One constraint to their increased use is the price. Subsidies for inputs have been removed as the agricultural economy has been liberalised, and because either the agricultural input itself, or the ingredients for the input are imported, their cost has been very sensitive to the exchange rate. With the free floating shilling, this has meant that in recent years there has been a growing discrepancy between the relative factor prices of agricultural inputs (based on the exchange rate) and agricultural outputs (based on the domestic market prices). For example, fertiliser use on smallholdings is usually confined to cash crops, and use on food crops is low, and actually the response per unit applied may be unprofitable.

A wide variety of inputs are used to some degree in the Study Area districts, depending on the crop, their price and the availability; these inputs include labor, credit, extension information, seed and planting materials, irrigation equipment, hand tools, veterinary drugs, mechanisation, chemical fertilisers, chemicals for plant protection, etc. The source and availability of these various inputs varies greatly from district to district and by input. For example, fertiliser is widely available, while specialist chemicals for vegetable production are less available. The more commercial orientated production areas, particularly those close to major towns are better served than the remote production areas with limited commercial production. Larger irrigation schemes with a critical mass of buyers are better served than the smaller individual or group schemes.

In the medium and high potential crop producing areas, private traders and input supply organisations operate, and the main purchased inputs are widely available. However, generally, in the less favoured areas because of the limited demand, prices are higher and availability is less certain. Stockists everywhere are loath to invest their capital in a slow moving item, such as pesticide, which may have a limited demand that season due to good growing conditions and low pest incidence.

In some areas, the cooperatives organised around tea and coffee production may be acting as sources of the inputs used on those crops. The KTDA supplies mixed fertiliser on easy credit terms to increase the output of tea. Although it frowns upon the diversion of this input to other crops, it cannot control the use. Coffee cooperatives also often have well functioning fertiliser supply networks.

In summary, there are a variety of sources for inputs such as fertiliser, chemicals and seed, including the government, the private sector, farmers cooperatives and farmers' service centers. The distribution of stockists of inputs varies considerably across the Study Area. For example, Kirinyaga, which has an long established cash and horticultural crop production and marketing system, combined with a high population density had 256 stockists of various kinds of agricultural inputs, located throughout the district in 1995. At the other end of the Study Area, Nyambene had 21 stockists in 1995, more than half of them (11 stockists) located together in Maua. A major source of fertiliser in Nyambene district is the KTDA.

Stockists in Kirinyaga District (1995)

	Gichugu	Ndia	Mwea	Municipality	Total
Private	36	27	42	19	174
Union	2	2	1	2	7
Societies	37	31	2	1	71
HCDA	1		1		2
KGGCU			1	1	2
Total	76	60	47	23	256

Source; Annual District Report Agriculture

Stockists in Nyambene District (1995)

Division	Number
Igembe Central	11
Igembe South	0
Igembe North	1
Tigania North	1
Tigania Central	2
Tigania West	1
Lare	5
Tigania East	0
Mutuati	1
Uringu	0

Source; Annual District Report Agriculture

b) Animal Labor and Agricultural Machinery

Mechanisation is not widely used on the small, undulating farms found in much of the area, nor is ox cultivation a common tradition. The main mechanical inputs used are hoes, sprayers, hose pipes and sprinklers. The hoes are a widely available item, imported from China. Sprayers and sprinklers are either import items, or produced locally in the flourishing jua kali sector. Mechanised farming is currently confined to the large farm sector, smallholders use human labor.

4.4.4 Farm Management Conditions

1) Area-Wise Farming Population, Farm Household and Available Farm Labor

The total number of households in the Study Area is estimated at 503,765 at present and about 2.85 million is estimated as the population of farm families based on average family size. Among the family size, 1.8 to 2.0 persons aged above 15 years old are considered as available farm labor. Based on this estimation, 0.91 million to 1.01 million persons would constitute available farm labor in the Study Area.

2) Average Farm Size

The area-wise average farm size is estimated at 1.95 ha per farm, which is smaller than 2.50 ha of the national average. Average farm holding size varies considerably by district. Farm Management Handbook shows average farm size of 4.44 ha in Embu, 3.97 ha in Meru, 1.86 ha in Kirinyaga and 1.80 ha in Nyeri district. Beside those smallholders, there exist large holders holding more than 700 ha in some

cases.

3) Farm Economy and Living Condition

The Welfare Monitoring Survey II 1996 shows that monthly household income is composed of income from crops, livestock and non-farm income. Area-wise household monthly income is averaged at 6,891 Ksh, which is lower than 9,696 Ksh of the national average and 8,508 Ksh of the rural average. Some 9,320 Ksh/family in Meru is the highest in the Study Area, the lowest is Tharaka Nithi at 4,255 Ksh. While, as to monthly expenditure based on the same statistics, a deficit is indicated in Kirinyaga and Tharaka Nithi. As compared with the national average of 9,696 Ksh, low living standard and income disparity must be noted. The number of absolute poor households in the Study Area is reported at 155,019 family in 1997, which accounts for 31 percent of the total farm households. About 88 percent of farm households keep some livestock such as cattle, goats and poultry to supplement farm income. A family composed of 5.66 persons annually consumes about 711 kg of maize, 80 kg of beans, 149 kg of root crops and 115 kg of vegetables. It is said that those rural people do not generally consume export-oriented horticultural crops such as Karella (bitter gourd), French beans and snow peas etc. Cabbage, carrots, Irish potatoes and onion are the major vegetables sold in the local market for local consumption.

Farming activities depend on natural conditions, particularly annual rainfall, which will affect not only planting and harvesting time but also crop productivity and areas being planted. Small farm size averaged at 1.95 ha per family is also the major constraint for farmers. Compared to males, females must generally work harder for fetching water and fuelwoods, childcare, housekeeping and even in farming practices.

4) Marketing from the Viewpoint of Farmers

Marketing of crops has predominantly been done by individual farmers, and marketing channels of vegetable are varied by crops because of Kenyan's meal custom. For example, export-orient crops such as French beans etc. are mainly for exporting, while on the contrary, cabbage etc. are for local markets. Though pricing of farm products should be determined depending on supply and demand, the farmgate prices have currently been noted to be low, even below the cost of production of crops. While, selling prices of those crops to the consumers are quite high, because of transportation costs etc. However, farmers have been forced to sell their produce to traders even at lower prices because individual farmers have no alternative in marketing and no means for transportation to markets. The current marketing system is advantageous for middlemen and exporters.

Contract farming is also commonly practiced in the Study Area, which is managed mainly by exporters for stable procurement of export-oriented horticultural crops throughout the year. In this case, contract agreement noted conditions between exporters and farmer's group is exchanged and signed by both side. On the contract, duties and services done by both side and price of crops are noted. Exporters offer extension services for farmers on crop husbandry involving seasonal farming practices and moderate utilization of fertilizer and agricultural chemicals, grading, handling/packing of crops etc. However, some farmers and DAO staff say that contract farming is risky for farmers because of dishonesty between both side.

5) Extension Services

Extension services are divided into two types, that is, governmental ones and private ones. DAO of each district is responsible for agricultural extension services in implementing visiting farms and providing training on crop and animal husbandry etc. However, the number of extension staff is very small compared to farm households and means such as vehicle and motorcycle for visiting farms are very limited, resulting in inadequate extension services for farmers. Extension services by the private sector are provided as mentioned in the above paragraph.

4.5 Water Utilization for Irrigation Purposes

Under the current law, a right to use water can only be acquired and issued by the Water Apportionment Board (WAB). Irrigation water use also require a permit from WAB.

Priority for irrigation water use is lower than for domestic, public, industrial and river maintenance water use. According to data-base of water permits of MLRRWD, water abstraction for irrigation is permitted only during "Flood flow", which is defined as a river flow exceeding normal flow.

Outline of water right permitted in the related drainage basins is shown Table 4.5-1. The permitted total discharge for general and minor irrigation schemes amounts to about 15.3 cu.m/sec. The quantity is equivalent to 31 percent of the total permitted in "Flood Flow" of 48.430 cu.m/sec.

4.6 Conditions and Accessibility of Rural/Social Infrastructure

4.6.1 Domestic Water Supply

1) Current Service Level and Beneficiary Population

Rural water supply facilities for domestic use can be categorized into four types by management agencies for operation and maintenance.

a) Under government agencies such as MLRRWD, County Councils (CC) and NWC&PC
b) Under Project Committee (PC) for the community-based self-help project.
c) Under institutions such as schools, training centers, hospitals and so on.
d) Individual/private facilities which include tea/coffee estates, factories.

Among these four types of water supply facilities, the government facilities are comparatively large scale and better facilitated as they normally supply only to the major towns. Most of facilities under PC (self-help) and institutions are simple systems without chlorinating facilities. The service level of PC projects is normally supply to individual households and communal faucet at market places. Those PC facilities have not been well constructed and mostly incomplete as a system due to lack of fund. Thus, they need rehabilitation, improvement and expansion to secure the access to domestic water even at a minimal level. The individual facilities are very small scale to supply only 10-40 beneficiaries.

