with the total cultivable area, it could be estimated that current cropping intensity in the Study Area is low, at about 63 percent.

3) Ratio of Irrigated Areas

Only 1.37 percent of the existing cultivable area is irrigated in the Study Area, implying that rainfed farming has been predominant. The ratio is the lowest in Embu at 0.14 percent and highest in Kirinyaga at 6.79 percent. Despite the potential for agricultural production, inadequate exploitation of the irrigation potential is a major constraint. Topographic conditions of the Study Area are considered a hindrance to developing large scale irrigation projects.

4) Employment in the Agricultural Sector

It is estimated that more than 85 percent of people aged above 15 years are working on their own farms. The agricultural sector also provides the largest employment opportunity for wage workers in the Study Area. Some 800 thousand people have been working in this sector and most of them belong to small scale farms. Although the large farms' sector contribution to the cash crop production might be minimal, the sector contributes significantly to the regional economy through provision of employment opportunities for rural people. During coffee picking season a number of households subsist on income earned from picking coffee on the large farms.

5) Number of Farm Households

There exists 503,765 farm households in the Study Area, which are divided into 497,222 (98.7%) of small-scale farms and 6,543 (1.3%) of large scale farms, respectively. The averaged family size of 5.66 is bigger than the national average of 5.2. The main crops planted by large farms are wheat and coffee. Food crops such as maize, beans, potatoes and cash crops such as horticultural crops, coffee, tea etc. are planted on the small scale farms.

6) Distribution of Farm Size

The averaged farm size at 1.95 ha per farm household which is smaller than 2.5 ha of the national average. However, there is a big difference in farm size between smallholder farmers and large ones. The small scale farm size ranges from 1.6 ha to 10.5 ha, while large scale farms range up to 700 ha.

7) Agricultural Income

The District Development Plan for 1997-2001 shows the district-wise agricultural income. By analyzing these figures, the agricultural character of the district can be known. The total agricultural income in the Study Area is estimated at 16.98 billion Ksh and 64.8 percent of which is crop output and 35.2 percent livestock output. Among seven (7) districts, Nyeri produces the largest value accounting for 48.7 percent of the total, followed by Kirinyaga at 14.3 percent, and smallest is Tharaka Nithi. Nyeri district earns 54.8 percent of income from livestock sector and this is the highest among seven (7) districts, while Nyambene and Embu earn 94 percent and 99 percent from crop sector, respectively.

8) Contribution of Horticulture Farming to the Regional Economy

In Kenya, vegetables are grown in all the provinces, but Central province is known as the main vegetable producing province. Most of the vegetable are grown by smallholders holding less than 0.6 ha of farm size.

According to the statistics of 1995, 4,532 ha is utilized for growing export-oriented horticultural crops, and 36,514 ha for Irish potatoes, 10,173 ha for banana and 12,566 ha for vegetables and fruits for domestic use in the Study Area. Some 74.5 percent of planted area of 707,771 ha is cultivated to produce food crops such as maize and beans. Export-orient horticultural crops account for 0.6 percent of the total planted area. Taking into consideration most farmers in the Study Area are smallholders, who are the major growers of horticultural crops, improvement of horticultural cropping affects both the individual farm economy and the regional economy.

Area Planted (1995)

(unit : ha)

	Nyeri		Kirinyaga		Old Embu	
	Area Planted	%	Area Planted	%	Area Planted	%
Food	51,387	58.5	58,934	69.0	136,476	84.3
Industrial	14,130	16.1	19,522	22.9	15,585	9.6
Export Horti. Crops	635	0.7	1,396	1.6	817	0.5
Irish Potatoes	15,450	17.6	1,675	2.0	2,670	1.6
Bananas	1,417	1.6	1,364	1.6	4,267	2.6
Other Vegetables	4,017	4.6	2,240	2.6	615	0.4
Other Fruits	787	0.9	235	0.3	1,537	0.9
Total	87,823	100.0	85,366	100.0	161,967	100.0

	Tharaka Nithi		Meru		Nyambene		Study Area	
	Area Planted	%	Area Planted	%	Area Planted	%	Area Planted	%
Food	75,701	70.0	95,090	68.7	109,544	86.9	527,132	74.5
Industrial	30,399	28.1	26,055	18.8	11,164	8.9	116,855	16.5
Export Horti. Crops	56	0.1	1,189	0.9	440	0.3	4,532	0.6
Irish Potatoes	630	0.6	13,369	9.7	2,720	2.2	36,514	5.2
Bananas	865	0.8	650	0.5	1,610	1.3	10,173	1.4
Other Vegetables	249	0.2	1,230	0.9	415	0.3	8,766	1.2
Other Fruits	251	0.2	754	0.5	236	0.2	3,800	0.5
Total	108,151	100.0	138,337	100.0	12,129	100.0	707,772	100.0

9) Some Constraints on Horticultural Farming

- Poor infrastructure which results to poor transport of outputs and inputs including information dissemination, particularly in the rainy season.
- Lack of cooling facilities which prolong the shelf life of the export crop and fruits.
- The cost of farm inputs, fertilizer, fungicides and insecticides.
- Insect damage in the case of French beans has increased.
- Farmers continue to misuse chemicals resulting in high residue levels.
- Soil fertility has been declining.
- Unpredictable weather conditions have discouraged farmers from using expensive inputs on their farms.

4.1.3 Regional Social Status

1) Population Growth Rate

The total population in the Study Area is estimated at about 3.154 million, which accounts for 11.9 percent of the total population of the country. However, annual increase ratio of population in the Study Area is averaged at 3.00 percent compared to national average of 3.42 percent. The highest rates are in Embu and Meru at 3.20, followed by Nyambene. Nyeri is the most populated district with about 730 thousand population, while the smallest in Mbeere with 175 thousand persons (refer to Figure 4.1-1).

2) Sex-wise Population and Density

The estimated total population of about 3.15 million in 1997 is composed of 44.7 percent male and 52.3 percent female, on an average. Compared to national level, female population ratio is 0.5 percent higher.

Average population density is 149 persons per sq.km, which is higher than the 37 of the national average. Among seven (7) districts, the highest in Kirinyaga at 264/sq.km and the lowest in Mbeere at 89/sq.km.

3) Ethnic Groups

Several ethnic groups are living around Mt. Kenya, Kikuyu in the southwestern part, Embu in the southeastern, and Meru in northeastern part, respectively. Generally each ethnic group lives in the specific area of their own ethnic group.

4) Literacy

Literacy level of adult aged above 15 years shows a high rate in the Study Area. The highest are in Nyeri at 90.8 percent and Tharaka Nithi at 90.5 percent. Because of the administrative change in Meru and Embu, the literacy data of Nyambene and Mbeere are not available. Compared with females, the literacy rate of male is higher (refer to Figure 4.1-8).

5) Access to Safe Water

District data on the percentage of households with access to safe water and a main water source shows that 46 percent of households have access to safe water and piped water, and rivers are the main water sources of water used by the majority of the households in the Study Area. Meru is the highest at 62.5 percent, followed by Nyeri at 59.9 percent, while the lowest is Kirinyaga at 30.4 percent. The latest data for Nyambene and Mbeere are not available. The national average of access to safe water is 44.9 percent (refer to Figure 4.1-7).

About 28 percent of households in the five (5) districts take from 16 to 30 minutes to fetch water during the dry season and 29.9 percent in the wet season.

6) Educational Status

It can be said that literacy rate of household heads is generally high, ranging from 75.4 percent in Meru to 90.5 percent in Tharaka Nithi and the male heads are observed to be more literate than the female heads. However, 10.5 percent of the total population in the Study Area has never attended school for various reasons. This rate is highest in Meru at 14.8 percent and lowest in Nyeri at 6.4 percent. The national average is 18.4 percent.

7) Per Capita Income

There exists income disparity even in the Study Area. The highest annual per capita income is in Meru at 19,500 Ksh, followed by Embu at 17,997 Ksh, Kirinyaga at 16,078 Ksh, Nyeri at 16,035 Ksh and lowest in Tharaka Nithi at 9,681 Ksh. As compared with 27,403 Ksh of the national level and 62,566 Ksh of Nairobi, large gap must be noted (refer to Figure 4.1-6).

Monthly household expenditures for food account for 57.8 percent of the total expenditures excluding own crop consumption.

8) Status of Women

According to the survey conducted in 1988/89, 87 percent of the female population lives in rural areas and works in farming activities. As male has a tendency to work away from home, the roles of female in the rural areas have become important. For example, fetching water and fuel-woods, cleaning house and cooking are the major daily works done by females, in addition, females work in farming activities such as planting, weeding and harvesting of crops.

Although national average of female headed households accounts for 24.5 percent, the ratio in the rural areas is generally higher at 26.2 percent. In the Study Area, Nyeri shows the highest percentage of female headed households at 27.8 percent, while lowest is in Tharaka Nithi at five percent.

9) Food Availability of the Districts

Maize and beans are the staple foods for the people and those crops are grown as well as rice, bananas and so on. However despite of cropping, food deficit even in maize and beans occurs in some

districts and the balance between production and demand has fluctuated depending on climate, particularly annual rainfall.

Actual statistics on food balance by crops are available for Kirinyaga and Nyambene. For example, deficit in maize has always occurred over these five (5) years in Kirinyaga. However, there has been surplus of beans and rice with exception of 1993 when there was shortage of beans. The deficit in maize and beans is offset by importation from other districts directly or through the National Cereals and Produce Board. While if a surplus is produced it, is sold to neighboring districts.

Food balance in Nyambene is more serious, compared to Kirinyaga. Kirinyaga district does not attain self-sufficiency in food production. Although a food deficit is not experienced every year, climatic conditions play a great role in determining the crop production. One of the reasons for this is considered that farming has been over-dependent on cash crops such as tea and coffee and another reason is attributed to harsh climatic conditions in the lower ecological zones. Nyambene district also imports foods from neighboring districts, especially from Meru.

Nyeri also imports maize and beans from neighboring districts such as Meru, Nyandarua, and there are some divisions which depend on famine relief to meet demand because of frequent drought hit in those divisions.

Meru district meets self-sufficient in food and supplier to those districts facing food deficit.

Tharaka Nithi does not produce enough food to meet internal demand, resulting in its importing food crops from Meru, Embu, particularly horticultural crops from Meru. The reason is for that farming has been concentrated on cash crops (tea, coffee) and climatic conditions in the lower lands in which drought is prone to occur.

Food Availability Analysis in Nyambene District

Crop	Year	Requirement (1,000 bags)	Production (1,000 bags)	Surplus/Deficit (1,000 bags)
Maize	1993	782	297	-485
	1994	807	474	-333
	1995	833	1253	420
Sorghum	1993	44	31	-13
	1994	121	32	-89
	1995	132	50	-82
Millet	1993	44	10	-34
	1994	121	9	-112
	1995	132	10	-122
Dolikos	1993	19	12	-7
	1994	20	11	-9
	1995	20	21	1
Beans	1993	19	28	9
	1994	20	21	1
	1995	20	38	18
Green Grams	1993	19	3	-16
	1994	20	8	-12
	1995	20	18	-2
Pigeon Peas	1993	19	57	38
	1994	20	34	14
	1995	20	58	38
Milk(1,000)	1993	48	11	-37
	1994	49	11	-38
	1995	51	12	-39
Cowpeas	1993	19	7	-12
	1994	20	12	-8
	1995	20	17	-3

Source; District Development Plan 1997-2001, Nyambene District

Food Availability Analysis in Kirinyaga District

Crop	Year	Requirement (ton)	Production (ton)	Surplus/Deficit (ton)
Maize	1991	54,498	12,130	-42,368
	1992	56,308	34,588	-21,720
	1993	54,240	19,984	-34,256
	1994	55,894	48,943	-6,951
	1995	57,960	41,465	-16,495
Beans	1991	4,996	14,291	9,295
	1992	5,162	9,815	4,653
	1993	4,972	3,800	-1,172
	1994	5,224	11,374	6,150
	1995	5,313	11,579	6,266
Rice	1991	1,135	28,258	27,123
	1992	1,173	27,840	26,667
	1993	1,130	26,100	24,970
	1994	1,165	29,230	28,065
	1995	1,208	29,100	27,892
Banans	1991	6,857	5,994	-863
	1992	7,085	5,000	-2,085
	1993	6,825	5,200	-1,625
	1994	7,033	13,200	6,167
	1995	7,293	13,640	6,347

Source; District Development Plan 1997-2001, Kirinyaga District

Table 4.1-1

Socioeconomic Indicators of the Study Area

	Kenya	Study Area							Share to Nation(%)
		Embu	Nyambene	Meru	Kirinyaga	Nyeri	Mbeere	Tharaka Nithi	
1. No. of Divisions	-	5	14	10	4	7	4	8	52
2. No. of Locations	-	15	53	27	20	34	15	28	192
3. No. of Sub-Locations	-	52	129	75	76	190	36	55	244
4. Total Land Area(sq.km)	582,646	708	3,224	3,012	1,437	3,286	2,097	2,295	16,039
5. Cultivable Area(ha)	3,826,000	49,600	184,200	216,500	102,500	260,550	161,029	156,100	1,130,479
6. Ratio of Cultivable Area(%)	0.86	70.06	57.13	71.88	71.33	79.78	76.79	68.02	70.48
7. Irrigated Area	82,000	68	605	4,078	6,955	1,681	1,813	239	15,439
8. Ratio of Irrigated Area(%)	2.14	0.141	0.331	1.881	6.791	0.951	1.191	0.15	1.37
9. Planted Area for Crops	NA	161,967	126,129	138,337	85,366	87,822	in Embu	108,150	707,771
9. Population	26,423,580	298,342	597,760	540,168	492,942	729,595	175,219	325,770	3,153,794
9.1. Male Population(%)	49.3	48.7	49.1	49.9	49.5	48.5	48.7	48.9	49.1
9.2. Female Population(%)	50.4	51.3	50.9	50.1	50.5	51.5	51.3	51.1	50.9
10. Population Density(person/sq.km)	37	132	143	116	264	186	89	112	149
11. Annual Increase of Population(1979-1989%)	3.42	3.20	3.14	3.20	3.00	2.20	3.08	2.92	3.00
12. Average Family Size(1994)	5.20	6.00	5.52	6.00	5.10	5.30	5.50	6.20	5.66
13. No. of Farm Households of which Small Holders	2,756,438	61,014	107,200	92,000	82,012	93,543	22,996	45,000	503,765
Large Holders	2,700,000	59,424	105,256	91,000	81,950	93,471	22,985	43,156	497,222
14. Average Farm Size(ha)	38,438	1,590	1,944	1,000	82	72	31	1,844	6,543
15. Ratio of Landless Households(%)	25.8	15.7	NA	3.5	18.8	20.0	NA	0.2	-
16. Income and Expenditure(Ksh./month/family)	9,696	7,995	in Meru	9,320	5,986	6,898	in Embu	4,255	-
16.1. Average Income	7,393	5,382	in Meru	7,020	6,324	6,824	in Embu	6,849	-
16.2. Average Expenditure	27,403	17,997	in Meru	19,500	16,078	16,034	in Embu	9,681	-
17. Annual Per Capita Income(Ksh)	31.3	84.6	NA	48.7	28.2	29.8	NA	48.0	30.8
18. District Agricultural Income	-	1,759,900	1,134,457	1,384,446	1,912,520	3,674,000	599,900	528,663	10,993,886
18.1. Crop Income(1,000 Ksh)	-	114,933	117,116	446,772	487,615	4,459,400	232,500	130,666	5,988,702
18.2. Livestock Income(1,000 Ksh)	-	1,874,533	1,251,573	1,831,218	2,400,135	8,133,400	832,400	659,329	16,982,588
18.3. Total(1,000 Ksh)	-	44.9	45.6	NA	62.5	30.4	59.9	NA	32.2
19. Access to safe Water(%)	74.8	82.0	NA	77.4	89.6	90.8	NA	90.5	-
20. Adult Literacy Rate above 15 years(%)	-	-	-	-	-	-	-	-	-

Sources: Statistical Abstract 1995

District Development Plans 1997-2001

Welfare Monitoring Survey II 1996

Population Dynamics of Kenya 1996

District Annual Reports 1996

District Profile Survey 1998

Farm Management Handbook

Table 4.1-2 Land Holding

	Holding Area(ha)										(unit:%)
	Landless	Landless with Animals	0.01~0.59	0.6~0.99	1.0~1.99	2.0~2.99	3.0~3.99	4.0~4.99	5.0~7.99	8 and Above	
Whole Country	25.0	3.9	16.9	15.1	18.0	9.5	2.7	3.4	1.9	3.4	
Rural	9.1	4.5	20.1	18.5	22.3	11.5	3.3	4.1	2.4	4.2	
Urban	87.5	1.5	4.5	1.9	1.3	1.7	0.2	0.7	0.3	0.4	
Nairobi	95.6	0.6	2.4	-	-	0.7	-	0.3	0.3	-	
Central	23.8	3.6	37.1	15.6	12.6	4.7	0.9	0.9	0.4	0.5	
Coast	46.4	3.0	7.6	10.0	14.8	7.7	2.8	4.8	1.1	1.7	
Eastern	7.6	3.9	15.2	19.8	20.6	13.0	4.4	6.7	2.9	5.9	
North Eastern	18.2	55.7	3.9	6.0	8.4	3.3	0.5	1.8	1.4	0.6	
Nyanza	10.1	0.5	13.3	20.0	30.7	12.8	3.1	2.6	1.9	5.1	
Rift Valley	21.6	5.2	15.8	14.3	16.4	10.7	3.3	4.5	2.8	5.3	
Western	6.8	0.7	24.3	20.7	24.1	13.1	3.0	2.9	3.0	1.3	
Kirinyaga	18.8	3.0	37.6	22.0	12.1	5.7	0.5	-	0.4	-	
Nyeri	20.0	2.9	39.4	18.8	12.2	4.2	0.9	1.2	0.4	-	
Embu	15.7	0.3	21.3	26.7	18.9	8.1	0.7	5.8	-	2.6	
Meru	3.5	0.4	24.8	30.7	25.0	11.6	2.9	0.4	0.1	0.7	
Tharaka Nithi	0.2	1.1	24.1	21.3	37.0	11.1	-	3.8	1.4	-	