Table 4-5-1 Existing Water Permits inTana and Ewaso Ngiro River Basins

Code of D.A.	Water Permit (nos)	District	Popuration (nos)	Livestock (nos)	Other (nos)	Area Irrigated (ha)	Normal Flow					Flood Flow					Return Flow (m3/sec)
							Domestic (m3/sec)	Public (m3/sec)	Industrial (m3/sec)	Sub-total (m3/sec)	Other(Fish) (m3/sec)	Power (m3/sec)	General Irri. (m3/sec)	Minor Irri. (m3/sec)	Other (m3/sec)	Sub-total (m3/sec)	
(1) Upper Tana River Basin																	
4AA	203	Nye/Kri/Mura	45,149	139,894	5,716	1,745	0.070	0.000	0.003	0.072	0.050	0.531	0.988	0.023	0.007	1.548	0.203
4AB	188	Nye/Kri/Mura	30,715	31,602	14,292	1,396	0.163	0.003	0.112	0.278	0.051	0.521	0.420	0.035	0.000	0.976	0.385
4AC	143	Nye/Emb/Macha	2,668	13,860	3,095	268	0.085	0.033	0.042	0.158	0.111	2.003	0.076	0.014	0.000	2.093	1.448
4AD	109	Nye/Kri	6,107	5,908	4,999	77	0.558	0.000	0.032	0.590	0.004	0.019	0.059	0.008	0.000	0.087	0.001
4BA	57	Nye/Kri/Mura	2,762	226,811	10,135	132	0.028	0.000	0.025	0.053	0.003	0.003	0.039	0.004	0.000	0.047	0.003
4BB	138	Nye/Kri/Mura	10,867	17,778	17,995	263	0.100	0.001	1.037	1.138	0.003	0.150	0.304	0.013	0.000	0.468	0.147
4BC	243	Kir/Em/Mura /Thi/Nye/Macha	43,043	50,002	24,485	784	0.193	0.015	0.047	0.255	0.008	1.346	0.238	2.228	3.056	6.868	1.332
4BG	42	Mbere/Thika	409	145	2,205	39,877	0.003	0.000	0.044	0.047	0.001	0.024	0.503	0.001	0.000	0.528	0.019
4DA	462	Muranga Kir/Emb/Nye Thi/Kitui	64,460	18,531	28,080	1,060	0.197	0.047	0.056	0.300	0.025	7.696	0.609	0.649	0.022	8.977	6.913
4DB	172	Kir/Emb/Mur	28,281	20,618	10,158	1,466	0.108	0.000	0.034	0.142	68.244	1.104	3.864	0.011	0.000	4.979	0.255
4DC	192	Emb/Mbee/Kir	75,706	11,481	8,003	706	0.079	0.072	0.622	0.773	0.036	4.201	0.343	0.014	0.639	5.197	4.589
4DD	68	Kiri/Embu	1,079	1,667	710	75	0.002	0.000	0.000	0.002	0.001	0.001	0.028	0.019	0.000	0.048	0.000
4DE	-	Mbee/Macha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4EA	96	Meru/T-N	21,262	23,342	850	210	0.034	0.104	0.145	0.283	0.414	0.567	0.086	0.008	0.253	0.914	0.786
4EB	302	Thara-N/Meru	112,127	674,271	32,710	948	1.003	0.009	1.829	2.841	16.649	0.927	0.526	0.260	0.005	1.718	10.580
4EC	113	/Embu/Mbeere Embu/T-N/Nye /Mbeere	5,903	3,611	17,360	172	0.044	0.041	0.600	0.685	0.005	7.367	0.554	0.010	0.000	7.931	6.667
4ED	2	Muran/Embu	24	150	500	8	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002	0.000
4FA	-	Meru/T-N/Kitui	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4FB	1	Tharaka-Nithi	6,000	7,700	0	0	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4GA	-	Nyambene/Isiolo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	2,531	-	456,562	1,247,371	181,293	49,188	2.668	0.324	4.630	7.621	85.604	26.459	8.641	3.298	3.983	42.381	33.330
(2) Ewaso N'giro River Basin																	
5BA	31	Nyeri/Nyanda	1,354	1,417	480	34	0.014	0.000	0.000	0.014	0.000	0.009	0.061	0.002	0.000	0.072	0.005
5BB	67	Laikipia Nyeri/Laiki	45,924	45,293	3,515	454	0.098	0.190	0.000	0.288	0.000	0.011	0.074	0.006	0.000	0.090	0.009
5BC	206	Nyeri/Laiki	49,276	85,470	4,370	3,362	0.213	0.000	0.000	0.213	0.051	0.994	0.518	0.018	0.367	1.897	0.897
5BE	339	Laiki/Meru /Nye/Nyanbe	68,642	135,501	6,020	3,431	0.276	0.042	0.017	0.335	11.103	1.252	2.482	0.242	0.015	3.990	1.402
5DA	-	Meru/Isiolo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5ED	1	Meru	500	1,500	0	4	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000
Sub-total	644	-	165,696	269,181	14,385	7,284	0.602	0.232	0.017	0.851	11.154	2.265	3.134	0.268	0.382	6.050	2.313
Total	3,175	-	622,258	1,516,552	195,678	56,473	3.269	0.556	4.647	8.473	96.758	28.724	11.775	3.566	4.365	48.430	35.642

Note) Amount of permitted river water right for general irrigation schemes with an area of more than 7 acers is 11.775 cu.m/sec and for minor irrigation schemes with an area of less than 7 acers is 3.566 cu.m/sec.
The permitted total discharge for irrigation purpose is 15.341 cu.m/sec which is equivalent to 31persent of total permitted water of the flood flow

Source) Data-bank, Data-base Section, MOLDRWD

There are around 45 government facilities, 400 self-help facilities and 30 institutional facilities in seven districts. Self-help facilities are particularly common in Meru and Nyambene districts. Individual/private water supply facilities are not available except in Nyambene district where nearly 100 facilities exist. Therefore, the total number of individual/private facilities will become very large.

Water sources for domestic water are mostly rivers/streams and some dams, springs and groundwater. Spring water is often used for individual/private small facilities at the foot of the mountain areas, and use of groundwater through boreholes or open shallow wells with handpumps can be seen in the lowlands.

Beneficiary population from rural water supply facilities are between 34 percent and 88 percent, highest in Nyeri district at 88 percent followed by Kirinyaga and Meru districts at 61-62 percent, and lowest in Nyambene at 34 percent. Although some data from Embu district are not available, its coverage rate may be high as 60 percent, considering other infrastructure service levels like roads, electricity, public health and education. As an average in seven districts, nearly 60 percent of the population have been served by water supply facilities. Among four types of facilities, over 60 percent of the total population are served by the government facilities and 36 percent are under self-help projects. On the other hand, remaining 43 percent of population not covered by these facilities are considered in severe living conditions, taking water from rivers/streams or springs directly and with long carrying distances (refer to Annex M).

Due to the lack of funds by the GOK for the implementation of rural water supply projects, recent projects are mostly community based self-help project for which the government through the district water offices of MLRRWD provides technical support on examination of water sources, planning, design, implementation and operation stage. However, funds for construction, both materials and labor, are to be obtained by the community PC themselves, in most cases. MLRRWD will also assist in such seeking for funds by PC, and provide skilled labor during construction, even some materials in some cases when government funds are available. Sources of funds obtained in recent projects are foreign government aid, and UNICEF, IFAD, Catholic Missions and other NGOs to which rural communities do not have much access. Many PC projects for which water permits have been issued and designed, were completed by district water offices but have not been implemented for years due to the failure of fund procurement.

2) Operation and Maintenance Body

a) Government Project

The operation and maintenance (O&M) of the government operated facilities are carried out by relevant government agencies such as MLRRWD, CC or NWC&PC. MLRRWD is the main agency to provide O&M services to most water supply facilities in both rural and urban areas including some municipal urban water supply systems such as that in Meru town. County Councils (CC) undertake O&M of their urban/rural water supply systems like in Nyeri district.

b) Community-Based Project

The community based projects are operated and maintained by PCs which are formed by beneficiary members. Technical assistance on the maintenance and repair of the facilities is provided by

the district water office whenever required. However, many community based projects are not sustainable at present since the O&M fees have not been collected from the members at most projects. The district water office has advised PC to introduce the monthly fee for O&M use. At some community based projects in Embu district, the introduction of such fees is under process at a rate of 15 Ksh per month. The implementation process of the community based water supply project and the organization of PC are presented in Annex I and M.

3) Problems and Constraints

Problems and constraints of the rural water supply in the Area are summarized below:

Inadequate Low Level Facilities in the Rural Areas

This is due to lack of funds at the initial construction time and also due to lack of coordination among community members at the O&M stage. Initial construction funds are normally available only for the facilities at minimal service level. Adequate maintenance and timely repair are important to keep the facilities in best operational condition.

Lack of Access to Fund Sources in Community-based Self-help Projects

As mentioned above, most recent projects are community-based self-help projects under government direction for which the rural communities are facing difficulties in funds procurement for construction. Since government supports are generally only in the technical matter, communities have to look for donors to implement the project unless funds for construction are collected from the PC members.

Low Beneficiary Population Rate

Present beneficiary population from rural water supply facilities only amount to 57 percent of the total population of seven districts. This is mainly due to the shortage of a number of facilities in the rural areas and insufficient operation of the existing facilities.

4.6.2 Road Communication

1) Road Category

The access roads in the Study Area can be classified into three categories:

a) Ministry of Public Works classified roads
b) Unclassified village access roads

a) Ministry of Public Works Classified Roads

These are national roads classified by the Ministry of Public Works & Housing (MPWH) in various classes according to the level of services they offer. They range from Class A to E and Special Purpose Roads (SPR).

- Class A : International Trunk Roads
- Class B : National Trunk Roads
- Class C : Primary Roads
- Class D : Secondary Roads
- Class E : Minor Roads
- SPR : (Special Purpose Road) include Rural Access Road (RAR), Tea Roads (T), Government Access Roads (G), Sugar Roads (S), Wheat Roads (W) and Settlement Roads (L)

Class A to C roads form a trunk network in the Study Area mostly with asphalt surface, and class D, E and RAR roads form a rural network within the district with gravel or earth surface which is considered as a farm-to-market road. The only categories of classified roads encountered in the Project are class D, E and RAR.

b) Unclassified Village Access Roads

The unclassified roads are categorized into five parts depending on the responsible agency for maintenance of roads.

- National parks: Under Kenya Wildlife Service (KWS)
- Game reserves: Under local authorities but contracted to KWS
- Urban roads : Under local authorities (City & Municipal council)
- Rural roads : Under County Council
- Forest roads : Under Forest Department

The roads to be encountered in the Project are the rural roads maintained by each District County Council. These roads have developed from the foot tracks and still narrow with earth surface. They are not yet classified but heavily used by the inhabitants.

2) Existing Road Network and Conditions

In Kenya, the whole road network is estimated at 149,400 km consisting of 63,700 km of classified roads and 85,700 km of unclassified roads. In the Study Area, the classified road network amounts to 6,664 km, 13 percent of bitumen, 38 percent of gravel and 49 percent of earth surface. The length of unclassified roads is not available. The road network in the Study Area is presented in Annex M.

Among seven districts, Nyeri district has the biggest road network followed by Meru and Kirinyaga districts whose roads were well developed through RARP/MRP programs. Mbeere, Tharaka Nithi and Nyambene districts are poorly served with road networks. In Nyeri district, over 90 percent of roads are assessed as in good/fair conditions with bitumen/gravel surfaces on 68 percent of total roads, while in Nyambene district 75 percent of roads are in poor condition with earth surface on 73 percent of total roads. 70 percent of roads in the Study Area belong to class E and RAR (refer to Annex M).

Average daily traffic on the classified roads is 30-150 vpd for class D roads, less than 50 vpd for class E roads and 0-30 vpd for RAR according to the MPWH district works office.

Due to the mountainous and hilly topography, the roads traverse steep sections and therefore it is

difficult to maintain them. During the rainy seasons, surface gravel are easily washed away and deep gullies due to run-off water normally cut across roads. Especially in Nyambene, Meru and Tharaka Nithi districts, bedrock is easily exposed after road gravels are washed away and the roads become impassable. The earth roads in the lower part of the Study Area become muddy and impassable during heavy rains, and it becomes difficult to transport agricultural products to the market in time. Many road structures such as bridges and culverts on the roads are also in bad condition.

As for the access roads to the irrigation schemes in seven districts under the Project, 31 percent of schemes have fair access, 44 percent need improvement/rehabilitation, and 25 percent require the reconstruction works, according to the District Profile Up-date Survey conducted by the JICA Study Team (refer to Annex M).

3) On-going and Existing Road Development Program

a) Rural Access Roads Program (RARP)

The Rural Access Roads Program was the first labor-based program implemented in Kenya on the road projects. It was started in 1974 with assistance from the donor countries under the umbrella of ILO/ASIST by which the labor-based method (LBM) was introduced. The objective of the program was to construct a very extensive all-weather farm-to-market rural access roads using labor-intensive construction methods utilizing simple hand tools, agriculture tractors and heavy duty trailers for hauling gravel. By 1986 when RARP came to a substantial close, it had constructed 8,000 km of rural access roads in 26 districts of high agricultural potential areas in the country. However, since the RARP concentrated on the roads within rural community, other classified roads like secondary (D), minor (E) and special purpose roads remained in very poor condition due to lack of adequate maintenance.

b) Minor Roads Program (MRP)

As a result of RARP, the Minor Roads Program was started in 1987 with support from donor countries as well. The MRP planned to improve and maintain 4,500 km of roads in 26 districts of high agricultural potential in the country, addressing not only the rural access roads but also other classified roads (classes D and E) so as to provide all-weather access from the primary roads (class C) to agricultural farms. The LBM had continuously been improved through the MRP.

In the Study Area, SIDA has been supporting Nyeri and Kirinyaga districts since 1993/1994. The Agreement expired in June, 1997.

c) Road Maintenance Initiative (RMI)

The RMI was initiated by the World Bank and other donors as a component of the Sub-Saharan Africa Transport Program (SSATP) developed in 1989. The main objective of the SSATP was to improve transport efficiency through major policy reform, and the RMI was an instrument to define and resolve any road maintenance policy issues by African countries themselves. In Kenya, the RMI policy seminar was held in 1992 , and its long term objective was to secure sustainable improvement in the performance of the road sector. Main outcomes of the seminar were the introduction of road maintenance fuel levy and

implementation of Roads 2000.

d) Roads 2000

The concept of Roads 2000 is to provide viable and sustainable road maintenance procedures on the paved and unpaved classified road network. The Roads 2000 is a countrywide strategy and aims to improve maintenance on a network based system, as shifted from project based system experienced in RARP/MRP. Major works are routine maintenance, spot improvement and selective rehabilitation with LBM wherever appropriate and feasible. Machine based technology would also be utilized where appropriate and cost effective. Generally, LBM is utilized for roads carrying less than 50 vpd. Partial rehabilitation techniques will be used to rapidly bring presently unmaintainable roads up to a maintainable condition. Routine maintenance is established using a combination of lengthman system and gang system. Small scale contracting is also developed to take over the routine maintenance works.

In the Study Area, the Roads 2000 has been planned to be carried out under the assistance of SIDA for Nyeri and Kirinyaga districts (Central province) and EC for Embu, Mbeere, Tharaka Nithi, Meru and Nyambene districts (Eastern province). The Agreement for support in Nyeri for three years was signed in July,1997. Actual work is now on-going after procurement of equipment was made. SIDA support in Kirinyaga was commenced in 1998 and procurement of equipment is on-going. The Agreement for EC support in the five districts of the Project area was signed in January, 1997, and actual work was commenced in March, 1998. However, present roads condition was so poor that strategy of EC Roads 2000 was changed from the initial Roads 2000 strategy under which the roads was to improve on a network basis. New strategy for EC Roads 2000 is to improve on a road section basis selecting one or two priority roads for each district. Presently investigation and survey works have been conducted after priority roads were selected.

SIDA assistance projects are planned to implement MPWH force account works, on the other hand, in EC Roads 2000 Project consultants were hired for project management and improvement works are to carried out mainly by contractors and partly by force account.

The details of improvement target of EC Roads 2000 for five districts are as Follows;

-	Embu District	:14.8 km	(E638& E635 roads)
-	Mbeere District	:15.0 km	(D467 road)
-	Tharaka Nithi District	:13.6 km	(D472 roads)
-	Meru District	:15.0 km	(D482 road)
-	Nyambene District	:24.0 km	(D482 road)

4) Operation and Maintenance

a) General

O&M works of roads consist of two categories, i.e. routine maintenance and periodic maintenance. Major activities of routine maintenance are bush clearance, spot patching, cleaning of ditches, cleaning of culverts and miter drains, while periodic maintenance includes regravelling for unpaved roads, resealing for paved roads, repair and replacement of road structures.

Currently, 70 percent of periodic maintenance works of the classified roads are being executed by contractors and 30 percent are by force account. On the other hand, 20 percent of routine maintenance works on the classified unpaved roads are carried out by single contractors known as lengthman system, and the rest are by force account units. However, the Ministry's strategy is to increase contracting on periodic maintenance works and the use of small contractors under lengthman system for routine maintenance. Both are on the LBM basis wherever applicable.

b) Road Maintenance Levy Fund

The Road Maintenance Levy Fund Act was enacted in November 1993, in order to raise the revenue required for funding the road maintenance of the road network. Then fuel levy was introduced in 1994 at the rates of 1.00 Ksh per liter of diesel and 1.50 Ksh per liter of petrol, and it became operational in the fiscal year of 1995/96. The Fuel Levy Fund is a much more sustainable source of funding the road maintenance than the road transit tolls which was introduced in 1984 under the Public Roads Toll Act. The proceeds of the fund are to be fully applied to road maintenance.

The rates of the fuel levy were increased year by year, and in 1996 it went up to 2.20 Ksh per liter of diesel and 2.70 Ksh per liter of petrol. The Road Maintenance Levy Fund for 1996/97 which consists of the fuel levy and the transit tolls amounted to 3,380 million Ksh, and it 79 percent was allocated for the contract maintenance of paved/unpaved roads, 17 percent for the force account maintenance of paved/unpaved roads, and 4 percent for the management operations.

c) Operation and Maintenance Body

The Roads Department of MPWH is responsible for the planning, construction and maintenance of the classified road network including all the bridges and drainage structures on the classified roads. Funds for O&M of the classified roads are Recurrent Fund and Road Maintenance Levy Fund, but as these funds from GOK are very short the O&M activities are depending on donors assistance which is put in the development fund for specific development projects such as RARP, MRP and Roads 2000.

Under the Roads Department of MPWH, there are two Branches in charge of road maintenance, namely the Paved Roads Branch and the Unpaved Roads Branch. The maintenance of the paved roads is organized and administrated through the Provincial Office, while that of the unpaved roads is carried out mainly at the district office through District Road Engineers (DREs) for equipment based maintenance and through District Maintenance and Improvement Engineer (DMIEs) for labor based maintenance (refer to Annex I).