Source: Welfare Monitoring Survey II 1996

Table 4.1-3 Distribution of Households with Cattle

(unit:%)

	Holding Cattle Size(head)							
	No Cattle	1 Cattle	2~3 Cattle	4~5 Cattle	6~10 Cattle	11~15 Cattle	16~19 Cattle	20+ Cattle
Whole Country	53.2	10.2	18.0	7.7	5.7	2.0	0.5	2.8
Rural	42.9	12.4	22.0	9.5	6.9	2.4	0.6	3.4
Urban	93.5	1.8	2.1	0.5	1.0	0.5	-	0.6
Nairobi	97.1	1.4	0.9	-	0.3	0.3	-	-
Central	51.2	23.1	20.8	2.9	1.7	0.2	-	0.1
Coast	85.1	2.6	5.1	2.1	2.3	0.9	0.2	1.9
Eastern	43.9	12.6	24.0	8.7	5.8	2.1	0.4	2.6
North Eastern	37.2	1.1	3.5	4.6	4.4	4.5	1.2	43.4
Nyanza	44.2	10.5	24.2	10.8	6.7	2.4	0.4	0.8
Rift Valley	46.4	6.1	16.7	10.3	10.4	3.7	1.2	5.1
Western	38.3	13.8	26.0	13.0	6.1	1.9	0.5	0.5
Kirinyaga	45.6	26.8	23.4	2.8	1.4	-	-	-
Nyeri	49.0	19.6	28.6	2.1	0.5	0.2	-	-
Embu	54.8	17.2	17.9	6.0	3.1	0.2	-	0.9
Meru	37.0	15.7	36.3	4.9	4.8	1.1	-	0.2
Tharaka Nithi	35.7	28.0	26.4	5.3	1.7	1.4	-	1.4

Source:Welfare Monitoring Survey II 1996

Table 4.1-4 Irrigation Area

(unit:ha)

	Whole Country	Central Province	Eastern Province	Study Area				
				Nyeri	Kirinyaga	Embu	Meru	Total
Commercial Large Scale								
Coffee	18,769	16,982	1,351	458	61	78	46	643
Vegetables/Fruits/Flowers	4,210	458	271	62	0	116	0	178
Total	22,979	17,440	1,622	520	61	194	46	821
Small Holders								
Group Based Scheme	16,758	1,268	3,903	990	245	110	1,100	2,445
Individual farms	1,339	662	116	95	88	43	35	261
Total	18,097	1,930	4,019	1,085	333	153	1,135	2,706
Central Managed by Authorities								
Tenants-Based	10,080	5,537	0	0	5,537	20	0	5,557
Estates	245	0	75	0	0	0	0	0
Total	10,325	5,537	75	0	5,537	20	0	5,557
Grand Total	51,401	24,907	5,716	1,605	5,931	367	1,181	9,084
Occupation(%)	100.0	48.5	11.1	3.1	11.5	0.7	2.3	17.7

Source:Atlas of Irigation and Drainage in Kenya Mar. 1990

Table 4.1-5 Ranking of the Top Five Crops (1995)

	(unit:ha)					
	1st	2nd	3rd	4th	5th	Total
Meru Area	Maize 34,300	Beans 33,850	Coffee 17,795	Potatoes 13,369	Wheat 13,300	112,614
Nyambene Area	Maize 50,100	Beans 38,400	Coffee 7,362	Sorghm 5,000	Pigeon Peas 4,900	105,762
Tharaka Nithi Area	Maize 23,680	Beans 10,975	Millet 10,400	Coffee 9,252	Sorghum 7,295	61,602
Kirinyaga Area	Beans 25,731	Oil Crops 25,731	Hort.crops 25,696	Maize 25,596	Paddy 5,820	108,574
Embu Area	Maize 21,440	Beans 11,880	Coffee 8,791	Tea 3,431	Potatoes 2,120	47,662
Nyeri Area	Beans 28,118	Maize 24,149	Potatoes 16,605	Coffee 11,903	Tea 6,176	86,951
Mbeere Area	Maize 32,160	Beans 17,820	Sorghum 16,660	Cow Peas 9,734	G.Grams 5,766	82,140

Source: District Development Plan 1997-2001

Table 4.1-6 Ranking of Districts in Planted Area by Crops (1995)

	(unit:ha)						
	1st	2nd	3rd	4th	5th	6th	7th
Maize Area	Nyambene 50,100	Meru 34,300	Mbeere 32,160	Kirinyaga 25,596	Nyeri 24,149	Tharaka Nithi 23,680	Embu 21,440
Beans Area	Nyambene 38,400	Nyeri 28,118	Kirinyaga 25,731	Mbeere 17,820	Embu 11,880	Tharaka Nithi 10,975	Meru 0
Coffee Area	Meru 17,795	Nyeri 11,903	Tharaka Nithi 9,252	Embu 8,791	Nyambene 7,362	Kirinyaga 161	Mbeere 0
Tea Area	Nyeri 6,175	Kirinyaga 5,395	Embu 3,413	Nyambene 3,249	Meru 3,043	Tharaka Nithi 1,594	Mbeere 0

Source: District Development Plan 1997-2001

Figure 4.1-1

Population and Population Density (1994)

	Population	Density
Embu	298,342	132
Nyambene	591,760	143
Meru	540,166	116
Kirinyaga	492,942	204
Nyeri	729,595	186
Mbeere	175,219	89
Tharaka Nithi	325,770	112
Total	3,153,794	149

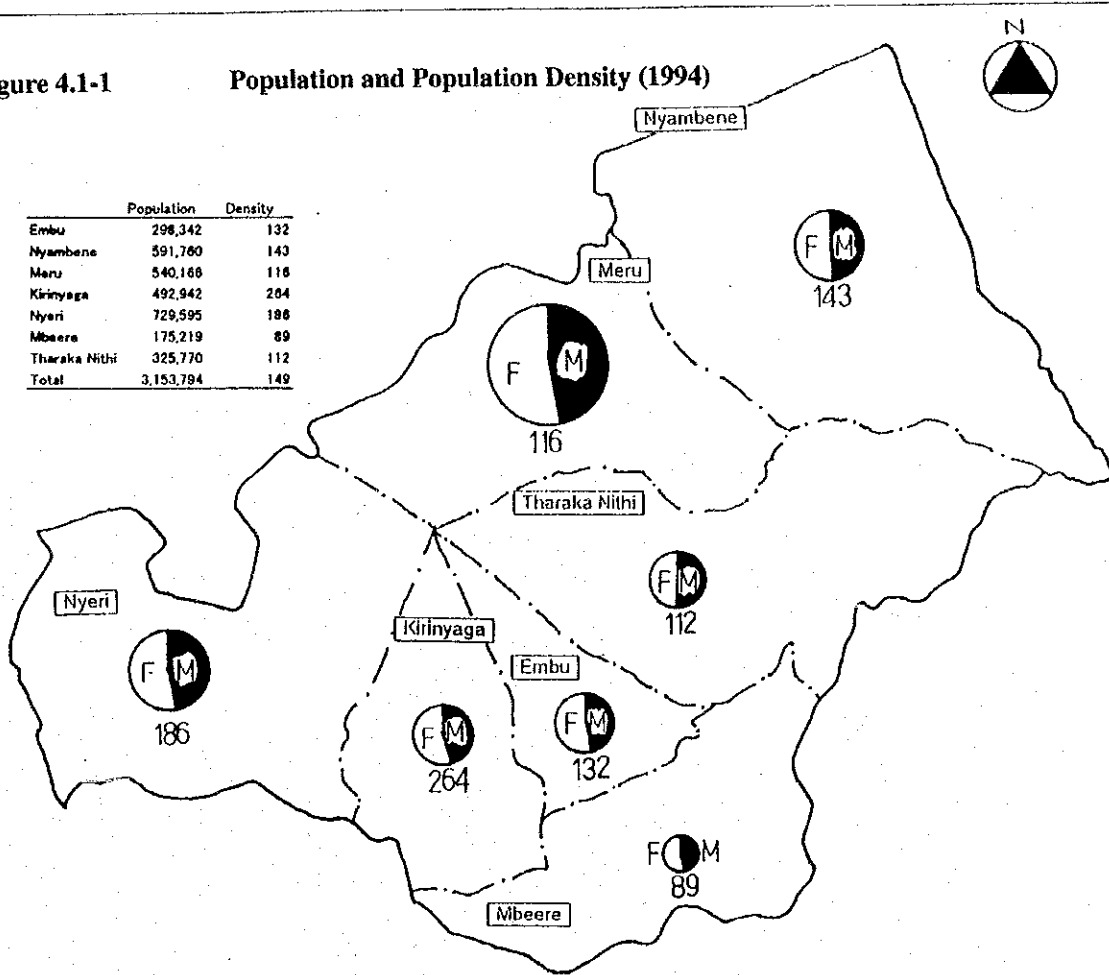


Figure 4.1-2

Ratio of Cultivable Areas

	(sq.km)		Ratio(%)
	Total Land	Cult. Area	
Embu	708	496	70.1
Nyambene	3,224	1,842	57.1
Meru	3,012	1,586	52.7
Kirinyaga	1,437	1,025	71.3
Nyeri	3,266	2,564	78.5
Mbeere	2,097	955	45.5
Tharaka Nithi	2,295	1,581	68.0
Total	18,039	10,029	62.5

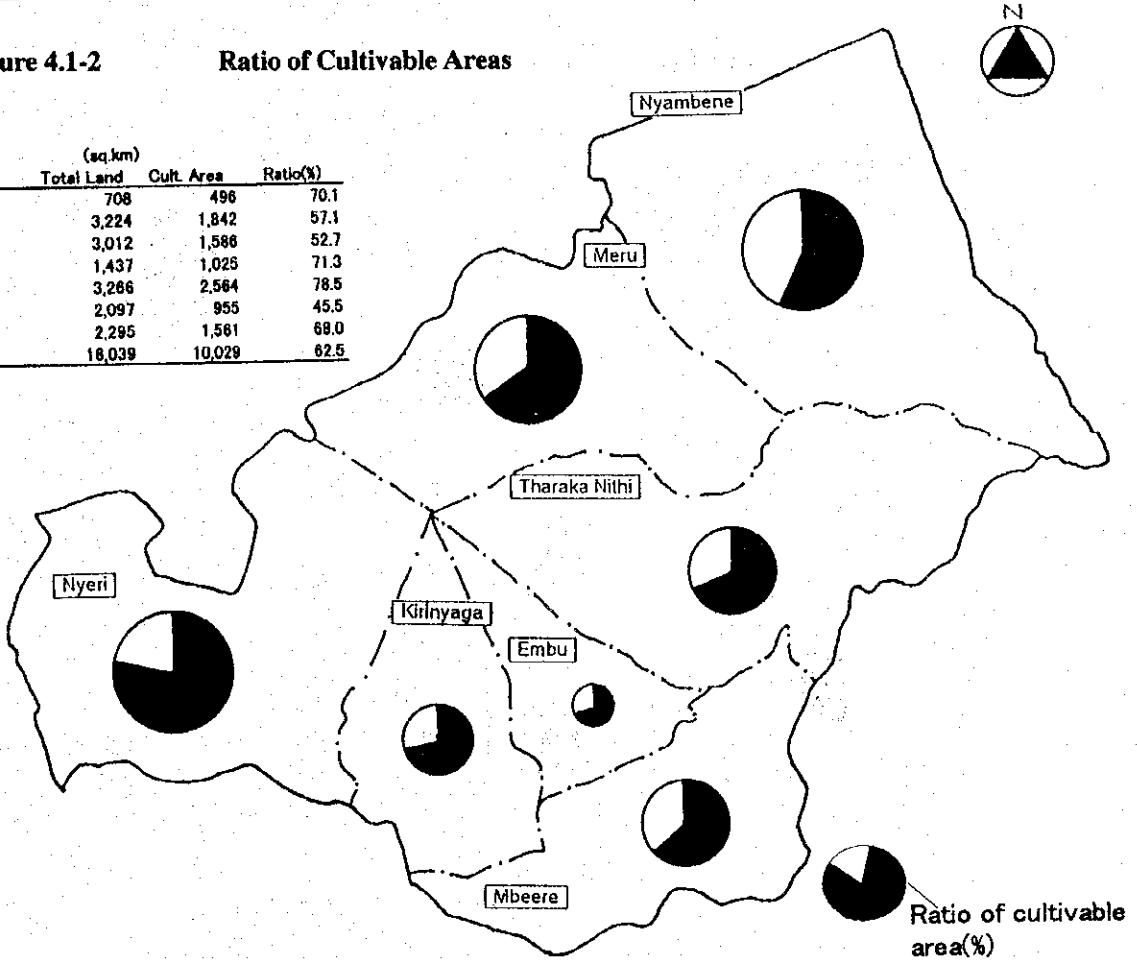


Figure 4.1-3

Ratio of Irrigated Areas (1990)

	Cult. Area (ha)	Irrig. Area (ha)	Ratio (%)
Embu	49,800	68	0.14
Nyambene	184,200	805	0.33
Meru	218,500	4,078	1.88
Kirinyaga	102,500	6,955	6.79
Nyeri	280,550	1,681	0.65
Mbeere	161,029	1,813	1.13
Tharaka Nithi	158,100	239	0.15
Total	1,130,479	15,439	1.37

Source: District Profile Survey 1998

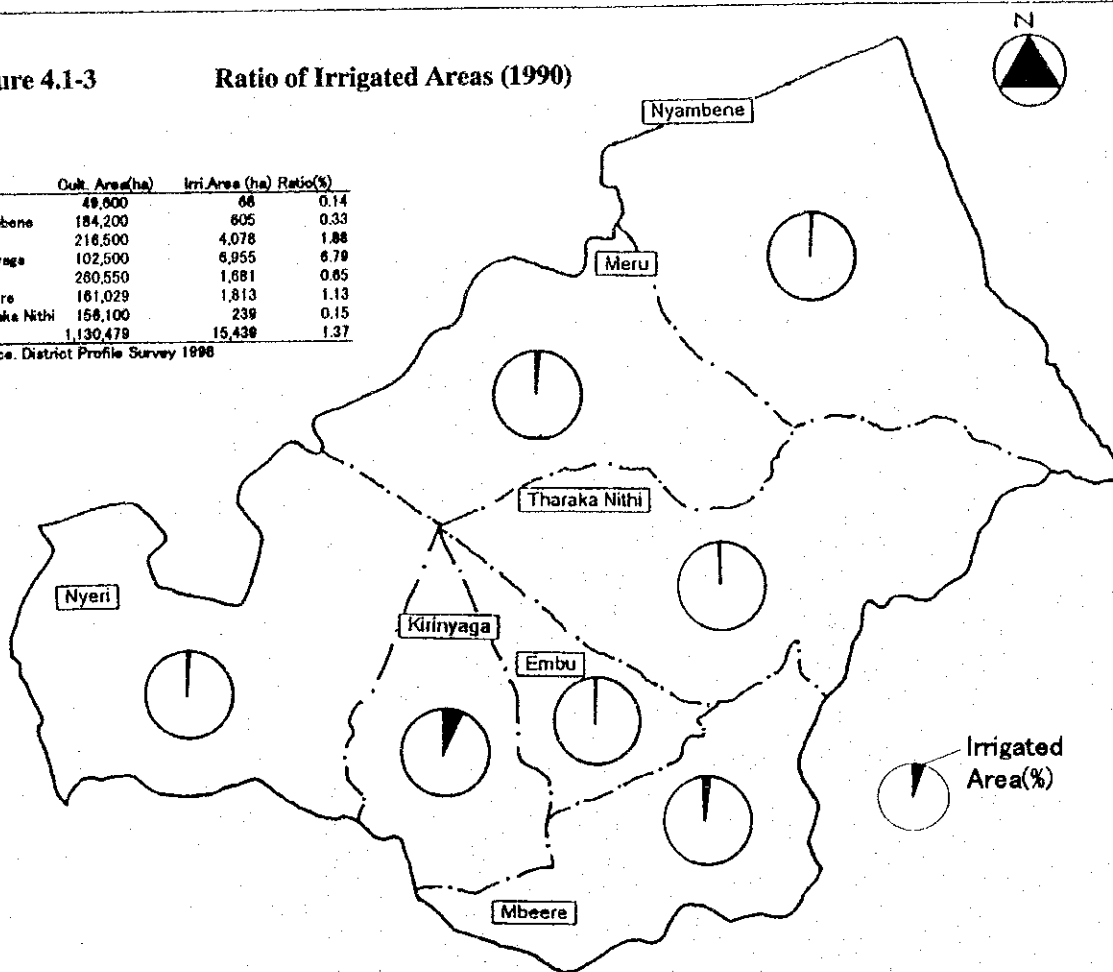


Figure 4.1-4

Number of Farm Households

	Small Farms	Large Farms	Total
Embu	59,424	1,590	61,014
Nyambene	185,941	3,389	169,330
Meru	91,000	1,000	92,000
Kirinyaga	96,538	62	96,600
Nyeri	93,471	72	93,543
Mbeere	22,965	31	22,996
Tharaka Nithi	43,156	1,844	45,000
Total	572,495	7,988	580,483