The District County Councils are responsible for the unclassified access roads. The source of funding for O&M of their roads is only county cess which is too little to carry out adequate road maintenance. Thus, O&M of these unclassified roads have been neglected for a long time with the result that most of the roads are impassable for vehicles.

5) Problems and Constraints

Impassable Roads in the Rainy Seasons

This is basically due to the natural topographical and climatic conditions of the Study Area and due to lack of the maintenance activities. As mentioned above, the roads in the mountainous, hilly and undulating terrain are difficult to maintain due to much run-off water on the steep gradient roads during the rainy seasons. Therefore, maintenance cost of such roads becomes high. Adequate and continuous routine maintenance will be the most essential to keep the roads passable even in the rainy seasons. This is also connecting to the availability of fund for O&M of roads. Currently, the fuel levy fund is a main source for the maintenance activities unless foreign donors assistance is present. Technically, gravel surface roads are at least required to be all-weather road.

4.6.3 Rural Electrification

1) Present Conditions

Supply of electricity in the Study Area has been carried out through the Rural Electrification Program, however the national electricity grid is limited to major urban centers and some rural market centers only. Among seven districts, supply level of electricity is high in Nyeri, Kirinyaga and Embu districts, and low in Mbeere, Tharaka Nithi and Nyambene districts. Particularly many divisional centers of Mbeere and Nyambene districts have not been supplied with electricity.

Electricity is mainly used for commercial purposes in the urban and market areas, public institutions like hospitals, schools, hotels and administrative and trading centers, and industrial activities such as tea, coffee and cotton factories. However, most health centers, schools and industrial factories in the rural areas have not received electricity supply. Breakdowns in power supply happen frequently due mainly to over-utilization.

On the other hand, many individual households have not received electric power services. Therefore, in both urban and rural areas, woodfuel and charcoal are the most common source for cooking and paraffin is widely used for lighting. A number of hotels and institutions in the rural market centers also rely on charcoal for cooking and heating. Woodfuel resources are over-utilized in the rural areas as it is the only source of energy for domestic use, particularly in Kirinyaga and Mbeere districts where natural forest areas are scarce. In Tharaka Nithi district, agro-forestry is practiced by communities to generate available fuelwood production.

Hydro-electric power generation is another source of energy currently being undertaken by the Catholic Diocese of Meru (NGOs) on a small scale in Meru district. The generation of small hydro-electric power has great potential in the areas where many swift flowing rivers and water falls are available such as in Meru and Tharaka Nithi districts. Tharaka Nithi district has a plan to look into the possibilities of setting up small hydro-electric power stations to supply electricity for industrial development.

2) Problems and Constraints

Problems and constraints of the existing rural electrification are summarized below:

Limited Power Supply

The electricity grid network is very limited, to major markets and towns. This lock of electricity supply in the rural areas, especially to the rural market centers and highly productive agricultural areas have constrained development of the rural economic activities and discouraged establishment of new small-scale industries. The expansion of the electricity grid network will enhance the integration of the agricultural sector with emerging industrial sector. It will also promote informal sector activities in the rural areas which would increase employment opportunities and stem rural-urban migration.

Unreliable Electric Power Supply

Under the limited power supply, frequent breakdowns have occurred due to over-utilization. Such unreliable electric power supply greatly affects the efficiency of existing commercial and industrial activities which rely on power supply, especially the small-scale industries and metal fabrication industries whose owners can not afford stand-by generators.

4.6.4 Public Health

1) Present Conditions

The health services in the Study Area are provided by the government, the missions (NGOs) and by private medical practitioners. Principal health facilities to render the medical services are hospitals, health centers and dispensaries. Hospitals are located in the major district centers, health centers are in the rural market centers, and dispensaries are in the rural areas. In the seven districts, there are 25 hospitals, 45 health centers and 229 dispensaries (refer to Annex M).

The government hospitals are generally well equipped and staffed with specialized doctors and nurses. The dispensaries normally have two to three nurses while the health centers have clinical officers. However most health facilities lack equipment necessary for their efficient operations. There is therefore need to strengthen the staffing and medical equipment in the hospitals.

The conditions of distribution of health facilities differ among districts, i.e. fairly distributed in Nyeri, Kirinyaga and Tharaka Nithi districts and poor in Mbeere, Meru and Nyambene districts. The doctor/population ratio is high in Nyeri district (1:14,000) and low in Mbeere (1:87,000) and Nyambene (1:65,757) districts.

The government hospitals and health centers are generally over-utilized because they have better facilities and staff. The introduction of user charges (cost sharing) in government hospitals did not affect the attendance as GOK user charges are lower than the medical fees of NGOs/mission hospitals. It can be also partly explained that the local community has become more enlightened on economic realities. However, very few can afford even these minimal charges due to the general poverty in the rural area.

Nevertheless, the services at the dispensaries have remained free.

The private health facilities are generally under-utilized due to high charges. Attendance in private hospitals declines when drugs are available at government health facilities and increase when certain health services can not be obtained from the government health facilities.

2) Problems and Constraints

Problems and constraints of the existing health facilities and services are summarized below:

Inadequate and Lack of Health Services and Facilities

Health services and medical facilities in the Area are inadequate in terms of the quality of facilities, number of personnel and availability of drugs and other medical kits, particularly in Mbeere and Nyambene districts. Mobile clinics and other outreach services are non-existent in most parts of the Area. This partly attributed to the poor road network and partly to shortage of staff and equipment. As a result, morbidity rates become high in the Area. Adequate health services and medical facilities are necessary social infrastructure to encourage private sectors, rural communities and skilled workers to contribute to the development activities in the rural areas.

Shortage of Health Facilities in Rural Areas

Even in Nyeri district which is the best facilitated area among seven districts, average walking distance to the nearest health facility, normally to the dispensary in the rural areas, is five kilometers. In Keni East and Keni West divisions of Nyeri district, its distance becomes around 12 km. Some divisions of Mbeere district have no health facilities at all, and since 1993 there has not been any additional health facilities constructed in the district.

4.6.5 Education

1) Present Conditions

Formal education system in the Study Area is primary school education for eight years and secondary school education for four years. Those schools are mostly run by either provincial or district governments. There are also pre-primary schools for one year period which are normally attached to the primary school or sponsored either by church organizations, NGOs or private owners.

Other than the formal education system, there are many types of educational training facilities (institutions). They are technical training institutes, youth polytechnics, farmers training centers, teachers training college, family life training centers, and so on. Most of these institutions offer technical skills necessary for industrialization of the districts.

The number of schools and other educational institutions with their enrollment and teacher/pupil ratio in seven districts of the Study Area are presented in Annex M. Present situation of the formal education are almost the same among seven districts.

The teacher/pupil ratios in seven districts are about 1:30 for the primary schools and 1:15 for the secondary schools while the national average is 1:40 and 1:35 respectively. This means that the existing school facilities are under-utilized, especially most of the secondary schools operate far below capacity with over-staffing. Beside this however, some schools are under-staffed particularly the primary schools located in the remote areas. It is also pointed out that the rate of drop out of schools is high for both boys and girls. Major causes of high drop out rate can be described below:

- Boys are involved in on-farm employment, tea picking and taking care of livestock.
- Frequent drought and migration to higher potential zone contribute to primary drop out.
- High cost of education leads to drop out in secondary level.
- Girls drop out of schools due to early marriages, pregnancies and lack of school fees.

Important training institutions are youth polytechnics and technical training institutes. They are normally two years. Youth polytechnics play an important role in absorbing students from both primary and secondary schools who are unable to continue with formal education. Technical training institutes function as post secondary school training institutions, and students take different courses which include Artisan/Masonry, Carpentry and Joinery, Craft, Plumbing and Welding, Business Administration, Garment Making and Catering.

Although the demand of technical education in these institutions is high, the level of utilization is generally low due mainly to lack of basic facilities and equipment. Exceptionally in Kirinyaga district, technical institutions are over-utilized because of high demand of technical skills. In Mbeere district, the number of existing youth polytechnics is not sufficient to meet the demand of technical education. In most districts, there is strong need to expand and equip all these training facilities to accommodate increasing population and demand for skilled manpower for industrialization process in the districts.

2) Problems and Constraints

Problems and constraints of the existing education facilities are summarized below:

Lack of Adequate and Well Equipped Education and Training Facilities

Most schools of both primary and secondary levels do not have vital physical facilities such as science laboratories, workshops, libraries and sometimes even adequate classrooms. As a result therefore, this becomes one of the causes of low utilization of schools particularly at the secondary level. Most of the youth polytechnics also lack workshops, tools, equipment, electricity supply and instructors, and thus unable to provide high quality technical training. Many graduates of such schools and youth polytechnics therefore fall short of the necessary skills required to start small industrial concerns.

Low Utilization of Schools and High Dropout Rate

As indicated in the low teacher/pupil ratios of the primary and secondary schools, school facilities are under-utilized at all seven districts. This under-utilization of the available facilities renders the human resources of the district unskilled and therefore unable to undertake industrial development. Several factors can be considered to such low utilization as shown below:

- Low enrollment of the projected school age population
- High cost of education fee especially for secondary school
- High rate of drop out of schools
- Inadequate physical facilities
- Lack of enthusiasm by parents in sending their children to school
- General poverty

Among the causes above, the high drop out rate leads to many students having no development career skills which can be utilized in the industrialization process. Pupils/students who drop out of schools are to be encouraged to enroll in the youth polytechnics to acquire technical skills.

4.7 Rural Environment

4.7.1 General Environmental Conditions and Responsible Government Body

There is a considerable risk of soil erosion by farming in the steep foothills of Mt. Kenya. Therefore, soil and water conservation of catchment areas is one of the important activities related with environment and it is promoted through cooperation of MOALD and MENR. The work plan of Soil and Water Conservation Branch (SWCB) of MOALD in 1997/98 and development budget of the Forest Department (FD) of MENR are shown as below;

Work Plan of Catchment Area for Soil and Water Conservation (1997/98)

District	Catchment		No. of Farmers	No. of Divisional Personnel		No. of Vehicle	No. of MC
	No.	Area (ha)		Div. Soil Conser-vation Officers	Technical Assistant		
Nyeri	14	4,044	3,337	7	14	1	7
Kirinyaga	8	4,440	2,425	4	7	1	3
Embu	10	2,620	3,000	5	10	2	3
Mbeere	8	4,960	1,680	4	8	1	4
Tharaka Nithi	20	7,295	4,110	9	18	1	7
Meru	16	6,830	2,570	8	15	1	10
Nyambene	15	2,965	2,720	8	14	1	8
Total	91	33,154	19,842	45	86	8	42
Other Districts	706	218,155	117,246	306	617	76	358
Grand Total	797	251,309	137,088	351	703	84	400

Source; Workplan 1997/98, Soil & Water Conservation Branch, MOALD

Forestry Development Budget of MENR, 1995/96 - 1997/98

(unit: K £=20Ksh)

District	Forestry and Plantation Development				Rural Afforestation Extension Schemes				Total
	1994/95	1995/96	1996/97	1997/98	1994/95	1995/96	1996/97	1997/98	
Nyeri	129,983	193,351	212,689	233,955	12,643	23,647	26,010	28,614	860,892
Kirinyaga	33,833	50,317	55,361	60,896	8,285	15,576	17,068	18,983	260,319
Embu/Mbeere	24,046	35,767	39,355	43,011	10,951	21,327	23,350	25,762	223,569
Tharaka Nithi	31,564	46,954	51,648	56,813	14,335	72,133	74,942	85,561	433,950
Meru	80,381	125,958	138,543	152,299	11,374	21,305	23,436	25,051	578,347
Nyambene	27,576	41,021	45,121	49,635	14,650	74,225	76,929	87,669	416,826
Total	303,337	457,601	503,362	553,598	61,287	206,886	218,385	245,878	2,773,903

Source; Program Review and Forward Budget 1995/96 - 1997/98, Ministry of Finance, 1996

Principally, soil and water conservation plan is based on the participation of farmers in consideration of socio-economic issues. For that purpose, farmers committee formation is promoted through PRA, meetings and leadership training. Planting of Napier grass and trees (mainly *Grevillea rubusta*) around the farm, and along the slope and roads is promoted. The training and workshop for soil and water conservation was carried out for 26,115 inhabitants (14,030 women and 12,085 men) in the Study Area in 1995/96. It is planned for about 5,000 women and 14,000 men in 1997/98 (see Table T.1-1 and 2, Annex T).

KWS works for the objectives of the reduction of crop and property damage costs to local communities through the erection of an electric fence in areas where damage is substantial and controlling problematic animals in areas not covered by the fence. For example, some elephants were moved from Mwea National Park to another area. The compensation of 30,000 Ksh is paid for the killed people by wildlife, though the amount is very low and it takes more than five years for the procedure.

Some NGOs work in the Study Area mainly for the promotion of afforestation; Plan International in Embu and Meru, CPK Diocess in Embu and Kirinyaga, Farm Africa in Meru, and Mt. Kenya Eco-cultural Forum in Meru. Figure 4.7-1 indicated MENR's organization structure.

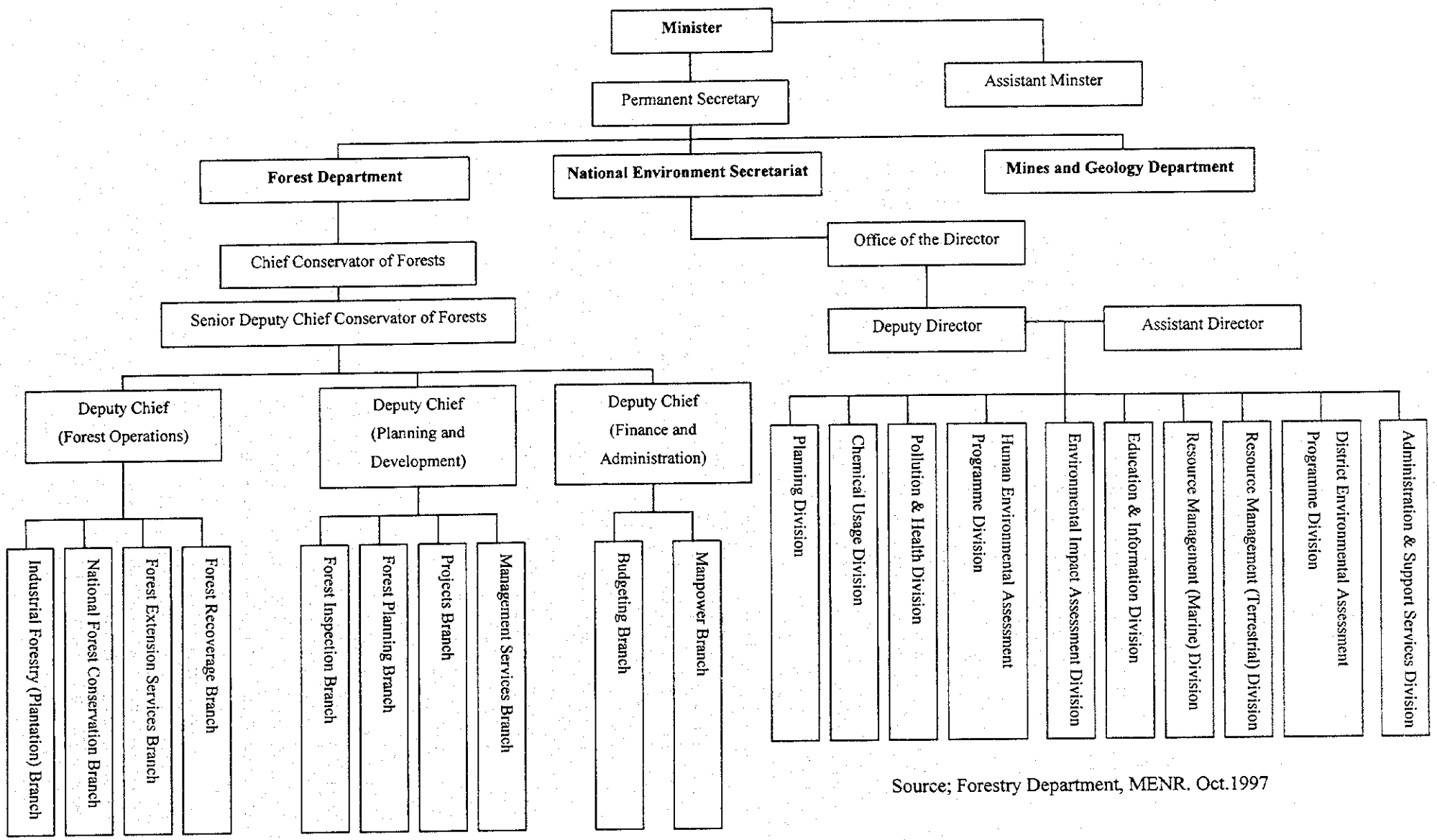
4.7.2 Flora and Fauna

1) Forest

Statistics shows that the total forest area in Kenya is 1,684,064 ha in 1996 and almost no change since 1984. However, actually 42,098 ha of forest including important virgin forest was excluded from the Government forest from 1986 to 1993 and 26,525 ha of bushland in dry zone was incorporated into the Government forest. It means the deterioration of Government forest. The afforestation is not enough and the forest area is decreasing average 5,000 ha per year.

There are Aberdare Forest, Meru Forest, Mt. Kenya Forest, Nyambene Forest and Nyeri Forest in the Study Area. Especially, Aberdare Forest and Mt. Kenya Forest are important for the prevention of soil erosion and protection of catchment area and water source. All of forest in the Study Area are listed in the top ten of the high priority forest groups ranked by biodiversity, environmental and local use values and threat, and several species are listed in the endemic trees and shrubs (see Table T.1-3 and 4, Annex T).

Figure 4.7-1 Organizational Chart of The Ministry of Environment and Natural Resources



Source; Forestry Department, MENR. Oct.1997

The Mt. Kenya forests (210,000 ha) and the Aberdares/Kikuyu Escarpment (150,000 ha) cover large areas with a wide range of forest types, of which the *Octea* forest formation is being over-exploited for camphor, and *Newtonia* forest formation along rivers are being rapidly cleared. In the northeast of Mt. Kenya, including the adjoining Imenti/Meru forest, *Diospyros abyssinica-Olea europaea* and *Croton sylvaticus* formations occur, and at higher elevations *Crabia-Cola* forest occurs. Four threatened birds are found in these forest areas, with several additional threatened bird species in the Imenti/Meru forests. On Mt. Kenya there are six threatened large mammals, supplemented in the Aberdares by Jackson's mongoose and possibly the golden cat, the former being an endemic species.