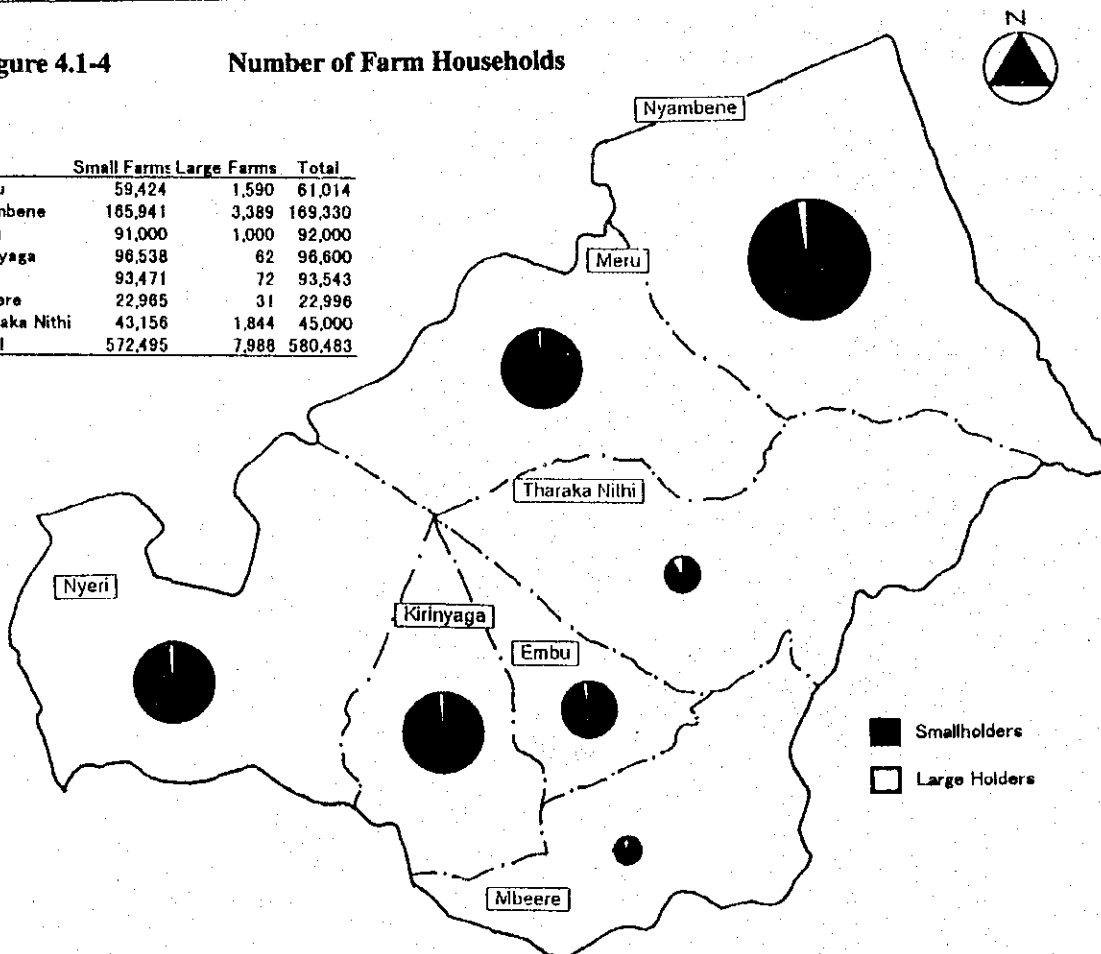


Figure 4.1-5

District Agricultural Incomes

	Crops	Livestock	Total
Embu	1,759,900	114,633	1,874,533
Nyambene	1,134,457	117,116	1,251,573
Kirinyaga	1,912,520	487,615	2,400,135
Meru	1,384,446	446,772	1,831,218
Nyeri	3,674,000	4,459,400	8,133,400
Mbeere	599,900	232,500	832,400
Tharaka Nithi	528,663	130,666	659,329
Total	10,993,886	5,988,702	16,982,588

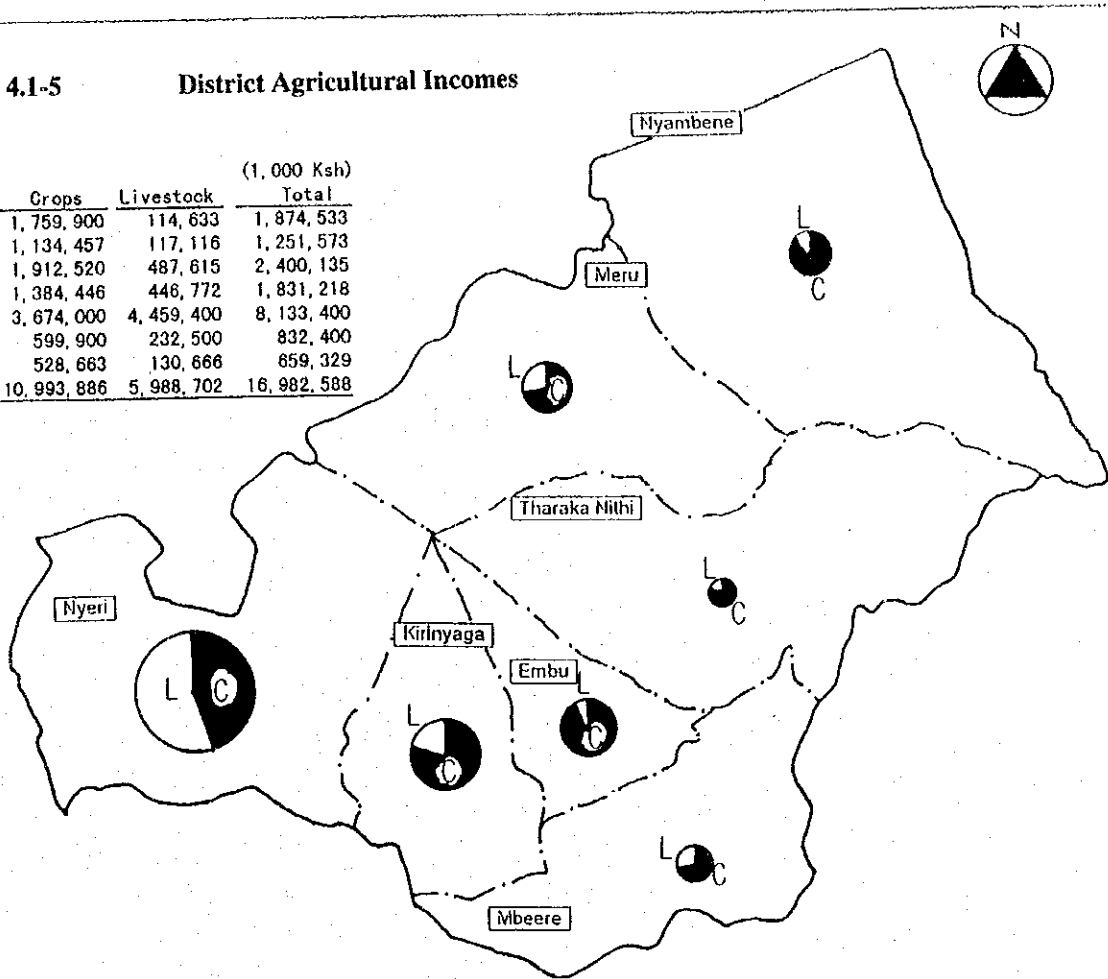


Figure 4.1-6

Annual Per Capita Incomes (1994)

	Income(Ksh)
Embu	17,997
Nyambene	-
Meru	19,500
Kirinyaga	16,078
Nyeri	16,034
Mbeere	-
Tharaka Nithi	9,681

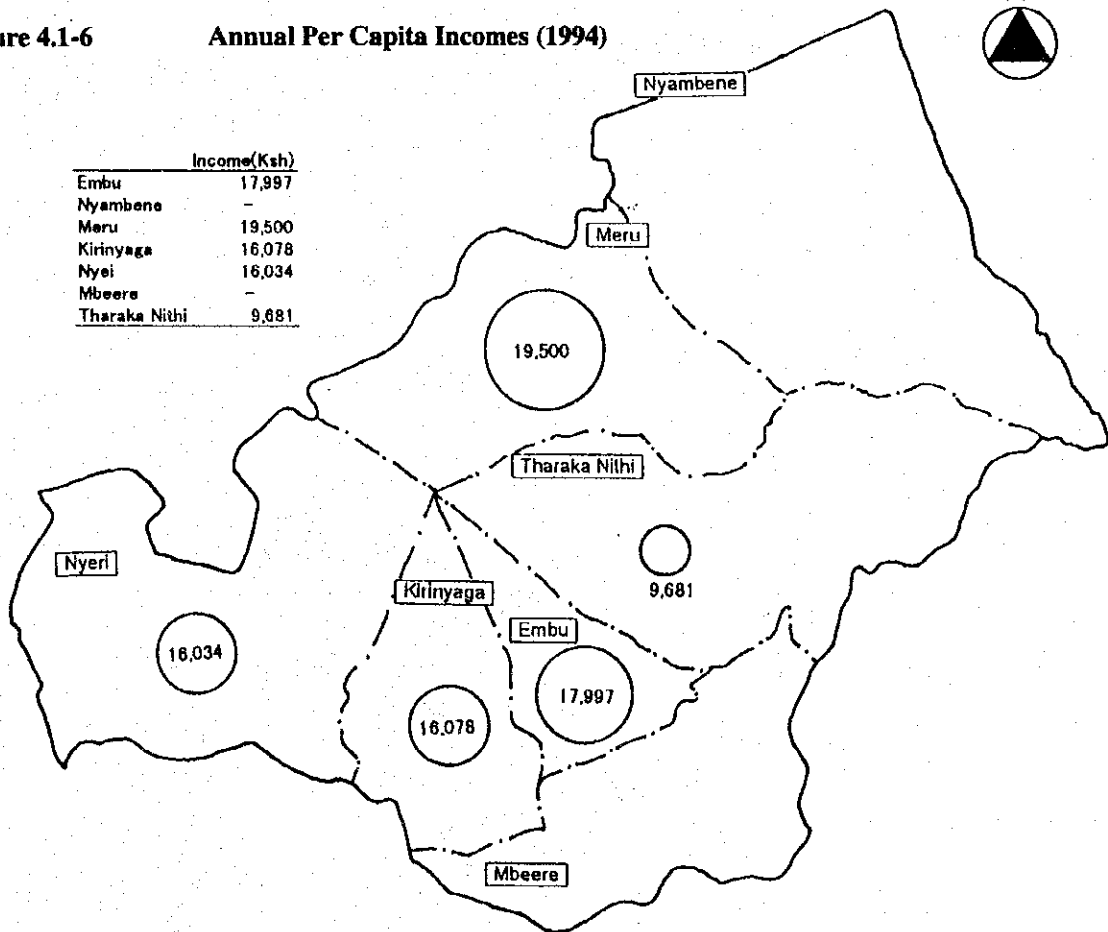


Figure 4.1-7

Access to Safe Water (1994)

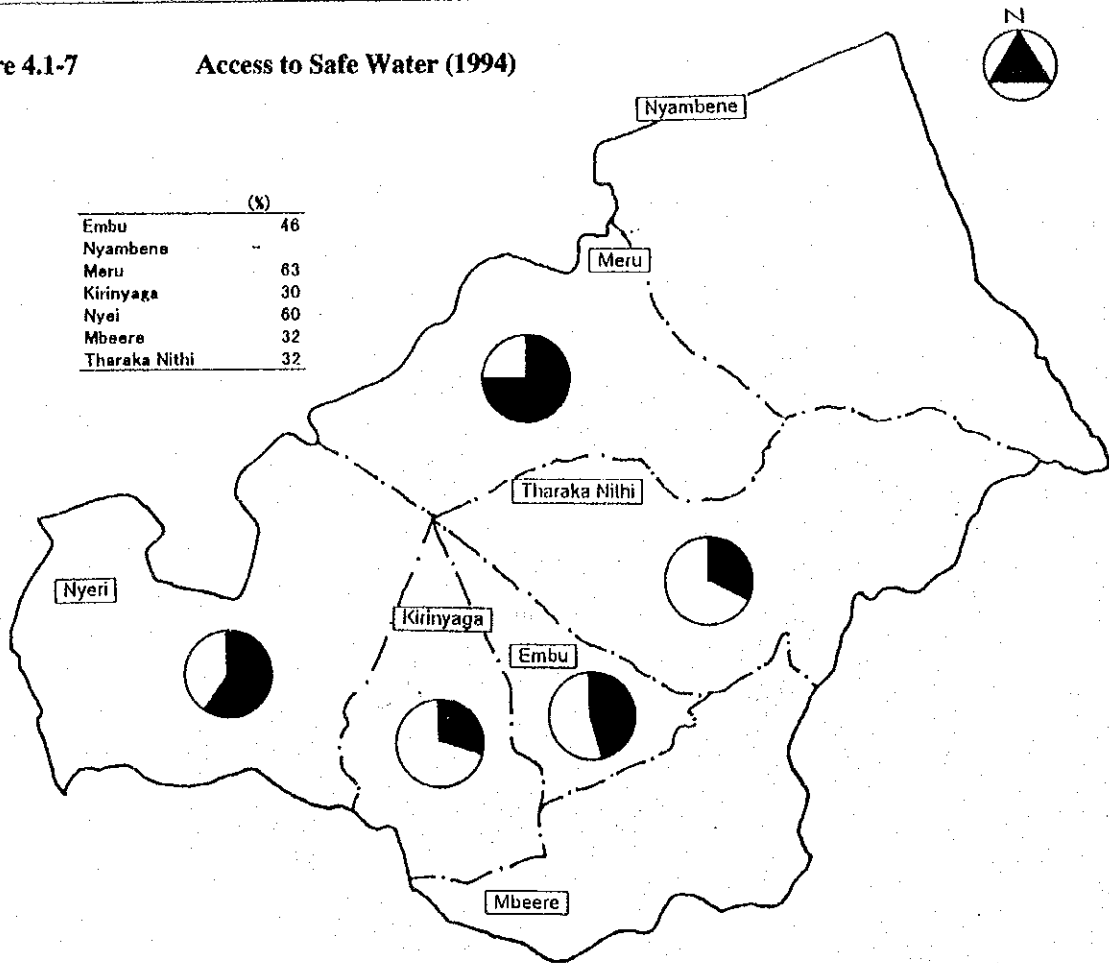


Figure 4.1-8

Adult Literacy (aged above 15 years)

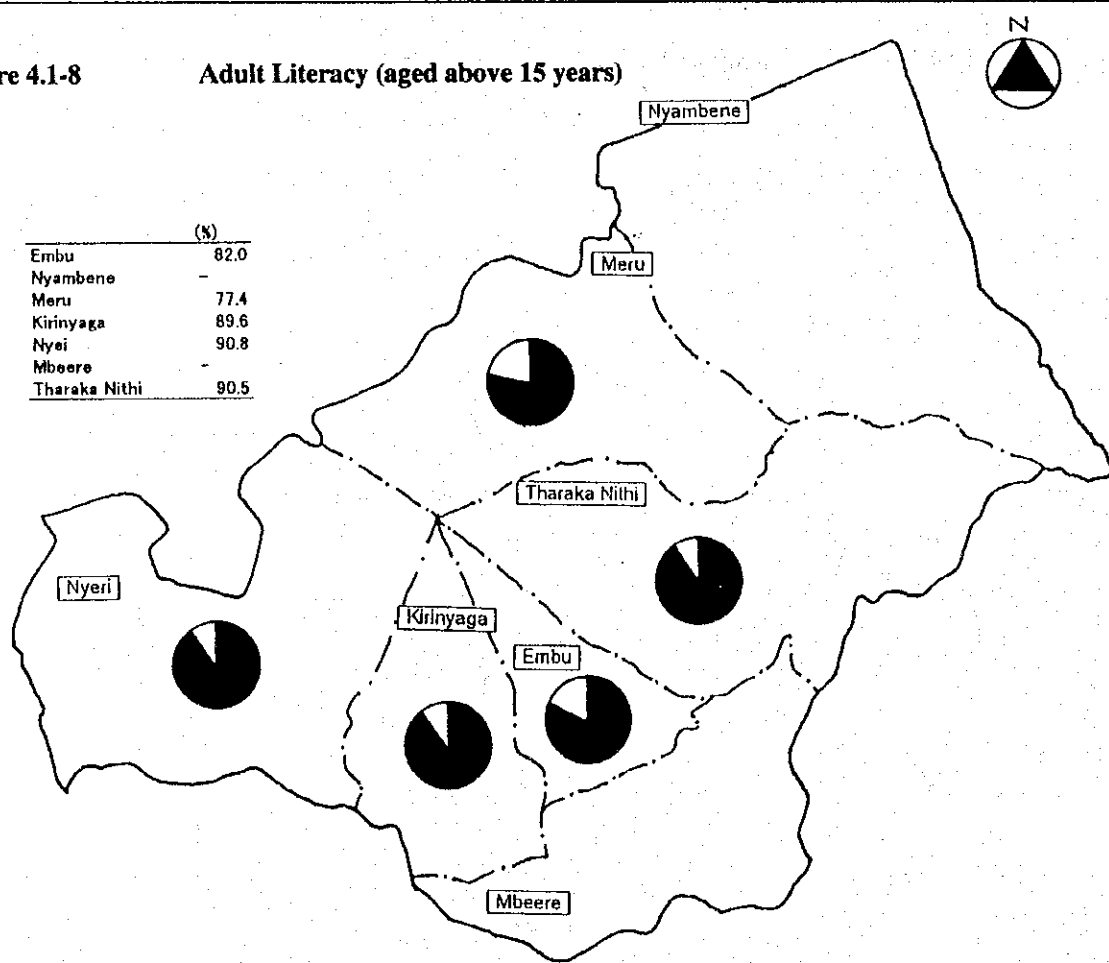
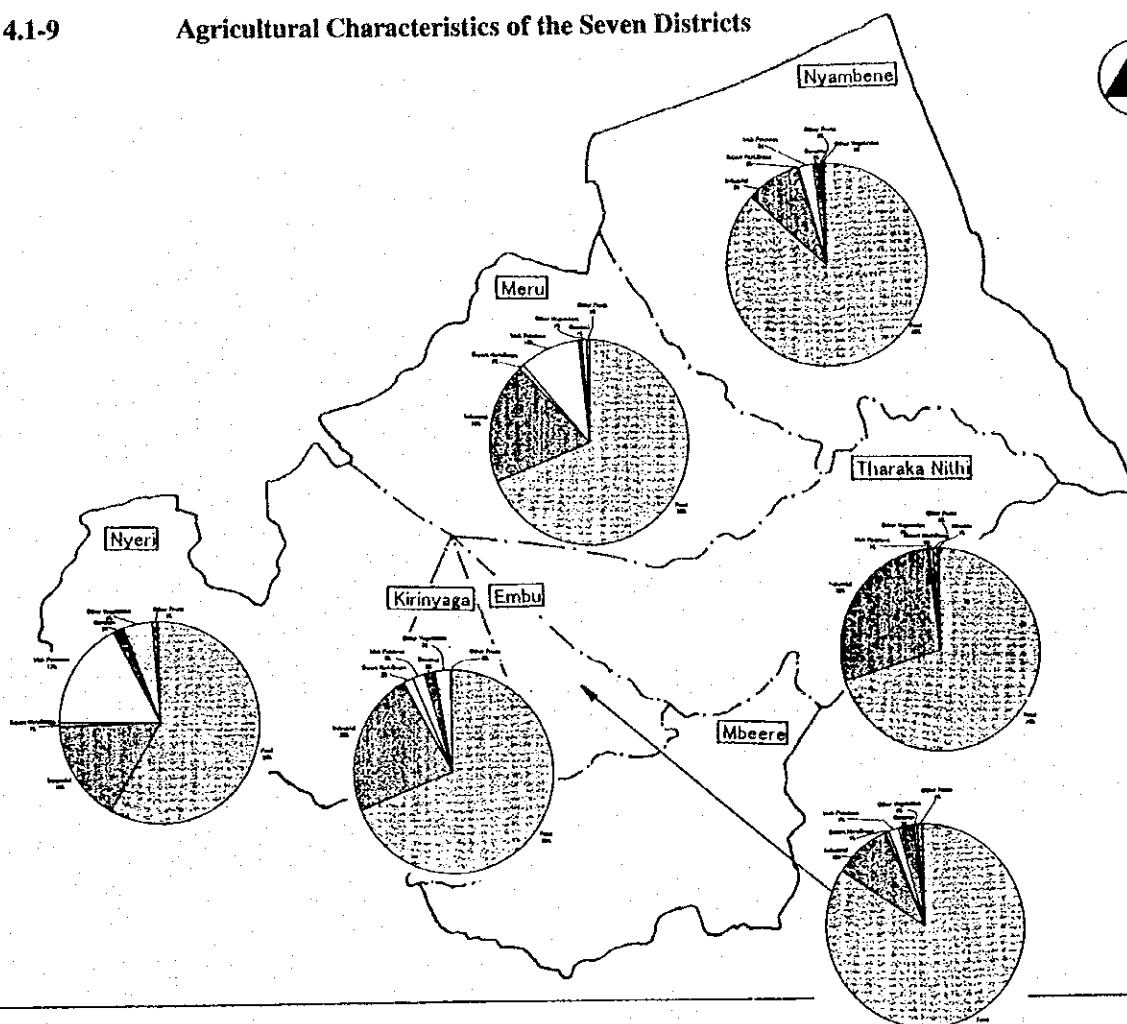


Figure 4.1-9

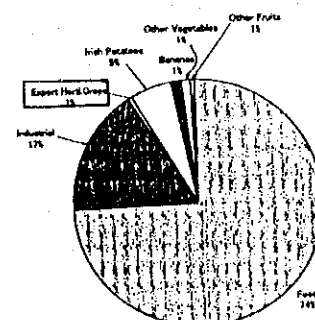
Agricultural Characteristics of the Seven Districts



Area Planted (1995)

	Nyeri		Kirinyaga		Old Embu	
	Area Planted	%	Area Planted	%	Area Planted	%
Food	51,387	58.5	58,934	69.0	136,476	84.3
Industrial	14,130	16.1	19,522	22.9	15,585	9.6
Export Horti. Crops	635	0.7	1,396	1.6	817	0.5
Irish Potatoes	15,450	17.6	1,675	2.0	2,670	1.6
Bananas	1,417	1.6	1,364	1.6	4,267	2.6
Other Vegetables	4,017	4.6	2,240	2.6	615	0.4
Other Fruits	787	0.9	235	0.3	1,537	0.9
Total	87,823	100.0	85,366	100.0	161,967	100.0

STUDY AREA



	Tharaka Nithi		Meru		Nyambene		STUDY AREA	
	Area Planted	%	Area Planted	%	Area Planted	%	Area Planted	%
Food	75,701	70.0	95,090	68.7	109,544	88.9	527,132	74.5
Industrial	30,399	28.1	26,055	18.8	11,164	8.9	116,855	16.5
Export Horti. Crops	56	0.1	1,189	0.9	440	0.3	4,532	0.6
Irish Potatoes	630	0.6	13,369	9.7	2,720	2.2	36,514	5.2
Bananas	865	0.8	650	0.5	1,610	1.3	10,173	1.4
Other Vegetables	249	0.2	1,230	0.9	415	0.3	8,766	1.2
Other Fruits	251	0.2	754	0.5	236	0.2	3,800	0.5
Total	108,151	100.0	138,337	100.0	126,129	100.0	707,772	100.0

Table 4.1-9

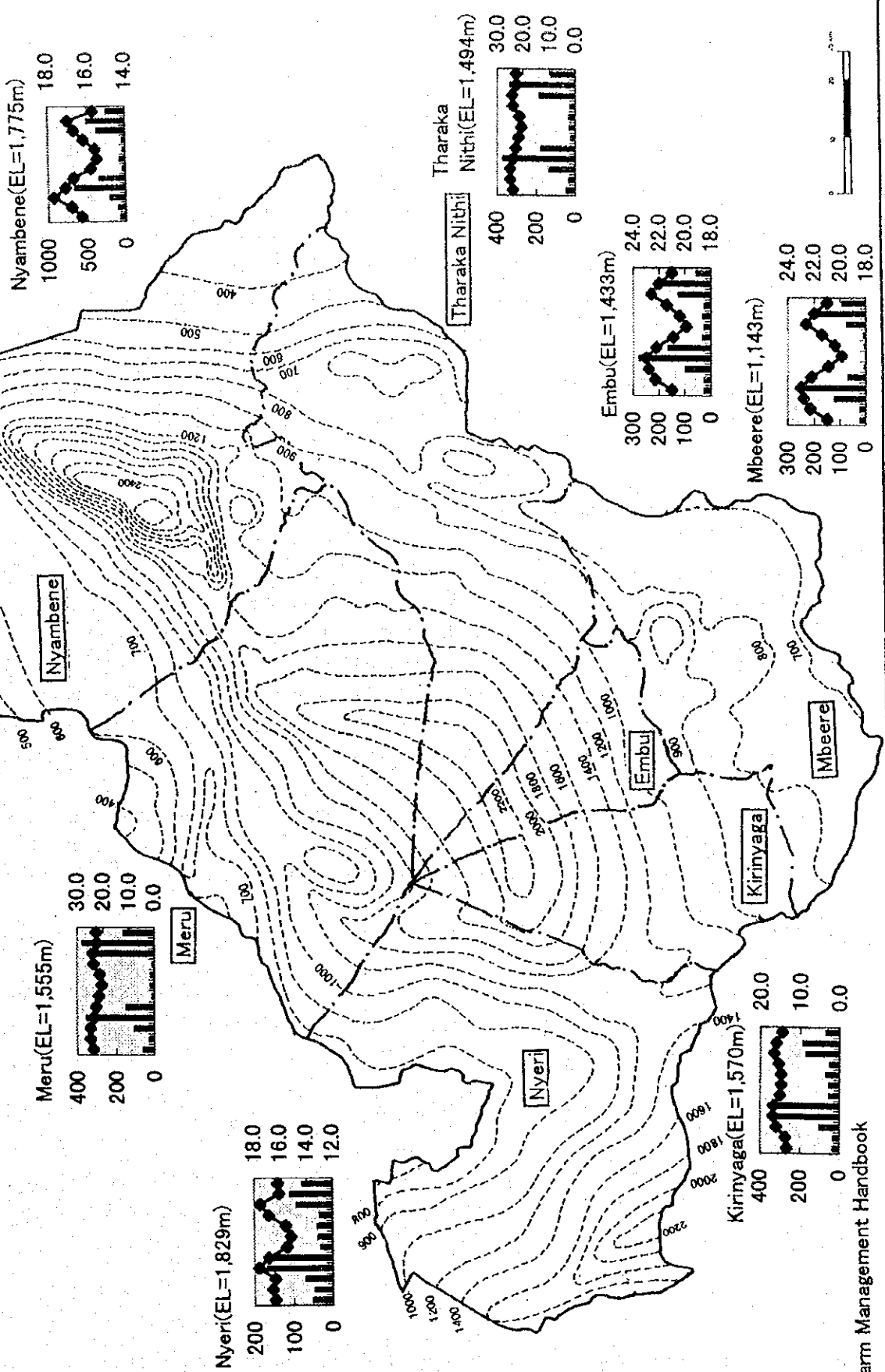
Agricultural Characteristics of the Seven Districts

	Embu	Nyambene	Meru	Kirinyaga	Nyeri	Mbeere	Tharaka Nithi
1. Total land(km ²)	708	3,224	3,012	1,437	3,266	2,097	2,295
2. Cultivable land(ha)	49,600	184,200	216,500	102,500	260,550	161,029	156,100
3. Irrigable area(ha)	68	605	4,078	6,955	1,681	1,813	239
4. Cultivable land per capita(ha/capita)	0.17	0.31	0.40	0.21	0.36	0.92	0.48
5. Total planted area(ha)	161,967	126,129	138,337	85,366	87,822	95,492	108,150
6. Population(1997)	298,342	591,760	540,166	492,942	729,595	175,219	325,770
7. Population density(pers/km ²)	132	143	116	264	186	89	112
8. Aged 15-50 population/total population	126,411	245,246	302,614	216,883	317,111	74,243	135,025
9. Total agricultural income of district(1,000Ksh)	1,874,533	1,146,168	1,671,685	2,400,135	8,133,400	832,400	659,329
9.1 Crop income(1,000Ksh)	1,759,900	1,134,457	1,224,913	1,912,520	3,674,000	599,900	528,663
9.2 Livestock income(1,000Ksh)	114,633	11,711	446,772	487,615	4,459,400	232,500	130,666
10. Agricultural income per capita(ksh)	6,283	1,937	3,095	4,869	11,148	4,751	2,024
11. Planted area with export-oriented horti.crops	817	440	1,189	1,396	635	550	56
12. Planted area with horti.crops(ha)	9,906	5,421	17,192	6,910	22,306	0	56
13. Maize production(ton)	62,712	112,725	61,740	41,465	26,028	32,160	21,600
14. No. of farm households	61,014	107,200	92,000	82,012	93,543	22,996	45,000
15. Farm size(ha/farm household)	4.44	3.30	3.97	1.86	1.80	6.00	6.05
16. Family size(person/family)	6.00	5.52	6.00	5.10	5.30	5.50	6.20
17. Maize per capita(kg/capita/year)	210	190	114	84	36	184	66
18. Ratio of female headed households(%)	24.9	NA	16.3	23.6	27.8	NA	5.0

Note: Horticultural crops cover export-oriented crops, potatoes, bananas, and other fruits and other vegetables.

Source: District Development Plan 1997-2001
Welfare Monitoring Survey II May 1996
District Profile Survey 1998

Figure 4.1-10 Isohyetal Map of the Study Area



Source. Farm Management Handbook

4.2 Local Administration of the Study Area

4.2.1 Administrative Framework

For ease of administration and provision of government services, the whole country is divided into 8 provinces including the City of Nairobi. In turn, the provinces are demarcated into a hierarchy of administrative units i.e.: district, division, location, sub-location and down to the village level. Government departments are then super-imposed on this administrative frame-work.

The Study Area covers two administrative provinces i.e. Central Province and Eastern Province with head-quarters in Nyeri and Embu respectively. Two districts are included in Central Province (Nyeri and Kirinyaga) while 5 districts are featured in Eastern Province (Mbeere, Embu, Tharaka Nithi, Meru and Nyambene).

4.2.2 Provincial Administration

Within the Kenyan context, the term "Provincial Administration" refers to the power and authority structure from the "president" down to the "assistant-chief". The "Provincial Administration", which is attached to the Office of the President, is the most dominant and extensive government organ and projects its authority and influence through highly visible administrative officers at a number of levels stretching from the Provincial Commissioner (provincial level) down to District Commissioner, Chief and Assistant Chief (community level). The "Administration" is responsible not only for maintaining law and order but also for oversight and coordination of development activities promoted by the Government.

Up to now, the most powerful legal tool used by the administration in the management of rural communities is the "Chief's Act" which empowers the administration to regulate social, political as well economic behaviour of rural communities. For instance, the Chief's act has been used to enforce attendance of public meetings (barazas), non-cultivation of river banks, compliance with agreed water usage in an irrigation scheme or any other aspect the Chief perceives to be for the good of the local community.

However, there are far-reaching political and legislative reforms currently taking place in the country. Consequently, the role of the Provincial Administration in the management of rural communities will probably be re-defined.

4.2.3 Other Government Ministries and Departments

Nearly all Government ministries that offer public services are represented at provincial and district levels. However, some key Ministries such as Agriculture, Health and Education maintain a presence at the divisional level, locational and even sub-locational levels.

4.2.4 Local Government Authorities

At the district level, local authorities are established under the Local Authorities Act. Such local authorities exist as County, Town, Urban, Municipal and City Councils. For the bulk of the rural communities, it is the County Councils that are of more relevance since they are responsible for providing

the following services:

- Administering Trust land within the district
- Assigning and administering market centres
- Maintaining rural access roads

In return, the local authorities levy charges on a wide range of marketed commodities within the district such as horticultural produce, charcoal, grains, legumes, sand and quarry stones.

4.2.5 District Focus Emphasis

In 1983, Government of Kenya (GOK) made a policy decision to shift development focus from the centre in Nairobi to the districts. Consequently, "development committees", comprising government officers and local leaders, were established at all administrative levels. It was envisaged that planning would start with the sub-location development committee and culminate with the District Development Committee (DDC), chaired by the District Commissioner. It is at the DDC where development proposals are reviewed and prioritized. Presently, the DDC is the most active planning level where meetings are scheduled in advance, minutes of meetings strictly kept and a well resourced secretariat exists. Meetings by lower level planning committees, however, have not been regular and the subject of discussions have not always been recorded.

4.2.6 Regional Administration under MOALD

Agricultural services within a province are coordinated and supported by the Provincial Director of Agriculture (PDA) who is located at the Provincial Headquarters. In carrying out these coordination and support functions, the PDA is assisted by a number of specialized officers (crops, horticulture, farm-management, irrigation etc.).

The district, however, is the focal point for provision of agricultural technical services to smallholder farmers. Headed by the District Agricultural Officer (DAO), a team of subject matter specialists is based at the district headquarters and is responsible for providing technical back-up and training support to divisional and locational agricultural extension officers.

At the divisional level, a Divisional Extension officer is responsible for managing extension services in the division through locational and sub-locational extension assistants. The locational and sub-locational extension assistants are the ones in daily contact with the community, hence they are often referred to as front-line or grass-roots extension staff.