The most common tree in these forests is *Neoboutonia macrocalyx*, a secondary colonising species of no present commercial value. In the large mountain blocks bamboo is found over a wide area. In the Mt. Kenya forest, where accessibility is a major constraint, logging has been restricted to the more accessible places, leaving a high proportion of commercial species in undisturbed areas.

2) National Parks and National Reserves

In the Study Area, there are three National Parks and one National Reserve, which covers the total area of 2,419 sq.km.

National Parks and National Reserves

District	National Park/National Reserve	Area
		(sq.km)
Study Area		
Nyeri	Aberdare National Park	766
Mbeere	Mwea National Reserve	68
Meru	Meru National Park	870
Nyeri, Kirinyaga, Embu, Tharaka Nithi, Meru	Mt. Kenya National Park	715
Neighboring to the Study Area		
Isiolo	Buffalo Springs National Reserve	131
	Shaba National Reserve	239

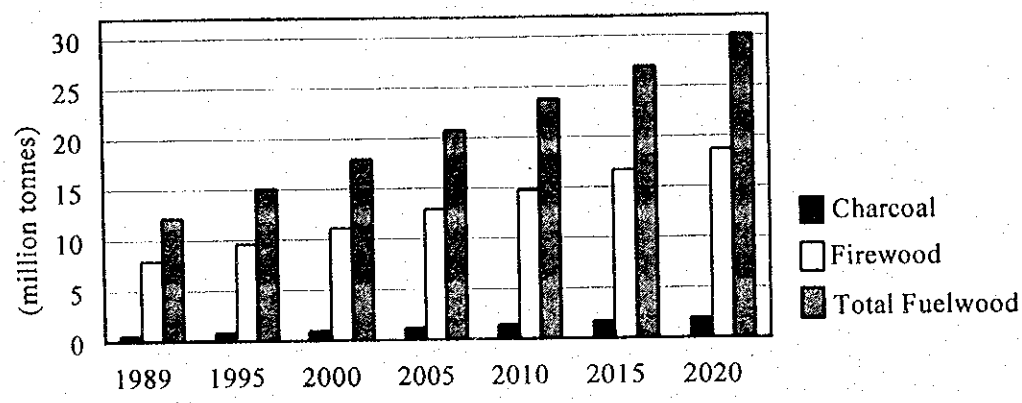
Source; Wildlife Protection Report, 1990

Various kind of wildlife are inhabit in these National Parks, National Reserves and in the forest in the Study Area. Some of them are listed in the endangered wildlife in Kenya such as elephant, black rhinoceros, cheetah, etc.

4.7.3 Fuelwood

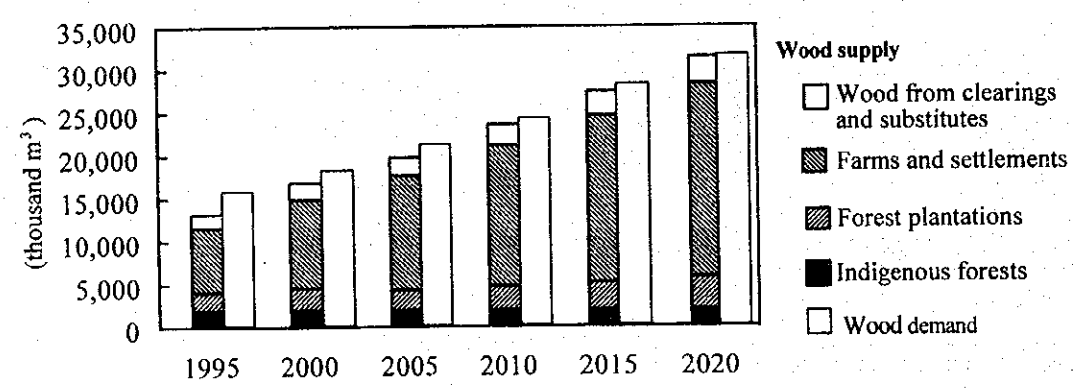
About 71 percent of the energy consumed annually in Kenya comes from wood, mainly as firewood for cooking and heating in the rural areas, and as charcoal in the urban areas. 100 percent of interviewed farmers in the Study Area use firewood for cooking, which is mainly produced in their farmland where the forest is not nearby. People are aware of decreasing forest resources and the importance of agroforestry. According to the Forestry Master Plan, fuelwood demand will increase with an average of 4.7 percent per year from 1989 to 2020 and the wood will be supplied mainly from farms as shown below. It means that the promotion of agroforestry is one of the important element in the Forestry Master Plan.

Projected Demand for Charcoal, Firewood and Fuelwood



Note; Fuelwood demand consists of demand for wood used in charcoal production and demand for firewood.
Source; Kenya Forestry Master Plan, MENR, 1994

Projected Wood Supply and Demand in the High-Potential and Medium- Potential Districts under the Master Plan Scenario

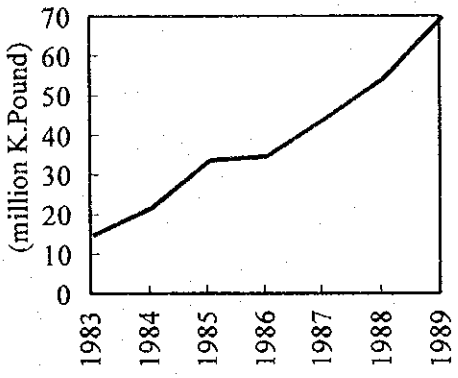


Source; Kenya Forestry Master Plan, MENR, 1994

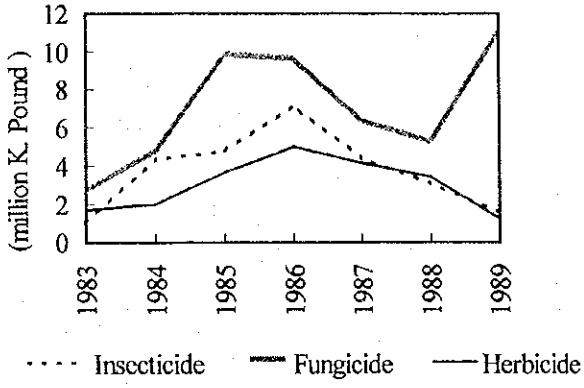
4.7.4 Agro-Chemicals

The greatest source of water contamination in Kenya is from agro-industrial activities that cause water pollution through fertilizers and pesticides, and silt resulting from soil erosion.

Use of Chemical Fertilizer



Use of Pesticide



Source; Survey for the Improvement of Environmental Information, 1993, JICA

EIA of SIS in 1992 shows that some herbicides are used much over than recommended level at Island Farms in Nyeri; Sencor of 12 times and Gramoxone of six times for cabbage. Gramoxone is the commercial name of Paraquat and it is not permitted for agricultural use in the EU (MRL is shown in Table T.1-7, Annex T).

4.7.5 Damage by Wildlife

Damage to crops caused by wildlife, specially elephant is a serious problem for the farmers neighboring forest. During the marauding season, farmers watch their farmland all night. In some areas where the damage is most serious, electric fence is constructed by KWS. Damage by wildlife in Nyeri is shown below;

Value of Damage by Wildlife Adjacent to the Aberdares Forest Reserve in 1992

(unit: Ksh)

Damage		Net Income Loss and Replacement Cost/Lost Inputs	
		Mean per Household	Total Area *
Livestock		190,855	6,645,648
Crops:	Maize	7,378	438,875
	Potatoes	23,541	365,298
	Wheat	55,954	1,157,564
	Pyrethrum	14,062	36,368
	Beans	21,533	389,813
Posts, Wire and Fencing		17,145	950,777
Total			9,984,343

* ; Total Area covers 4,250 ha within 1.5 km of the forest boundary including 192 households.

Source ; A Survey to Assess the Damage Caused by Wild Animals to Farm Households Adjacent to the Aberdares Forest Reserve, KIFCON, 1992

Average Crop Loss by Wildlife Adjacent to the South Western Side of Mt. Kenya Forest Reserve

Division	Sub-Location	Average Crop Loss (%)	Range (%)
Kieni-East	Kamburaini	67.5	35 - 100
	Warzo-Jet	50	45 - 55
	Kimahuri (Island Farm)	73.6	57.1 - 88.75
	Ndathi	55.4	6.6 - 95
	Ngode	75	N.A.
Mathira	Sagana	82.9	55 - 96.6
	Ruturu	67.5	0 - 93.6
	Gatei	70.1	0 - 100

Source; Damage Caused by Forest Animals to Farms Adjacent to the South Western Side of Mount Kenya Forest Reserve, KIFCON, 1993

4.7.6 Rural Health Environment

There are six hospitals in Nyeri, two in Kirinyaga, five in Embu, one in Mbeere, three in Thraka Nithi, five in Meru and three in Nyambene. There are no health facilities in some divisions, two divisions in Meru and five divisions in Nyambene (see Table T.1-8, Annex T).

Drinking water for farmers in the Study Area is river, spring, well and rain water. In some areas, piped water is connected in the house though it is not always treated and is taken directly from the river. Some of the rivers and springs including protected springs are contaminated by coliform as shown below. Chemical analysis of some drinking water, source in Nyeri and Meru is shown in Annex T. The results are within the standard except Koonyo Spring in Meru which has too much sodium.