4.3 Natural Conditions in the Study Area

4.3.1 Topography

The main physical features of the Study Area are Mt. Kenya (5,199m) at the center, the Aberdares Range (3,999m) to the west and the Nyambeni Range (2,414 m) elongated from south-east to north-east. The altitude of the Study Area becomes lower to the eastward direction, and the lowest altitude is 300 m at

Figure 4.2-1

Organization Chart of Provincial Agricultural Office

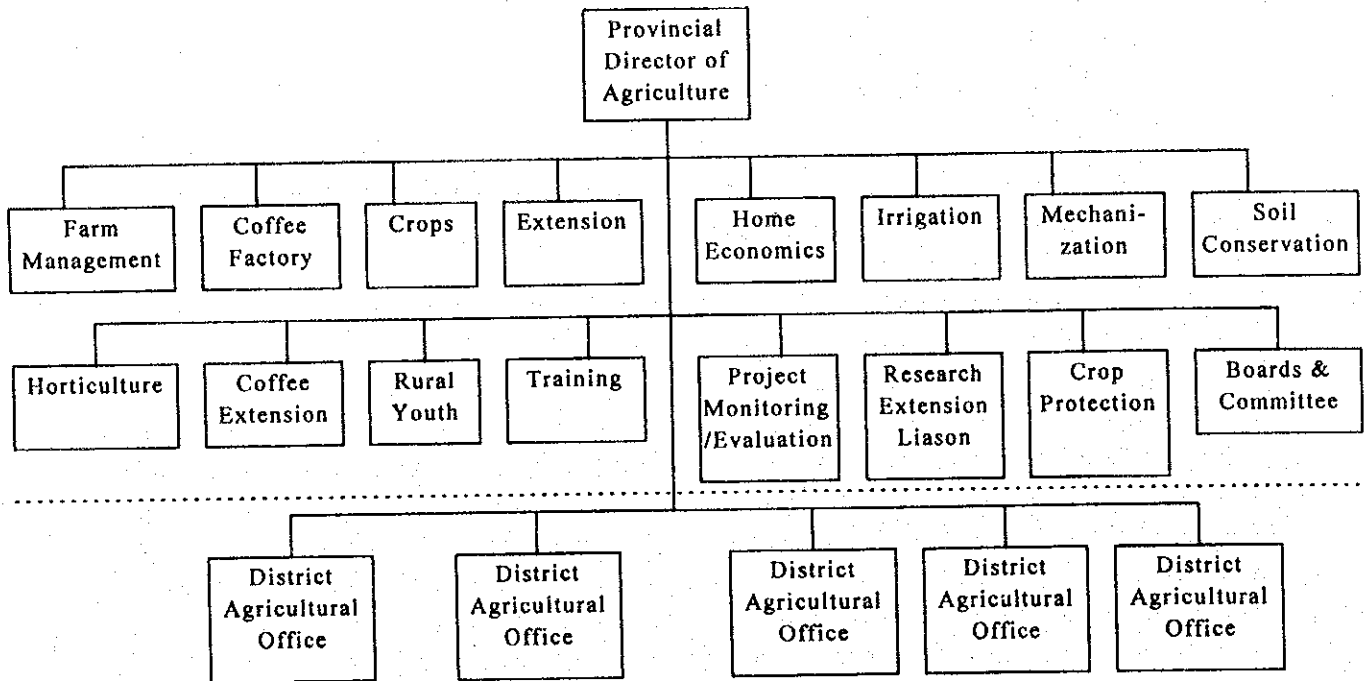


Figure 4.2-2

Organization Chart of District Agricultural Office

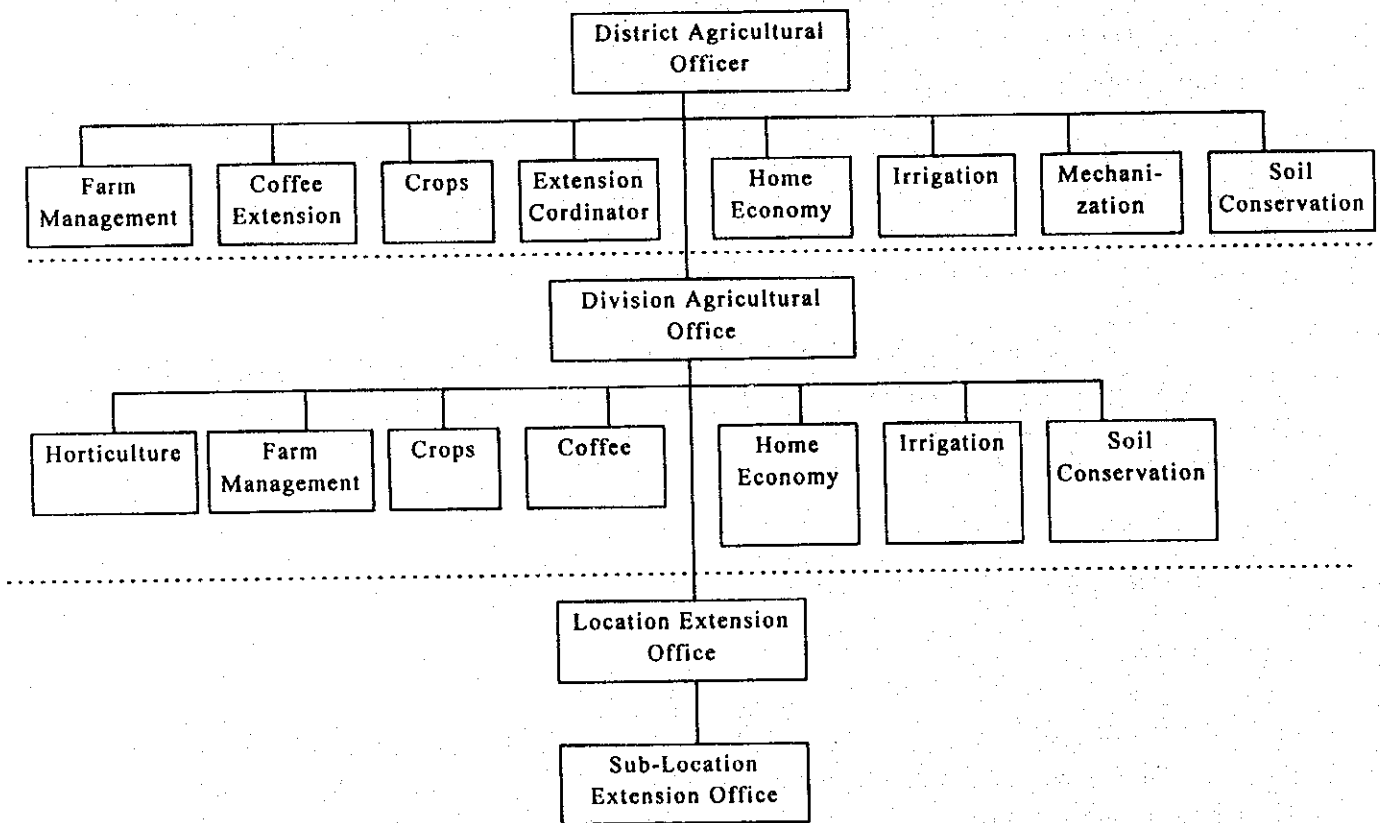


Figure 4.2-3

Organization Chart of District Office

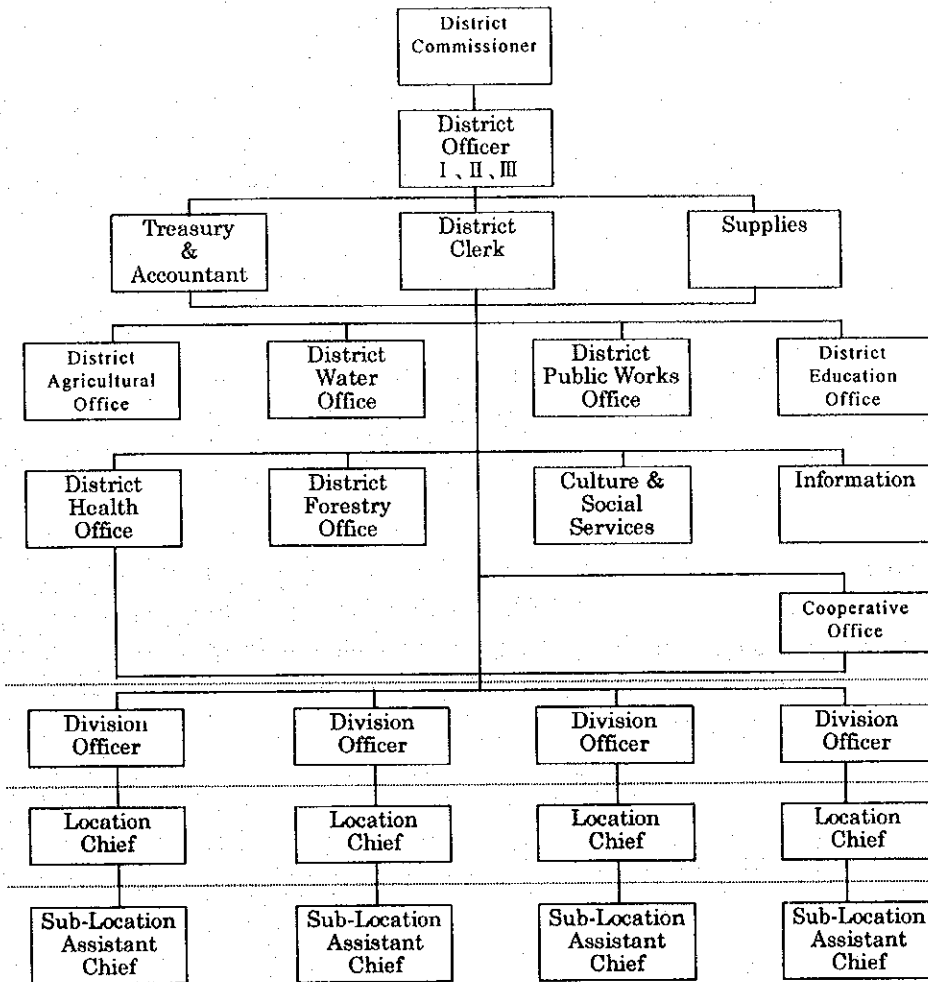
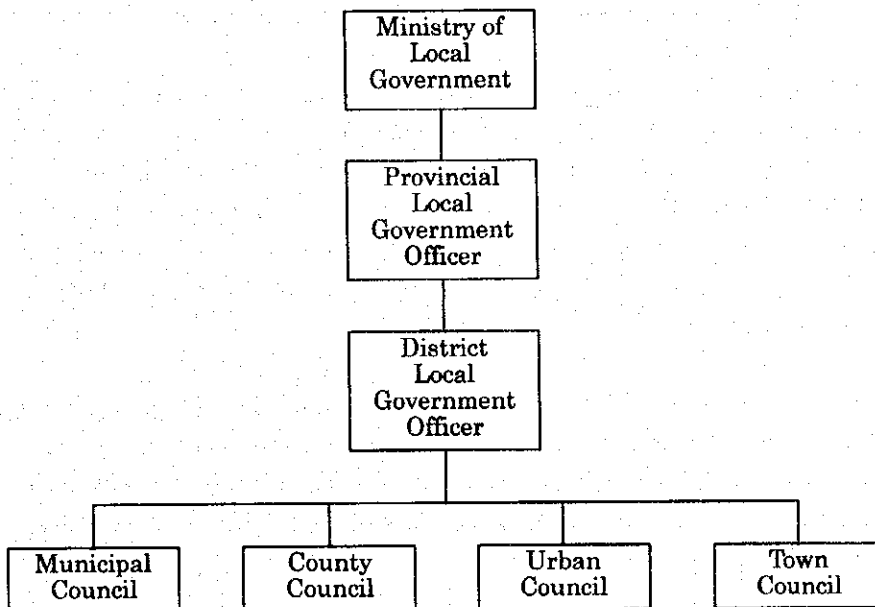


Figure 4.2-4

Organization Chart of Ministry of Local Government



Adamson Falls in Nyambene district. The tremendous range of altitude gives the Study Area a diverse climate as well as a wide range of Agro-Ecological Zones.

The lower volcanic slopes of Mt. Kenya and the Nyanbeni Range with an altitude of less than 2,400 m are mainly used for rainfed agriculture. The terrain is hilly to rolling although steep sloping, rugged parts also exist. The landscape is a humid in the upper part of the zone, and semi-arid in the lower part.

4.3.2 Climate

The climate in Kenya is generally influenced by the Intertropical Convergence Zone moving across the equator seasonally northward and southward, bringing two rainy and two dry seasons in a year. The rainy seasons occur during mid-March to May and early October to November, and are called the long rains and the short rains respectively.

The Study Area varies from humid to semi-arid zones depending on the altitude. The humid zone with an average annual rainfall of more than 1,100 mm extends from the eastern slope of the Aberdares Range and Mt. Kenya to the southern slope of the Nyambeni Range where the elevation exceeds 1,500 m. Whereas, the lower part of the slopes and all part of northward facing slopes are a semi arid zone with an annual rainfall ranging from 400 to 850 mm.

The meteorological data at Meru shown in Table 4.3-1 indicates that the annual precipitation reaches to 1,459 mm to annual rainfall of 1,259 mm and the annual average daily maximum and minimum temperatures are 24 °C and 13 °C. Monthly meteorological data at other representative stations are shown in Annex G.

4.3.3 Hydrology

The rivers in and around the Study Area originate in Mt. Kenya and the Nyanbeni Range which run from south-west to north-east demarcating the watershed between the Ewaso N'giro river system in the north and the Tana river system in the South. In Kenya, the major drainage areas are largely classified into five groups. The Tana and Ewaso N'giro river systems correspond to the drainage areas 4 and 5, respectively. These river systems are divided into several sub-basins. Runoff observation at Regular Gauging Stations (RGS) has been carried out by The Ministry of Land Reclamation, Regional and Water Development (MLRRWD) since 1940. The number of existing RGS in the Study Area is about 200. The list and location of major stations are shown in Table 4.3-2 and Figure 4.3-2. Monthly distribution of river runoff is shown in Figure 4.3-3. The monthly low flows occur in February and September and the monthly high flows in May and November.

According to the study result of the National Water Master Plan by JICA (1992), the annual runoff coefficient of upper Tana river at a junction point next to Adamson Falls reaches 28 percent on the naturalized discharge basis, while upper Ewaso N'giro at the unction point of Nanyuki River is six to eight percent on the same basis. The hydrological characteristics of the sub-basins concerned with the Study Area are summarized in Table 4.3-3.

4.3.4 Geology

The study Area is located to the east of the East African Rift Valley. The surrounding region is wholly underlain by the Precambrian Basement System and mostly covered by volcanic rocks and sediments from the major eruption centers of Mt. Kenya, Aberdares Mountains and the Nyambene Hills, and the associated parasitic cones. The formations are generally classified into the Precambrian Basement Rocks, Tertiary Volcanic and Quaternary Volcanic Rocks and Sediments.

4.3.5 Soil and Land Use

1) Soils

Mount Kenya, which dominates the Study Area, is the remnants of an ancient volcano, and its central peak, the second highest in Africa, is the plug. The mountain is made up of kenyte lava flows and occasional dykes of nepheline phonolite, with overlays of volcanic ash and basic tuff. Kenyte is a basic lava, rich in olivine and orthoclase feldspars. The eastern slopes and surrounding volcanic plains are mainly underlain by basalt, which produces fertile Andosols (deep, dark colored clay soils of high fertility and good drainage, have developed on the volcanic ash) and Nitosols (Kikuyu red loam, deep, clay soils with moderate to high fertility). Occasional intrusions of the basement gneiss, schists and quartzites occur, either in the eroded plain area, or as inselbergs. These outcrops cause localised changes in the fertility, and underlie low fertility Ferralsols and Arenosols. These poor soils are especially common in the lower, eastern parts of Embu, Mbeere, Tharaka Nithi, Meru and Nyambene. Throughout the Study Area, local alluvial deposits of silt, sand and gravel are found along streams, particularly in the plain areas surrounding the uplands.

The soil classification system used here is the FAO-UNESCO system modified for Kenyan conditions. The most important soil factors influencing crop production are depth, water holding capacity, the available nutrients, and the workability. A wide range of soils are found in the Study Area, influencing the land use and the productivity. Andosols and Nitosols are developed from lava under high rainfall. Cambisols are variable soils of moderate to high fertility, of recent origin. Ferralsols are iron rich soils, usually of low fertility, which develop under intense weathering. Acrisols are acid clays of low fertility. Arenosols are sandy soils of low fertility, developed on recent alluvium. Phaeozems are clay, prairie soils of high fertility. Vertisols are clay soils, developed in valley bottoms with montmorillonite or illite clay minerals predominating. The actual soils found at a particular location within the Study Area depend on a variety of factors, such as the parent material (geology), the land form (drainage and aspect), the slope (catena), the climate (temperature and rainfall) and the land use (erosion and vegetation).

Table 4.3-1

Monthly Meteorological Data at Meru Station

Station No. : 8937065
 Station Name : Meru Met. Station
 Location : latitude 0 5 S
 : longitude 37 39 E
 Period of Recd : 1975-1980
 Altitude : 1555 m

Month	Temperature				Relative Humidity		Daily Sunshine Hours (hrs)	Daily Wind Run (km)	Daily Evaporation (mm)	Monthly Mean Rainfall (mm)	Nos. of Raindays (days)
	Daily Maximum (°C)	Daily Minimum (°C)	Extrem high (°C)	Extrem low (°C)	Daily Maximum (%)	Daily Minimum (%)					
Jan	23.4	11.4	26.0	6.4	79	67	8.1	66.8	120	80	7
Feb	24.7	11.9	28.3	6.9	78	50	8.6	67.7	129	39	6
Mar	25.7	13.0	29.8	9.2	78	55	8.3	63.5	157	126	8
Apr	24.1	14.3	28.6	10.6	81	67	7.5	53.6	134	282	17
May	22.8	13.7	25.5	8.9	83	71	8.1	62.9	117	86	10
Jun	22.1	12.0	25.2	7.0	81	63	7.5	58.1	115	5	3
Jul	21.5	11.9	24.6	7.5	84	61	6.1	62.1	115	10	3
Aug	22.1	12.0	26.2	8.5	83	56	6.5	75.2	133	8	3
Sep	24.4	12.3	28.7	7.8	78	49	7.7	82.7	148	16	4
Oct	25.1	13.5	30.0	9.0	79	49	7.9	75.3	170	140	9
Nov	22.8	13.1	25.7	9.2	83	71	6.4	50.9	110	328	17
Dec	22.7	12.0	25.7	8.0	81	73	7.0	50.8	11	139	12
Max.	25.7	14.3	30.0	10.6	84	73	8.6	8.6	170	328	17
Min.	21.5	11.4	24.6	6.4	78	49	6.1	6.1	11	5	3
Ave.	23.5	12.6	27.0	8.3	80	61	7.5	7.5	121	104	8

Table 4.3-2

Existing Major Regular Gauging Station (RGS) in the Study Area

Basin Code	River	RGS Code	D.A. (km ²)	Location		Record Length	Recording Period
				Latitude	Longitude		
4AA	Sagana	1	96	S 00-18-00	E 37-04-00	42	1947-'92
	Thego	2		S 00-19-00	E 37-03-00	41	1947-'92
	Sagana	5	505	S 00-13-66	E 37-02-22	45	1949-'96
4AB	Little Sagana	6		S 00-22-00	E 37-08-00	45	1950-'96
	Amboni	5	420	S 00-19-00	E 36-59-20	39	1949-'87
4AC	Muraria	7	62	S 00-16-50	E 36-53-25	17	1978-'96
	Sagana	3	282	S 00-13-43	E 37-02-35	49	1948-'96
	Chania	4	210	S 00-14-85	E 36-57-30	37	1951-'88
4AD	Chania	5	179	S 00-14-76	E 36-53-55	35	1959-'96
	Gura	1	430	S 00-08-98	E 37-04-35	46	1951-'96
4BA	Sagana	1	1,836	S 00-08-88	E 37-04-00	15	1954-'68
4BB	Kururu	2	35	S 00-12-95	E 37-09-50	19	1978-'96
4BC	Rwamuthambi	4	158	S 00-00-20	E 37-14-30	38	1958-'96
	Kanderes Str.	6	6	S 00-14-55	E 37-13-15	18	1979-'96
4DA	Thiba	2	32	S 00-15-50	E 37-18-35	33	1950-'86
	Thiba	10	353	S 00-02-85	E 37-19-00	30	1967-'96
4DB	Nyamindi	4	285	S 00-03-45	E 37-22-10	13	1958-'73
4DC	Rupingazi	2	404	S 00-03-30	E 37-29-40	42	1955-'96
	Rupingazi	3	197	S 00-08-00	E 37-26-15	28	1969-'96
4DD	Thiba	2	1,500	S 00-03-54	E 37-30-22	29	1966-'94
4DE	Tana	2	6,633	S 00-13-53	E 37-30-10	9	1972-'80
4EA	Mutonga	1	124	S 00-27-95	E 37-39-30	45	1952-'96
	Mutonga	6	613	S 00-23-55	E 37-51-20	30	1964-'95
	Mutonga	7	1,880	S 00-17-65	E 37-53-45	31	1966-'96
4EB	Nithi	1	120	S 00-22-85	E 37-38-45	42	1953-'96
	Mara	2	83	S 00-24-68	E 37-38-50	21	1952-'72
	Thuchi	4	111	S 00-16-70	E 37-35-55	45	1952-'96
	Ruguti	5	115	S 00-17-95	E 37-37-15	44	1952-'96
	Ruguti	6A	368	S 00-18-96	E 37-51-30	35	1962-'96
	Tungu	9	80	S 00-21-85	E 37-39-36	39	1958-'96
	Mara	11	534	S 00-19-65	E 37-52-15	22	1967-'88
4EC	Ena	1		S 00-11-60	E 37-41-00	10	1953-'63
4ED	Tana	3		S 00-08-00	E 37-41-00	22	1952-'73
4FA	Thingishi	F4	91	N 00-03-30	E 37-39-35	44	1952-'95
	Mariara	F5	71	N 00-02-30	E 37-39-30	37	1955-'96
	Kathita	F10	878	S 00-34-55	E 37-58-40	38	1959-'96
	Thingishi	F11		S 00-29-95	E 37-58-37	7	1959-'65
	Thanato	F12				13	1959-'71
	Thingithu	F17	303	S 00-29-90	E 37-57-35	32	1965-'96
	Kathita	F19	1,702	S 00-25-80	E 38-00-20	31	1966-'96
	Tana Grand F.	F13	17,179	S 00-22-95	E 38-01-05	35	1962-'96
4FB	Rujirweru	F34			12	1980-'91	
5BA	Moyo	1	58	N 00-15-05	E 36-52-55	30	1931-'63
5BB	Uaso Ngiro	2	405	N 00-08-00	E 36-52-00	48	1947-'96
5BC	Burgret	6	98	N 00-06-34	E 37-02-15	41	1948-'94
	Ngobit	8	256	N 00-03-00	E 36-47-00	45	1947-'94
5BE	Timau	6	64	N 00-05-18	E 37-14-30	44	1944-'88
	Nanyuki	20	860	N 00-08-50	E 37-01-47	36	1959-'94
5DA	Ngare Ndare	5D1	140	N 00-11-27	E 37-20-50	21	1944-'65
5ED	Uaso Ngiro	5E3	15,300	N 00-38-30	E 37-40-40	41	1949-'88

Data Source) NWRMP 1992 JICA

Table 4.3-3

Summary of Hydrological Characteristics

Basin Code	Main River	Drainage Area (km ²)	Annual Mean Rainfall (mm)	Lowest Month of Rainfall	Naturalized Discharge				
					Average Runoff (m ³ /s)	Annual Runoff Coeffi. (%)	Lowest Monthly Q (m ³ /s)	Lowest Month	
1. Upper Tana River Basin									
4AA	Sagana	519	1,495	Sep	2.7	11	1.6	Jul	
4AB	Amboni	684	1,017	Sep	3.2	15	1.8	Jul	
4AC	Sagana	429	1,148	Sep	6.0	38	3.3	Sep	
4AD	Gura	441	1,038	Jan	6.3	43	3.6	Sep	
4BA	Sagana	317	1,282	Sep	4.2	33	2.2	Sep	
4BB	Ragati	259	1,508	Jul	4.0	32	2.4	Sep	
4BC	Tana	227	1,409	Sep	3.0	30	1.5	Sep	
4BD	Mathioya	547	1,170	Jul	16.0	79	11.0	Sep	
4BE	Tana	554	1,205	Jul	11.9	56	6.1	Feb	
4BF	Saba Saba	374	1,053	Jul	8.4	67	4.5	Feb	
4BG	Tana	443	1,042	Jul	9.5	65	4.8	Feb	
4CA	Chania	537	1,130	Jan	10.4	54	5.4	Sep	
4CB	Thika	313	1,109	Jul	2.4	22	1.1	Sep	
4CC	Thika	1,019	1,029	Jul	17.5	53	7.9	Sep	
4DA1-2	Thiba	715	1,326	Sep	6.9	23	2.9	Mar	
4DB	Nyamindi	453	1,343	Sep	4.3	22	1.8	Mar	
4DC	Rupingazi	354	1,162	Jan	3.7	28	1.8	Mar	
4DD	Thiba	452	1,162	Jan	4.3	26	1.8	Feb	
4DE	Tana	735	1,047	Sep	6.2	25	2.8	Sep	
4EA1-2	Mutonga	743	857	Sep	5.7	28	1.0	Sep	
4EB	Thuchi	1,193	1,048	Sep	9.3	23	4.0	Sep	
4EC	Ena	605	1,094	Jul	4.6	22	2.0	Sep	
4ED1-4	Tana	3,160	882	Jul	17.9	20	0.7	Sep	
4FA1-2	Tana	2,181	829	Jul	10.5	18	3.8	Sep	
4FB	Tana	3,950	650	Jul	2.0	2	1.2	Sep	
Total/Ave	Upper Tana (up to Adamson F.)	21,204	975	-	183.8	28	109.8	Sep	
2. Upper Ewaso Ngiro River Basin									
5BA	Engare Moyok	269	899	Jun	0.8	10	0.5	Sep	
5BB	Ewaso Ngiro	452	936	Jun	1.5	11	1.1	Sep	
5BC	Ewaso Ngiro	1,636	789	Jan	4.4	11	2.8	Sep	
5BD	Ewaso Ngiro	674	697	Jan	1.4	9	0.7	Sep	
5BE	Ewaso Ngiro	1,238	841	Jan	2.7	8	1.5	Jan	
Total/Ave	Upper E. Ngiro	4,269	812	-	11.0	10	7.6	Sep	
5DA1-3	Ewaso Ngiro	2,237	794	Jul	3.5	6	1.5	Feb	

Source) NWMP 1992 JICA

Figure 4.3-1 Study Area and Related River Basin

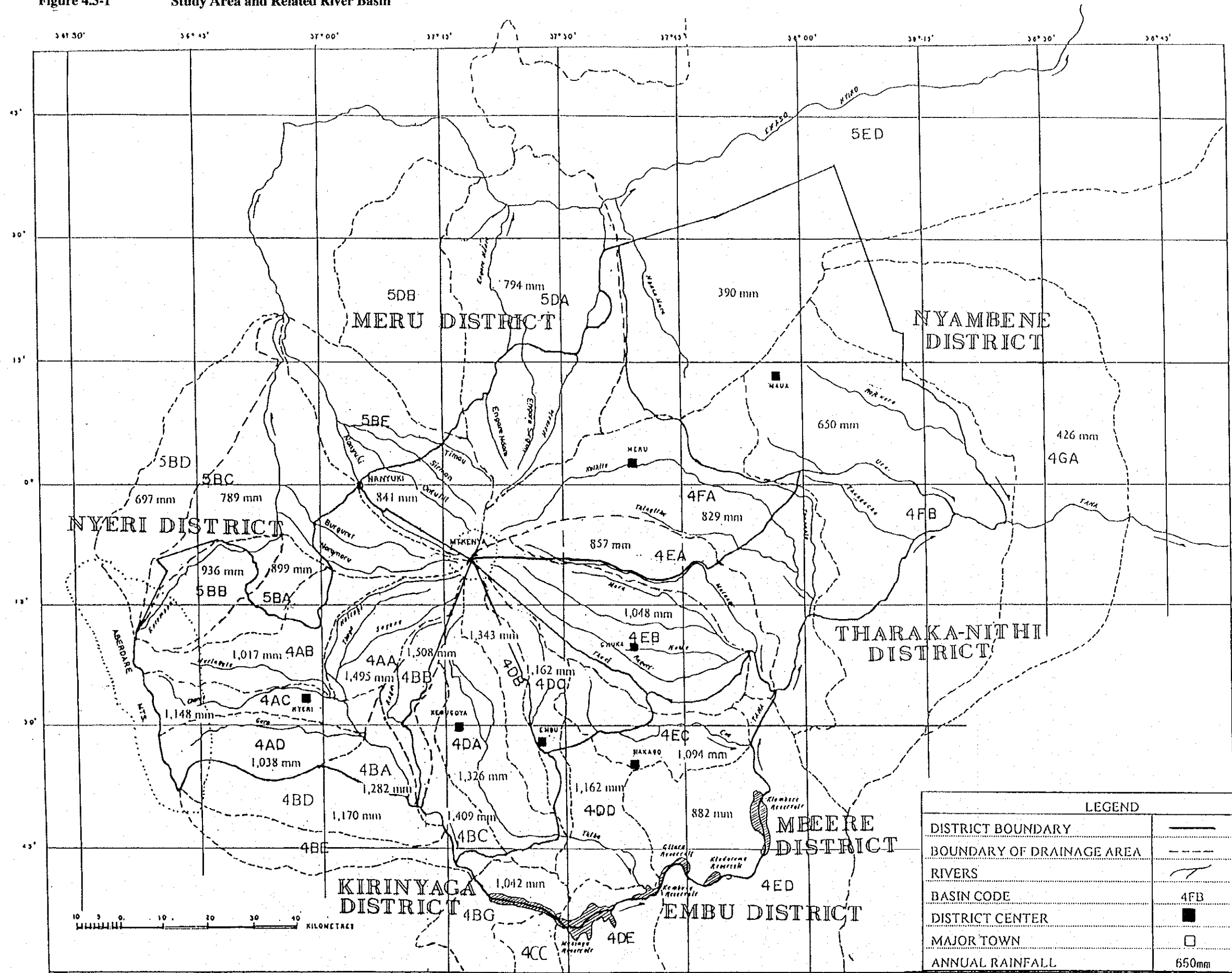
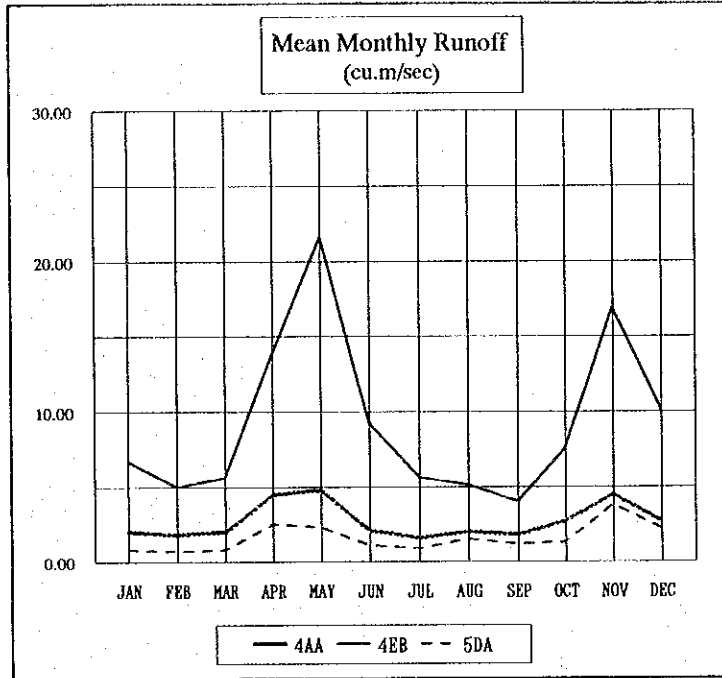


Figure 4.3-3

Monthly Runoff of Representative Sub-basin/RGS



Mean Monthly Runoff (cu.m/sec)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1. 4AA	cu.m/sec	2	1.8	2	4.5	4.8	2.1	1.6	2	1.8	2.7	4.5	2.7	32.5
	%	6	6	6	14	15	6	5	6	6	8	14	8	100
2. 4EB	cu.m/sec	6.7	5	5.6	13.9	21.6	9.2	5.6	5.1	4	7.5	16.9	10.1	111.2
	%	6	4	5	13	19	8	5	5	4	7	15	9	100
3. 5DA	cu.m/sec	0.8	0.7	0.8	2.5	2.3	1.1	0.9	1.5	1.2	1.3	3.8	2.2	19.1
	%	4	4	4	13	12	6	5	8	6	7	20	12	100

Source) NWMP 1992 JICA

Major Soil Type by District

(unit : %)

District	Andosol	Nitosol	Cambisol	Ferralsol	Vertisol
Nyeri	27	42	2.5	0	3.5
Kirinyaga	19	54	1	10	13
Old Embu	5.7	15	30	29	5
Old Meru	12	25	22	9.5	1.5

Source; Kenya Soil Survey

Mount Kenya dominates the area, and many of the Study Area soils have developed on its olivine rich basalt or ash. The upper summit zone of Mount Kenya with its Lithosols (hard rock within 25 cm of the surface) and Histosols (peat soils) is outside the scope of this survey. The soils below this zone on the steeper upper mountain slopes (>30 percent) are derived primarily from volcanic ash and tuff, with an occasional lava flow causing localised differences. Occasional intrusions of the basement gneisses, schists and quartzites occur, either in the eroded plain area, or as inselbergs. They are well drained, humic Andosols. On the south (Nyeri/Kirinyaga and Embu districts) and the east side of the mountain (Meru and Tharaka Nithi districts) these steeper slopes grade into undulating dissected footridges with mainly clay soils, first a mixture of ando-humic Nitosols and humic Andosols, and then at lower altitudes well drained humic Nitosols. The Nitosols (Kikuyu red loam) are important agricultural soils, Nyeri, Karatina, Embu, and Meru all have large areas of this well drained, extremely deep, dusky red to dark reddish brown, friable clay with its acid humic topsoil. Down to around 1,600 metres, the higher rainfall combines with the good water storage capacity of these Nitosols to make crop production much less precarious than in the drier plains which have thinner soils and lower, less predictable rainfall. However, years of intensive cropping in the densely populated areas has diminished the inherent fertility of many of the Nitosol areas.

In the west of Nyeri district, up the slopes of the Aberdare's the same sequence of humic Nitosols, ando-humic Nitosols, and humic Andosols is repeated. To the north-east of the Study Area, the Nyambene hills are also made of olivine basalt, but their lower summits are covered with shallow, humic Cambisols. Like Mount Kenya, the upper slopes have a mixture of moderately fertile Nitosols and fertile, mollic Andosols. Their surrounding volcanic footridges are covered with a mixture of shallow Nitosols, Cambisols, Acrisols and Phaeozems.

In the south and east of Embu district, below the footridges, the higher elevations of the plateau area have nito-rhodic Ferrasols, which around 1,500-1,200 metres start to grade into the rhodic and orthic Ferrasols, and ferralo-chromic/orthic/ferric Acrisols found on the lower elevations, which themselves merge into chromic Cambisols and ferralic Arenosols along the Tana river at around 800 meters.