Summary of the Bacteriological Examination of Water in the Study Area

Water Source	Coliform Contamination	
	+	−
Treated water	3 sites	
Rivers, streams and furrows	13 sites	
Protected springs	15 sites	2 sites
Unprotected springs	8 sites	3 sites
Borehole		1 site

Re; Details are shown in Tables T.1-9-14, Annex T.

The main water-related diseases reported in the foothills of Mt. Kenya are malaria, amoebiasis, intestinal worms, etc. In 1996, the top of diseases in Nyeri was upper respiratory tract infection and the second was malaria with 4,621 cases. Amoebiasis was the top with 4,609 cases in Meru. AIDS is increasing in the whole country and HIV positive population is 428,000 in rural area and 842,000 in urban area in 1996, which is 4.5 percent of the population (see Figure T.1-3, Table T.1-15 and 16, Annex T).

4.8 Current Activities of Non-Government Organizations in the Area

4.8.1 Non-Government Organizations and Their Activities

In the Study Area, many Non-Government Organizations (NGOs), which are registered with the NGOs Coordination Bureau, are currently assisting with activities in the rural areas in various fields such as irrigation, water supply, agricultural farming, health care, women groups, family planning, education, three nurseries, loans, etc. And, these NGOs are members of the District Development Committee. The list of working NGOs in the Study Area and their activity sectors are given in Table 4.8-1.

One of the major NGOs for assisting smallholder irrigation and drainage project is the Smallholder Irrigation Scheme Development Organization (SISDO) in the Study Area.

Apart from SISDO, there are other NGOs that have been involved in promotion of smallholder irrigation development within the Study Area. Such NGOs include Plan International, the Catholic Church (Dioceses of Meru and Embu) as well as the Anglican Church. The support given by these NGOs have mainly been in form of a grant for construction of irrigation infrastructure and limited credit facilities for purchase of in-puts (e.g. Nguru-Gakirue Irrigation Scheme promoted by the Catholic Diocese of Meru).

4.8.2 Smallholder Irrigation Scheme Development Organization (SISDO)

1) Establishment of SISDO

In 1989, the Ministry of Agriculture and Livestock Development (MOALD) carried out a review on the irrigation development project so far implemented by the Government. It was evident that donor funds were becoming more and more limited. It was also noted that the projects implemented earlier without full participation were not sustainable and were a continuous drain on government funds. The MOALD formulated a strategy to create an organization that would create revolving funds for irrigation development while at the same time ensuring full farmer participation in planning, implementation and operation of irrigation projects. Thus, the idea of forming a Smallholder Irrigation Scheme Development Organization (SISDO) was hatched.

SISDO was formulated in 1991 with the assistance of the MOALD and the approval of the Ministry of Finance and Economic Development, and began its major operations in 1992.

Figure 4.8-1 shows the SISDO organization chart.

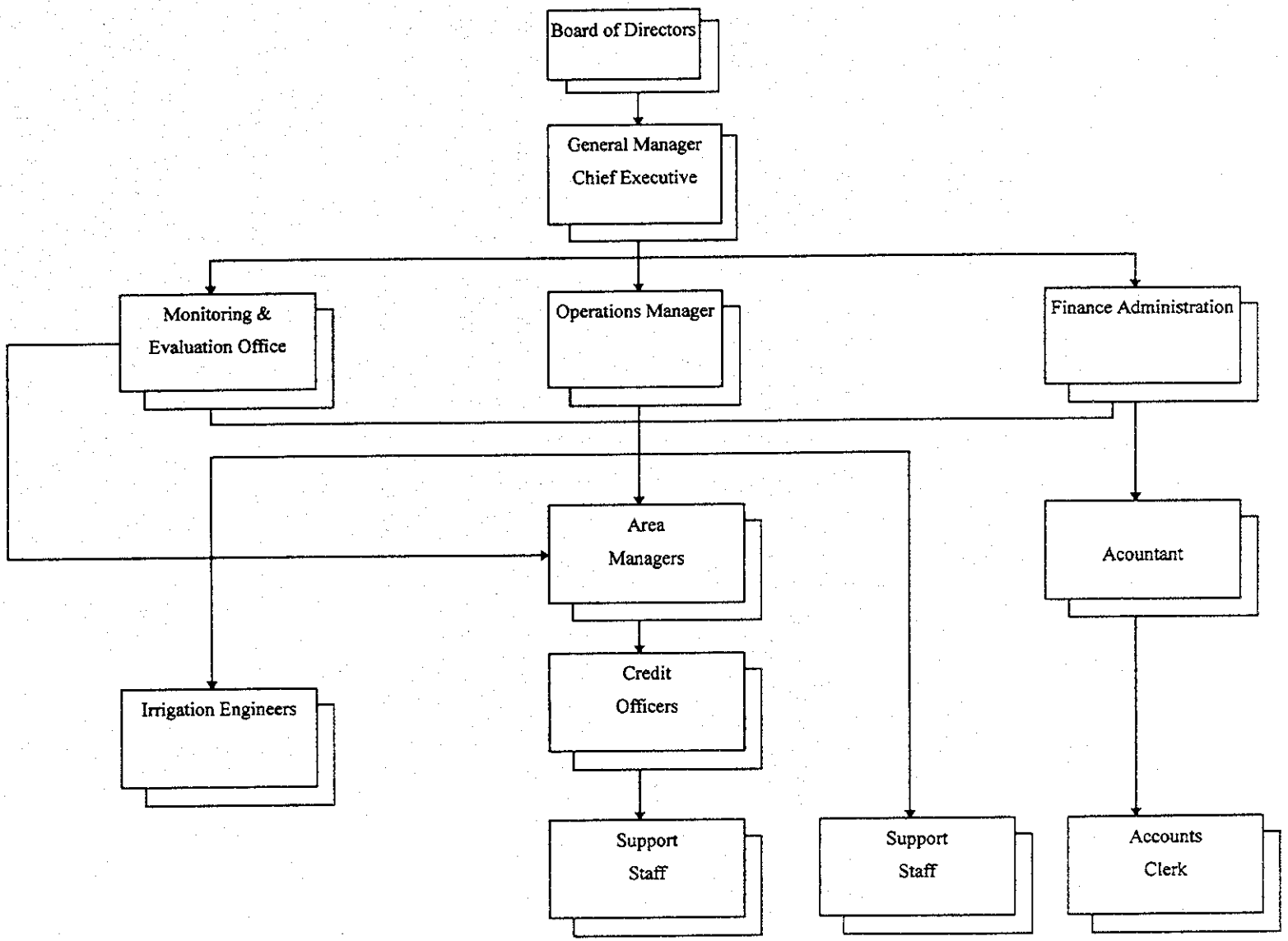
2) Objectives of SISDO

The main objectives of SISDO are to improve the standard of living of smallholder farmers/groups by assisting them to develop and manage sustainable income-generating projects by themselves without repeatedly seeking assistance from outside. Furthermore, the organization aims at creating a revolving fund which farmers can borrow for scheme development without relying on donor funding.

Table 4.8-1 List of Working NGOs and Their Activities

1.	Terranuova	:	Assisting irrigation and water supply
2.	PEP	:	Assisting needy families
3.	Organic Matter Management Network (OMMN)	:	Agriculture
4.	Smallholder Irrigation Scheme Dev. Orga. (SISDO)	:	Irrigation
5.	Partnership for Productivity (PFP) and loan for self-help	:	Assisting women's group
6.	Kenya National Farmers Union (KNFU)	:	Agriculture
7.	National Christian Council of Kenya (NCCK)	:	Lending
8.	Kenya Women Finance Trust (KWFT) groups	:	Lending to women
9.	Kenya Rural Enterprise Program (KREP)	:	Lending to groups
10.	International Labor Organization (ILO)	:	Lending to disabled persons and assistance to women
11.	World Vision International	:	Education, water supply
12.	SEFCO	:	Lending to artisans
13.	Narumoro Disabled Children's Home	:	Cater for disabled children
14.	Christian Children Fund	:	Family holder project
15.	African Development Foundation	:	Funding for water supply
16.	Catholic Church	:	Water supply
17.	Greenbelt Movement	:	Tree nurseries
18.	Christian Health Association of Kenya (CHAK)	:	Family planning
20.	Kenya Institute of Organic Training (KIOF)	:	Organic farming
21.	Hihudi	:	Assisting small groups
22.	TMCA	:	Providing various courses
23.	PCEA	:	Child labor project
24.	Partnership for Productivity	:	Money profit making
25.	Family Planning Association of Kenya	:	Family planning
26.	Juhudi Credit Scheme Project	:	Assisting small businesses
27.	Tetu Pyrethrum Farmers	:	Assisting farmers to get seeds and sell products
28.	Child Welfare Society	:	Assisting destitute families
29.	Kenya Blind Society	:	Training the blind for self-reliance
30.	Kenya Organic Farming	:	Advice to farmers for organic farming
31.	Red Cross	:	Aiding the needy
32.	Kenya Youth Training for Employment Creation	:	Assisting youth businessmen to acquire loans
33.	Kenya Water for Health Organization (KWAHO)	:	Project on money making
34.	Family Helper Project	:	Primary health care, agriculture and food security, small enterprise development, resettlement
35.	Catholic Relief Services	:	Food provision
36.	Action Aid	:	Aiding Project
37.	Freidrick Elbert Foundation	:	Assisting women's income generating projects
38.	Kenya Freedom from Hunger Council	:	Provision of relief
39.	Kenya Charity Sweepstake	:	Aiding Projects

Figure 4.8-1 Organization Chart of SISDO



3) Current SISDO Program and Activities in the Area

SISDO has prepared and assisted farmer's groups to install irrigation infrastructure in the following three schemes, which are already operational.