A similar sequence is found in Tharaka Nithi district, with the humic Nitosols of the lower elevations of Mount Kenya (along the Chuka-Ngeru road) grading into a mixture of moderately fertile eutric Nitosols, nito-chromic Cambisols and chromic Acrisols, which in turn become less fertile Ferrasols and Acrisols on the lower elevations, and finally shallow, stony, Cambisols and Arenosols along the Tana river.

Throughout the lower elevations of the Study Area there are scattered occurrences of localised soils developed on the smaller hills, a range of rhodic or orthic Ferrasols, dystic or eutric Regosols, humic,

ferralic or calcic Cambisols or Lithosols depending on the climate, slope and parent material found in the area.

The main source of soil information in Kenya is the Kenya Soil Survey. Soil maps (refer to figure 4.3-5) and descriptions of the major soils in the Study Area districts can also be found in the Farm Management Handbooks of Kenya, from which this brief summary description is largely drawn.

2) Land Use

a) General Pattern of Land Use

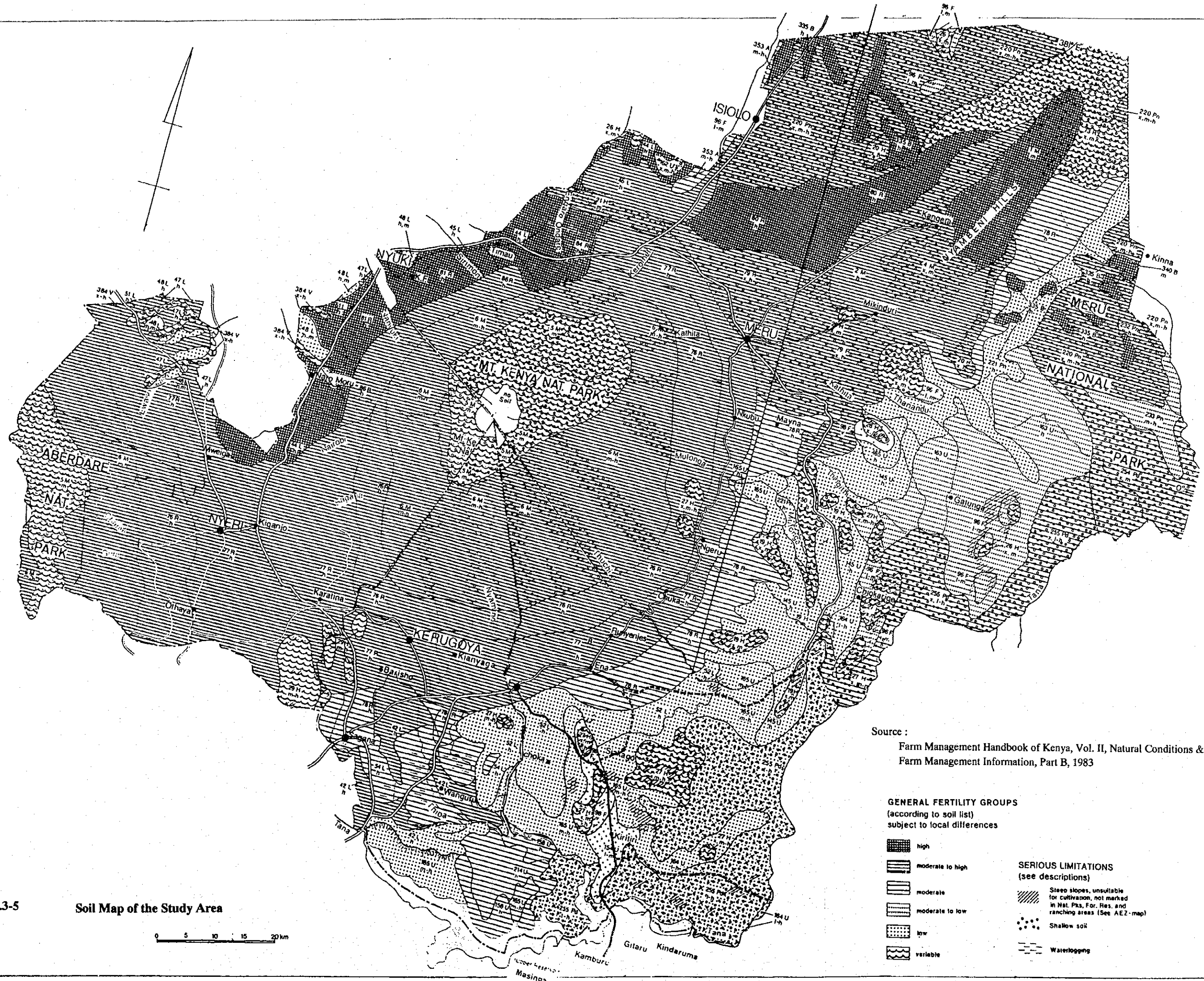
The main physical factors influencing land use are the soil, the slope and the climate. The soils tend to decrease in fertility from the highlands to the lowlands, with the actual soil and its fertility varying with its position in the catena, the underlying parent material, the aspect, the previous land use, etc. The natural vegetation, the land use and the relative importance of the various crops in the farming system is affected by altitude, through the direct effect of altitude on rainfall and also temperatures. Up to about 2,500 metres the rainfall tends to increase with altitude. The amount is also strongly influenced by the aspect. The length of the dry season is another major influence on the land use and crops grown. Besides these natural factors, the pressures of the human population, labor availability and the relative access of a location to markets will also affect the actual land use.

The agricultural zone of the Study Area lies between the steep slopes of Mount Kenya and Mount Nyambene which are forest reserve, and the lower more arid plains, where rainfall of less than 750 mm and the poor soils limit rainfed agricultural production. From 2,400 metres upward, frosts occur and forestry is the main land use, and from 1,000 metres down, with 750-500 mm rainfall, livestock farming and limited subsistence cropping of millet, sorghum and grams are the main land uses. Between the forest and the arid plains, the main cash crops, including tea, coffee, potato, bananas, horticulture, tobacco and cotton, plus subsistence crops like sweet potatoes, beans, maize, sorghum, millet, cow pea, taro, and cassava are grown. Maize and beans alone occupy approximately 375,000 ha or >50 percent of this farm area.

Livestock of various kinds are found throughout the Study Area, with sheep and dairy cattle predominating in the higher and wetter elevations, beef cattle and goats in the lower and drier regions. Dairy cattle are more important in the wetter areas, closer to the towns, and beef in the more distant drier areas. At both the upper and lower elevations within the Study Area the percentage of the land used primarily for grazing is larger, than in the mid elevations where zero-grazing and agriculture predominate. Throughout the area, fodder trees, forage crops, and napier grass can be seen. Crop residues are also commonly used as feed, e.g. banana stems, sweet potato tops, maize stalks, etc. Only small numbers of pigs and improved breeds of chicken occur in the Study Area, while nearly every farm has a flock of local chickens.

b) District/Purpose-Wise Area

Soils and climate are two (2) key determinants of land use. There are a wide range of soil types in the Study Area. In the higher elevations on the hill slopes, the soils are usually deep, well drained, clay and clay-loams of moderate to high fertility. Down on the surrounding plain, the soils are often shallower, sandy clays and sandy loams of moderate to poor fertility.



Source :
 Farm Management Handbook of Kenya, Vol. II, Natural Conditions &
 Farm Management Information, Part B, 1983

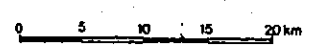
GENERAL FERTILITY GROUPS
 (according to soil list)
 subject to local differences

- high
- moderate to high
- moderate
- moderate to low
- low
- variable

SERIOUS LIMITATIONS
 (see descriptions)

- Steep slopes, unsuitable for cultivation, not marked in Nat. Pks, For. Res. and ranching areas (See AEZ-map)
- Shallow soil
- Waterlogging

Figure 4.3-5 Soil Map of the Study Area



Land and Land Use in the Study Area Districts

(unit : ha)

District	Total Area	Arable Area	Forest	Cropped	Irrigated
Nyeri	326,600	260,550	119,199	87,822	1,681
Kirinyaga	143,700	102,500	39,039	85,366	6,955
Embu	70,800	49,600	22,264	161,967	68
Mbeere	209,700	161,029	3,771	In Embu *	1,813
Tharaka Nithi	229,500	156,100	48,903	108,150	239
Meru	301,200	216,500	95,200	138,337	4,078
Nyambene	322,400	184,200	11,018	126,129	605
Total	1,603,900	1,130,479	339,394	707,771	15,439

Sources; District Development Plans (total and arable areas), District Forestry Office (gazetted forest areas), MOALD District Reports 1995 (cropped areas), District Profiles updated 1997 (irrigated areas).

* ; Cropped area in Mbeere is included in the area of Embu district of 161,967 ha.

(1) Nyeri District

The topography is dominated by undulating to rolling, volcanic foothill ridges. The altitude in the agricultural part of the district ranges from 1,220 to 2,380 metres. The rainfall ranges from a low of 650 mm on the Kieni plateau in the NW, through 1,500 mm in the foothills, and on up to 2,300 mm in the NE on Mt. Kenya.

The majority of the forested land is found in the montane areas, the Aberdare's National Park to the west and the Mount Kenya Forest Reserve to the east. Indigenous forest occupies 59,859 ha, bamboo 27,029 ha, plantations 14,170 ha, grassland 7,836 ha, bushland 6,306 ha, and non-gazetted plantation, 4,000 ha for a total of 119,199 ha.

In the drier/warmer areas of the Kieni plateau, at around 1,900 metres, dryland wheat and beef cattle are farmed. Forest is the main use of the upper highland zone, with cattle, wheat and potatoes also produced. The altitude here is 2,000-2,400 m. The lower highland zone, 1,800-2,100 m, is the tea and dairy zone. The upper midlands from 1,200 to 1,780 metres is the heart of the district's production, the coffee and maize zone; potatoes, bananas, beans and milk are also important products here.

The agricultural area in the densely populated, inter-montane portion of the district, is being intensively farmed in small family units. The natural soil fertility is declining, as is the average farm size. Coffee, tea, dairying, cabbages and maize are important cash sources. Beans and potatoes, are important subsistence crops. Nyeri has about 25 percent of its cropped land under bananas, potatoes, fruits and vegetables, the highest percentage in the Study Area.

(2) Kirinyaga District

In the upper parts of Kirinyaga district, the natural rainfall and soils have produced a forest belt running east-west which gives way to a tea and dairy zone, which merges into the coffee-tea zone. The main coffee zone runs east-west through Kerugoya and Kirinyaga, and the two northern divisions end on their southern borders with a marginal coffee belt. This is followed by a sunflower-maize belt which runs along the border of Mwea division. Mwea itself with its black cotton soils and lower rainfall has a

northern cotton zone, followed by a wider marginal cotton belt in the south.

(3) Embu District

There are 22,264 ha of forest in Embu. Irangi Forest has 18,393 ha in the Mt. Kenya Forest reserve. There are 600 ha of plantation around Njukiini, Maranga and Nduuri, and 3,871 ha of land approved and demarcated, but not yet gazetted.

In the upper areas, the humic Andosols are very suitable for tea cultivation, and in the central and lower parts of the district on the Nitosols coffee is the main cash crop grown. Coffee, tea and some dairy farming dominate the farming in the higher elevations, graded into bananas and maize along the Embu-Runyenjes road.

(4) Mbeere District

Because of the shortage of rainfall, only about one quarter of Mbeere district is agriculturally productive. Maize and some cotton production in the north grades into livestock ranching and millet and sorghum on the drier areas and poorer soils in the south. Tobacco is grown in Siakago division. The population density in Mbeere district is somewhat lower than Embu, probably linked to the poorer soils, plus the fact that farms in drier areas need to be larger to form an economic unit. In Gachoka division there are some large commercial irrigated farms.

(5) Tharaka Nithi District

In the wetter upland areas of Nithi, tea, and coffee are the cash crops, and maize and beans are the domestic crops. Bananas and potatoes are locally important. Millet and sorghum are the most important grains in the drier lower areas of Tharaka. Cowpeas, grams and pigeon peas are also grown on quite large areas also. Tobacco and cotton are the industrial crops here. A small amount of French beans, Asian vegetables, onions and tomatoes are grown under irrigation in the district. Less than two (2) percent of the cropped land was under horticulture in 1995.

(6) Meru District

Meru district, like the other districts, is mainly smallholder production, except for wheat and barley in Timau where wheat and barley are produced on large scale mechanised farms. Maize and beans are the main food crops. The cash crops are coffee, tea, export horticulture, French beans, snow peas and Asian vegetables, domestic horticulture crops; tomatoes, onions, garlic, cabbage and kales, and cotton. Potatoes are widely grown in Meru. Sorghum and millet is grown in the drier areas.

(7) Nyambene District

The main cash crops in Nyambene are tea, coffee, tobacco and miraa. Out of 125,000 ha. of cropped land in 1995, more than half was under maize and beans. The main cash crops were coffee, tea, cotton and tobacco. About four percent of the cropped land was under horticulture, a lower percent than any other district except Tharaka Nithi. Pigeon pea, Dohchous Lab, and millet are all important crops in the drier areas.

Agricultural Land Use in the Whole Study Area in 1995

Crop Type	Planted Area (ha)	Total Area (%)
Food	527,352	74.5
Industrial	116,855	16.5
Irish Potatoes	36,514	5.2
Bananas	10,173	1.4
Other Vegetables	8,546	1.2
Export Horticulture	4,532	0.6
Other Fruits	3,800	0.5
Total	707,771	100.0

Source; Calculated from MOALD Annual District Reports.

This summarizes a range, with wide variations between the Study Area. The main points to consider are as follows, and details are given in Annex H.

- The dominance of food crops (mainly maize and beans) in the cropping pattern. The areas range from 59 percent in Nyeri to 87 percent in Nyambene.
- The importance of Irish potatoes and bananas in the wetter districts. Their areas range from 0.6-17.6 percent and 0.5-2.6 percent respectively.
- The relatively small areas devoted to export horticulture, 0.1-1.6 percent.
- The relatively large areas devoted to other cash crops, such as coffee, tea, tobacco, cotton, 8.9 - 28.1 percent depending on the district.

More details are available in the Annex H.

4.4 Crops Grown in the Area

4.4.1 General Statistics on Horticultural Crops

1) Major Modes of Production by Types of Crop/Livestock

a) Smallholdings

An estimate of the total number of farms in the seven Study Area districts is in excess of 500,000, and 497,222 of these are smallholdings. The vast majority of the arable land in the Study Area is farmed by smallholders. The average farm size is 1.95 ha. Cultivation is by hand and the labor supply on smallholdings comes predominately from the family.

b) Medium-sized Irrigated Horticultural Specialists

Farms with their own irrigation supply located in the drier areas of Meru, and Nyeri district, and along the rivers in Mbeere. Producing mainly crops for export, such as Asian vegetables, French beans, and snow-peas.

c) Large-scale Commercial Farming

Not common in the Study Area, only 6,543 units above 20 ha in size are registered, and most are not very large. The large scale farms are found mainly in Timau division, Meru, where there are 87 large farms (average size 500 ha) producing mainly wheat, barley and sheep. Large-scale livestock and cereal farms are found in the drier areas of Nyeri district, and coffee estates in Meru and Nyeri.

d) State-run Irrigation Schemes

The only such scheme in the Study Area is found in Kirinyaga district, being the Mwea rice scheme (5,800 ha) run by the National Irrigation Board (NIB). This is a tenant scheme with central control of the water and planting and harvesting schedules. Recently (October 1997), the President announced that the tenants would be given title to their land. When this proposal is implemented, it is likely to fundamentally change the cropping patterns, organisation and water use of this large scheme.

e) Meat and Milk Production

Livestock are usually found associated with cropping throughout the Study Area. There are two main types of commercial livestock production system; intensive production of forage, such as Napier grass, combined with grazing in the higher altitude, wetter areas; and extensive range grazing in the drier areas, (500-750 mm). Dairy cattle predominate in the wetter areas, beef in the drier. Cheese and milk factories are located throughout the higher rainfall parts of the Study Area.

Commercial sheep flocks are kept on the large farms in Timau. Goats are kept throughout the Study Area. The capital available, the dry season grazing and the fodder, forage and crop residues produced on the farm are some of the critical determinants of which animals are kept and their stocking levels.

Animal Populations in the Study Area (1995)

Animal	Numbers	(unit : head, bird)
Cattle (Beef and Dairy)	895,156	
Sheep and Goats	1,195,333	
Pigs	29,913	
Chickens (local and improved)	2,102,497	

Source; Calculated from District Livestock Production Office Statistics

4.4.2 Land Tenure

1) Land Holding

The size of individual land holdings, within the Study Area, shows significant differences from district to district as shown below;

Farmland Availability in the Survey Districts

No.	District	Farmland Area(ha) (ha)	No. of Households	Average Holding Size (ha)
1.	Nyeri	260,550	93,543	1.80
2.	Kirinyaga	102,500	82,012	1.86
3.	Embu	49,600	61,014	4.43
4.	Mbeere	161,029	22,996	6.00
5.	Meru	216,500	91,000	3.97
6.	Tharaka Nithi	156,100	45,000	6.05
7.	Nyambene	184,200	107,200	3.28
	Total	1,130,479	503,765	

Source: Socio-Economic Survey (October 1997)

2) Land Tenure Systems

Three main types of land tenure co-exist within the Study Area as summarized below.

a) Free-hold Land

This is a form of land tenure where the owner possesses a registered title deed and can readily transfer ownership to a second party. However, for such transfer to take place consent of the local land board must be obtained. This form of land tenure is most prevalent in areas of the Study Area which have been long settled and where consolidation or demarcation has already been effected. This, for instance, is true in the whole of Nyeri district, the greater part of Kirinyaga and Embu districts. However, in Mbeere district and the lower parts of Tharaka Nithi, Meru, and Nyambene districts, survey and demarcation has largely been completed but issue of title deeds is in progress. The process of survey, demarcation and title deed issuance is only confined to areas already settled and excludes county council trust land or government state land.

b) Trust Land

This is land that is held in trust by the District County Council on behalf of the inhabitants of the district. It is available for use by the local inhabitants with the consent of County Council. In rare cases, trust land can be formally leased to outsiders by the county council for a specified period.

Within the Study Area, land under this tenure category is rapidly decreasing as a result of political pressure to demarcate and allocate the land to landless families. After issuance of title deeds, such allocated land changes status to free-hold.

c) State Land

This land is owned by the Kenya Government. Currently it is either being used for wild-life conservation and national parks, forests or for communal grazing land.

Again it is possible to transform state land into leasehold or free-hold land through direct grant of the land by the Commissioner of Lands.

4.4.3 Agricultural / Horticultural Production

1) Major Production by District

The main grain crop grown throughout the area wherever the rainfall allows is maize, while smaller amounts of wheat, barley, sorghum and millet are also grown in particular locations. The most important industrial crops are coffee, tea, and tobacco. Pyrethrum and cotton are grown on smaller areas. The main food crops are maize and beans, supplemented by Irish potato and bananas. The main domestic horticultural crops are cabbage, kales, carrots and onions, the main export vegetables, French beans, snow peas and Asian vegetables. The main fruit crops are avocado, mango, pawpaw and passion fruit.

For the yields of the various crops by district, see the Annex H. The seven districts in the Study Area have approximately 4,500 ha of land producing horticulture for export: 36,000 ha of Irish potatoes, 10,000 ha of banana, and 12,000 ha producing vegetables and fruits for domestic use.

The approximate production of the main crops in the Study Area in 1995 was French beans (6,700 ton), snow-peas (1,900 ton), Asian vegetables (2,800 ton), Irish potatoes (380,000 ton), tomatoes (36,000 ton), onions (54,000 ton), cabbage (46,000 ton), banana (93,000 ton), avocado (23,000 ton) and mango (9,000 ton).

Value of Agricultural Production in the Study Area (1995)

District	(unit : billion Ksh)			
	Horticulture	Cash & Food Crops	Livestock	Total
Nyeri	1.41	2.26	4.46	8.13
Kirinyaga		1.91	0.49	2.40
Embu		1.76	0.11	1.87
Mbeere		0.60	0.23	0.83
Tharaka Nithi		0.53	0.13	0.66
Meru	0.16	1.22	0.45	1.83
Nyambene		1.13	0.12	1.25
Total	1.57	9.13	5.99	16.97

Source; District Development Plans. (only Nyeri and Meru districts separated out the value of horticultural production from cash crop production.)

a) Nyeri District

Nyeri has the smallest amount (0.12 ha) of cropped land per head of population, (the figure of 0.36 ha per person of cultivable land, includes the large areas in Kieni West of dry land used for ranching). This high population density, combined with favourable soils and access to Nairobi has encouraged intensification and the development of a farming economy which combines food production for subsistence with large scale production for the market. Currently horticultural crops for both subsistence and sale occupy a very important role in the district agriculture. In the future, cultivation on increasingly marginal land, falling soil fertility and increasing population pressure will limit the extent of any further intensification.

In Nyeri district, out of 88,000 cropped hectares about 20,000-25,000 ha each of beans and maize are grown, 15,000 ha of Irish potatoes, and 5,500 ha of wheat. Kieni East is where most of the irrigated horticulture is currently located, French beans and snow-peas for export, (500 ha), and cabbage and tomato

for the domestic market, (2,500 ha), especially in Mathira division, north of Karatina.

The total irrigated area in the district is approximately 1,681 ha, and about 1,447 ha of this area is group-based small-holders. The actual area currently being irrigated is not clear. Fully irrigated schemes comprised 582 ha, mainly in Kieni East. The district profile identified another 5,300 hectares as potentially irrigable. Assuming available water, there are two types of irrigation expansion possible. Increasing the food production in the marginal areas of Kieni West and East, and/or expanding dry season production of horticulture, especially in the northern areas of Kieni west and east divisions.

Livestock Production and Sales in Nyeri District

Animal	1991		1995	
	Population	(sold)	Population	(sold)
Cattle	147,889	22,697,784 kg. milk 16,401 head	165,629	22,317,254 kg. milk 11,986 head
Sheep	115,431	17,327 head	111,992	12,454 head
Goats	54,999	7,114 head	61,084	5,662 head
Poultry	267,616		281,514	

Source; District Livestock Production Office, Nyeri, 1996.

b) Kirinyaga District

Kirinyaga district is even more densely populated than Nyeri, and the average farm sizes are even smaller, particularly in the northern parts of the district. The average cultivable area per head is 0.21 ha and the average cropped area was 0.17 ha. The cash crops in the district are tea, coffee, horticulture, rice, dairy and cotton. The subsistence crops are maize, beans, bananas, and potatoes. The rainfall ranges from 2,150-1,000 mm in the north to 1,000-300 mm in the south.

The north and central parts of the district (Gichugu and Ndia divisions) cover Mount Kenya and its slopes. Tea and dairying are the main occupations in these upper areas. The middle zone consists of ridges and valleys between 1,800 m and 2,800 m and has adequate rainfall (1,200-1,500 mm) for both food (maize and beans) and cash crops (coffee, tea, beans and horticulture). However, the topography, the rainfall and the soil texture in the middle zone makes road construction problematic and limits access to the markets.

The southern part of Kirinyaga district, Mwea division has a lower rainfall (800-1,200 mm). This division consists of gently rolling plains, and the main rainfed crops are sorghum, cowpea, and tobacco. Rice at Mwea is the main irrigated crop, and some irrigated horticulture crops (tomato and French bean) are also grown.

The main agricultural market centres are Kerugoya/Kutus and Wanguru (horticulture). The district is a maize deficit region, but exports rice and beans. It has five tea factories, 109 coffee factories, a rice mill at Mwea, and a cotton ginnery and a tannery at Wanguru.

Dairy cattle are important in Ndia and Gichugu, beef cattle in Mwea. The dairy farms are small, one to three (1-3) cows, crossbred Freisans, Ayrshire's and Guernsey's, usually stall-fed. The milk is consumed at home (50 percent), sold to KCC (10 percent), to a private dairy in Kagumo, or to individuals.

Beef cattle in the lower rainfall Mwea division are mainly Hozal and Zebu. The South Ngariama ranch raises Boran and Sahiwal cattle. There is a tannery operating in Sagana.

Livestock Production and Sales in Kirinyaga District

Animal	1991		1995	
	Population	(sold)	Population	(sold)
Dairy Cattle	64,540	34,707,148 kg. milk	66,220	39,967,521 kg. milk
Beef Cattle	23,548	11,648 head	25,840	9,616 head
Sheep	13,514		14,437	
Goats	39,699	3,237 head	42,044	3,657 head
Pigs	5,883	619 head	6,727	3,965 head
Poultry-local	261,870		446,296	
Poultry-improved	9,559			

Source; District Livestock Production Office, Kerugoya, 1996.

c) Embu District

Because of its topography, ridge and valleys on Mount Kenya's slopes, crop land is in limited supply in Embu. The cultivable land per head of population is 0.17 ha, the lowest of all of the districts in the Study Area. Fortunately, the climate and the topography lend themselves to cash crop production. Tea and coffee dominate the cropping, and are grown on about 27 percent (13,500 ha) of the 50,000 ha of arable area. Bananas are the important food crop, grown on more than 6 percent of the arable area.

The main agricultural market centres are Embu and Runyenjes. The district has two tea factories, 53 coffee factories, a tannery at Embu and fruit processing.

The dairy cattle density is high and milk yields are good, but the district lacks a creamery. Most milk is consumed on the farm or sold through the informal sector.

Livestock Production and Sales in Embu District

Animal	1991		1995	
	Population	(sold)	Population	(sold)
Dairy Cattle	44,561	1,525,088 kg. milk	62,280	
Beef Cattle	7,284	991 head	10,180	605 head
Sheep	11,423		15,982	
Goats	18,323	381 head	39,717	176 head
Pigs	1,293	187 head	1,808	702 head
Poultry-local	210,736		231,230	
Poultry-improved	19,657		13,335	

Source; District Livestock Production Office, Embu 1996

d) Mbeere District

Mbeere is drier than Embu and this is reflected in the ratio of cultivable land/head of population, which at 0.92 ha is the highest in the Study Area districts. Much of this land is only suitable for dryland ranching. Sorghum and millet are the important grain crops, >20,000 ha and dryland pulses, cowpea, pigeon pea, grams, chickpea occupy another 20,000-25,000 ha. The cropped area under horticulture of

about 2,000 ha is the second smallest of all of the Study Area districts. Much of this is in fruit; bananas, mango and papaya.

Beef cattle and goats, farmed extensively are the important livestock animals in Mbeere.

Livestock Production and Sales in Mbeere District

Animal	1991		1995	
	Population	(sold)	Population	(sold)
Dairy Cattle	436		610	
Beef Cattle	68,716	18,822 head	95,034	11,497 head
Sheep	18,840		26,330	
Goats	97,095	37,727 head	135,697	17,464 head
Pigs	207		289	
Poultry-local	189,264		207,670	
Poultry-improved	1,336		6,675	

Source; District Livestock Production Office, Embu 1996

e) Tharaka Nithi District

Tharaka Nithi district is a mixture of high rainfall areas close to Mount Kenya and the drier areas away to the east. Like Mbeere, the large areas of dryland increase the cultivable area per head (0.48 ha). The population density is not as high as other districts in the Study Area, and the average area per head of cropped land is 0.33 ha, the highest of the districts. However, the poor soils and the climate, combined with a lack of a tradition of crop production limits production, and the yields for many crops are lower. The main cash crop is coffee. The food crops are maize and beans in Nithi and sorghum, millet, grams, cowpea and pigeon pea in Tharaka. Horticulture is comparatively unimportant in the district, (2,000 ha, >2%).

The cattle in Tharaka are a mixture of intensively farmed dairy cattle in the higher rainfall Nithi area, and beef cattle farmed extensively in Tharaka. Goats are very important in the drier areas.

Livestock Production and Sales in Tharaka Nithi District

Animal	1991		1995	
	Population	(sold)	Population	(sold)
Dairy Cattle	125,213	1,015,934 kg. milk 5,493 head	150,885	1,060,880 kg. milk 12,206 head
Sheep	44,500	13,035 shoats	89,050	36,896 shoats
Goats	165,211		248,040	
Pigs	1,139		13,469	
Poultry	276,210		443,600	

Source; District Livestock Production Office, Chuka, 1996

f) Meru District

Meru like Nyeri at the other end of Mount Kenya is a mixture of dry and wet areas. Because of the dry areas with their lower populations it has the third highest amount of cultivable land per head, (0.40

ha) and the second highest amount of cropped land per head, (0.26 ha). Coffee dominates the cash crop sector, with over 17,000 ha. In areas where coffee is grown, the demands of this crop during the harvest season limits the time available for other farming activities during this time. Maize and beans are both grown on about 25 percent of the total cropped area (34,000 ha), and wheat is an important crop in Timau (>13,000 ha). Irish potatoes are very important (13,000 ha) and horticulture contributes to the 12 percent of the area (17,000 ha).

The area under group based smallholder irrigation in Meru is 4,078 ha, and individuals are irrigating 189 ha according to the updated district profile. There are apparently 65 group and 9 individual schemes at various stages of implementation.

Livestock Production and Sales in Meru District

Animal	1993		1995	
	Population	(Sold)	Population	(Sold)
Cattle	158,690	3,636,471 kg. milk 15,020 head	174,200	10,655,101 kg. milk 15,180 head
Sheep	165,100	17,690 shoats	198,800	25,220 shoats
Pigs	3,907	280 head	6,410	2,560 head
Poultry	316,700	63,340 head	213,700	64,150 head

Source; District Livestock Production Office, Meru, 1996

g) Nyambene District

Nyambene has a high population density, with 0.31 ha per head of cultivable land and 0.21 ha per head of cropped land. Many parts of the district are dry and unsuitable for intensive crop production. The relatively good soils and climate of the hill areas have encouraged high population densities in those areas. The slopes are an issue, and the cash crops tea and coffee are grown on large areas, (3-4,000 ha each). Maize and beans dominate the cropping system and are grown on more than 70 percent of the total cropped area of 125,000 ha. Potatoes and bananas are less important food crops, >2,500 ha and >1,500 ha, respectively.

The farming population in the district is gradually expanding towards the north and is reaching the limit of crop agriculture, due to the short rainy season there. The demand for irrigation, like in Meru and Tharaka Nithi districts, exceeds the available water resources.

Livestock Production and Sales in Nyambene District

Animal	1993		1995	
	Population	(Sold)	Population	(Sold)
Dairy Cattle	42,276		43,093	1,459,960 kg. milk
Beef cattle	97,232	8,173 head	101,185	8,823 head
Sheep	95,547	14,562 shoats	100,185	17,228 shoats
Goats	106,708		111,975	
Pigs	3,907		1,210	
Poultry-local	254,860		242,117	
Poultry-improved	10,116		12,100	

Source; District Livestock Production Office, Maua, 1996

2) Contribution to Employment

The same as the national level, agricultural sector contributes to provision of employment opportunity for the people in the Study Area. Estimation implies 0.8 million to 1.0 million persons work in this sector, particularly in growing food crops and cash crops including vegetables for export and local markets. Of which, based on the averaged labor requirement for horticultural crops of 150 man-days per ha about 90,000 people are estimated as working in producing horticultural crops. Large holders also provide employment for the people in crop husbandry of tea, coffee and other crops.

3) Contribution to Foreign Exchange Earning

The areas planted with crops in the Study Area total about 707,771 ha which is divided into 4,532 ha for export-orient horticultural crops, 36,514 ha for Irish potatoes, 10,173 ha for bananas and 12,566 ha for vegetables for local use and fruits. Here, French beans and Okra were used as the representative crop to estimate foreign exchange earning taking into account average yield and averaged export price. As the result, horticultural crops produced in the Study Area contribute about 1.6 billion Ksh to foreign exchange earning in the Study Area.

4) Cropping Pattern, Cultivated Area and Production Volumes

Cropped area and production of major crops in the Study Area are summarized in Table 4.4-1. Details are given in Annex H.

5) Production and Trade Statistics of Agricultural Inputs

a) Seeds, Fertiliser and Agricultural Chemicals

In 1994, the Central Bureau of Statistics reported that 1,043 million Ksh of fertiliser, 57 million Ksh of insecticides, 145 million Ksh of fungicides and 903 million Ksh worth of seeds were used in Kenya. The majority of these inputs were used on the larger commercial farms, and for a wide variety of reasons the use of improved inputs by small scale farmers is generally low. One obvious way to increase the efficiency and productivity of the smallholder sector is by increasing the use of improved inputs.

Table 4.4-1
Cropped Area and Production of Ten Major Crops in Each District

Crop	Nyeri District			Kirinyaga District			Old Embu District			Tharaka Nithi District			Meru District			Nyambene District		
	Crop Area (ha)	Production (ton)	Yield (ton/ha)	Crop Area (ha)	Production (ton)	Yield (ton/ha)	Crop Area (ha)	Production (ton)	Yield (ton/ha)	Crop Area (ha)	Production (ton)	Yield (ton/ha)	Crop Area (ha)	Production (ton)	Yield (ton/ha)	Crop Area (ha)	Production (ton)	Yield (ton/ha)
Coffee	13,805	48,800	3.53	14,665	51,460	3.51	8,925	42,000	4.71	9,252	16,155	1.75	17,795	38,739	2.18	4,034	4,045	1.00
Tea				4,607	38,234	8.30	4,580	31,444	6.87	15,000	4,500	0.30	2,824	1,412	0.50	2,500	1,000	0.40
Cotton										1,740	696	0.40						
Tobacco																		
Sunflower																		
French Beans																		
Snow Peas	420	1,470	3.50															
Wheat	5,500	3,850	0.70															
Barley																		
Maize	21,690	26,028	1.20	25,569	41,465	1.62	17,400	12,528	0.72	5,468	3,445	0.63	34,300	61,740	1.80	50,100	112,725	2.25
Sorghum							5,350	3,852	0.72	16,231	10,228	0.63				4,506	4,050	0.90
Millet																		
Rice	23,754	15,915	0.67	5,820	29,100	5.00	29,700	24,057	0.81	13,512	5,472	0.40	33,850	30,465	0.90	38,400	34,560	0.90
Beans				25,731	11,579	0.45	6,420	4,045	0.63	6,837	3,077	0.45				3,000	2,160	0.72
Grams							10,950	6,899	0.63	4,130	1,115	0.27						
Compeas							5,550	3,996	0.72									
Chickpeas							5,150	3,708	0.72	4,130	1,673	0.41						
Pigeon Peas																		
Njahi																		
Groundnut																		
Irish Potatoes	15,450	154,500	10.00	1,675	11,725	7.00												
Sweet Potato				285	2,850	10.00												
Tomatoes	780	14,040	18.00	1,350	16,200	12.00												
Cabbage	2,000	36,000	18.00															
Banana	1,417	7,935	5.60	1,364	13,640	10.00												
Avocado	680	13,600	20.00															

Data source :MOALD Annual Report 1995 for each district.
Data of Mbeere are included in those of Old Embu district.