- Mukuria Kimbogo scheme in Meru District (implemented in 1995)
- Kagati scheme in Nyeri District (implemented 1996)
- Ciambaraga scheme in Tharaka Nithi (implemented 1997)

Aside from the above-mentioned schemes, many other schemes are under various stages of preparation, surveys, designs, farmers training/mobilization and paying for of security funds. Among those, the following four schemes are at the final stages to begin implementation or are under implementation.

- Muteithia scheme in Nyeri District is in the final stage of raising security funds surveys and, designs; tendering is being finalized.
- Ruungu Scheme in Tharaka Nithi District is under implementation.
- Nthambo scheme in Tharaka Nithi is in the final stages of raising security funds.
- Kionyo Githigacio scheme in Meru District is under preparation. Surveys and designs have been done, and farmers are finalizing the raising of security funds.

4) SISDO Loan Program

SISDO is currently involved in the following loan programs;

- Development of group-based irrigation project developed with, and managed by, the farmers,
- Development of pump-fed irrigation systems for individual farmers,
- Provision of farm inputs to groups of farming in irrigation schemes, normally women who make up the majority of agricultural farm workers,
- Provision of hybrid milk cows to groups of farmers in clusters. This will be the high stage for farmers who have excelled in utilization of farm input loans.

In 1995, SISDO entered an agreement with the Cooperative Bank of Kenya (CBK) which will handle lending issues for SISDO. SISDO will then concentrate in identification and preparation of groups to be assisted in follow-up during loan repayment period. Under this program, the following arrangements are undertaken;

- SISDO will deposit a guarantee fund to the bank equivalent to 70 percent of the project cost (this ratio will be reduced as creditworthiness of smallholder is proved through good loan repayment).
- Each farmer will contribute 15 percent of the project cost and deposit it with the Bank. Thus the loan required is 85 percent of project costs.

As of August 1998, Cooperative Bank of Kenya (CBK) stopped extending credit facilities to smallholder irrigation schemes. As a result, SISDO transferred its banking facilities from the Cooperative Bank of Kenya to Development Bank of Kenya (DBK). Presently, SISDO is conducting negotiation with DBK with a view to establishing a partnership that would offer credit facilities to smallholder irrigation sector under better interest rates will be fixed at about 16 percent, grace period of three to six months and a payment period of four years.

CHAPTER V.

DETAILED ANALYSIS OF HORTICULTURAL CROP PRODUCTION SYSYTEM, HOUSEHOLD AND COMMUNITIES

CHAPTER V. DETAILED ANALYSIS OF HORTICULTURAL CROP PRODUCTION SYSTEM, HOUSEHOLD AND COMMUNITIES

5.1 Social Organisation and Leadership within the Community

5.1.1 Kinship Group

In nearly all the Study Area, existing population groupings largely reflect kinship relationships which date back to the original land acquisition and settlement. During this early period, there was a tendency for close family members to occupy adjacent land thus giving rise to a kinship-based settlement pattern. With population increase, neighbourhoods and villages were shared by a community with close family links. Later on, however, new immigrants have come and bought or rented land thus creating pockets of families unrelated to the originally settled groups. This is true in areas that were settled during pre-colonial times such as Rupingazi as well as in areas of more recent settlement such as Kiorimba, Ruungu and Island-Farm.

In the past (pre-dating the colonial era), the basic social organization units for the communities around Mount Kenya were kinship groups which comprised family members with common identity and descent. These kinship groups then coalesced into clans which in turn formed the tribe or sub-tribe. Cutting across kinship groups as well as clans, were the age set groups which consisted of members of approximately the same age and who had undergone initiation ceremonies at a similar period. The age-sets existed in order to act as a counter-balance against self-centerness of kinship groups and clans thus promoting overall tribal cohesion and stability.

All three social elements (kinship group, clan, age-set) offered useful mechanisms for settling conflicts as well as for mobilizing the community's collective effort for resource management (agricultural and grazing land).

The clan, through its clan elders, exercised relatively more power particularly on matters pertaining to the following:

- Defending clan members' interests against other clans through negotiation or, as a last resort, through military means, on matters relating to land disputes, or compensation when a clan member was killed or injured it by a member from outside the clan
- Facilitating important ceremonies (coming of age, government transition, weddings, burials)

With the on-set of the modern era, the roles of kinship groups, clans and age-sets have substantially diminished as these have been taken over by new institutions such as State Government, Churches as well other community-based organizations (cooperatives, Water Users Associations, Self-help Groups etc.). However, even to-day, kinship groups and clans still discharge important functions side-by-side with the new institutions. For instance, within the Study Area, the kinship groups currently provide the following services:

- Coordinating welfare activities such as weddings and burial ceremonies
- Raising funds, on behalf of poor members, for paying school fees or hospital bills

- Resolving intra-community conflicts (farm border disputes, family disagreements etc.)
- Collaborating with the formal authority structure (chief and assistant chief) in maintaining peace in the locality

5.1 2 Age Groups

In the olden days, age groups were important elements of the traditional social and cultural life of the community together with gender, defined different roles for various age groups within the community. During that time, elders occupied the apex of the community's government and authority structure. They were responsible for making key decisions on the community's resources. In addition they directed other age groups in performing specific tasks such as defence and land opening by young men (18- 30 years) and looking after livestock by the youth (under 18 years) as well as in arbitrating any conflicts that arose among the community.

Within the Study Area, age-groups, as a factor of social organization and governance, has lost much of its relevance. Other attributes, such as education, wealth status as well as formal employment position in government and the private sector, have become more important determinants of social status and authority. Since most Kenyans have a rural home, a person with a prominent position in the government will always be consulted on local issues back home although his age does not qualify him as an elder.

5.1.3 Elders

In different kinship groups and clans, there are people who (on account of age, experience and natural leadership qualities), are normally requested to arbitrate on disputes or take a lead in community events. It is from the ranks of such people that the Government chooses elders to assist the local assistant chief. These village elders are not paid a formal salary by government, however, when they participate in an arbitration session with the assistant chief, they receive a token payment normally funded by the parties that are in dispute.

In two districts (Nyambene and Meru), there exists an informal council of elders by the name "Nchuri-Ncheke". Although the council's authority is now much reduced, it still plays a significant role in resolving inter-clan and inter-ethnic conflicts as demonstrated in the recent land dispute between Igembe and Tharaka Communities of Nyabene and Tharaka Nithi districts respectively.

5.1.4 Assistant-Chiefs and Chiefs

As explained earlier, traditionally, the government systems of the communities around Mount Kenya were highly decentralized and were based on a combination of kinship, clan and age-set system. The present chief system was a colonial innovation which managed to persist even after independence. Presently, Assistant chiefs and chiefs are civil servants and constitute the lowest ranks in the chain of Authority that stretches from the Provincial Commissioner at the Provincial Headquarters. The assistant chief is responsible for a sub-location while a chief is in charge of a location consisting of two or more sub-locations. Both the sub-chief and chief play the following roles:

- Acting as the "eyes" of the government on matters of general law and order
- Resolving local disputes with the help of village elders
- Calling public meetings for transmitting important government messages
- Receiving government visitors and coordinating their meeting with the local community

To be appointed an assistant chief or a chief, one must be local to the community, have modest education (form IV) and demonstrate good character.

5.1.5 Self-Help Groups

A substantial number of self-help groups are known to exist within the Study Area. Group formation is a coping mechanism that enables members to pool resources or efforts in order to obtain benefits which they cannot achieve while acting alone. A summary of self-help groups identified during the socio-economic survey, covering seven sites, is given the following table.

By far the largest number of self help groups are supported by women and are engaged in a wide range of activities including:

- Encouraging savings habits among their members by pooling cash resources and handing them to each member in turn for buying such items as roofing sheets or domestic utensils (so called "Merry-go-round") groups
- Coordinating agricultural production and/or crop marketing, e.g., women's groups in Kibirigwi Irrigation Scheme

Compared to women's groups, men's groups are few and the ones that exist are aimed at helping closely related members in meeting emergencies such as burial and hospital bills, as well as school fees. In one instance, in Ruungu, the men's-group encourages its members to accumulate savings with a view to starting trading business.

On the other hand, youth self-help groups pursue such activities as sports as well horticultural production and marketing. At Island Farm, the young people have recently set up a "Self-Help Youth Group" that acts as a "middle-man" between the farmers and horticultural crop buyers from urban centres. Using informal (perhaps illegal) but effective policing arrangements, they have ensured that no buyer's vehicle collects horticultural produce from the area unless invited by the group. To the great annoyance of the farmers (the youths' parents, included), the youth group retain for themselves a relatively large margin of the price paid by the outside buyers. They do however provide a marketing service by operating telephone communication between the farming area and the nearby urban centre at Karatina. Buyers' vehicles, waiting at Karatina, then only drive to the farming area when informed that a collectable load of produce has been bulked at the farm level. A summary of women's and men's self-help groups is given below;

Summary of Self-Help Groups and their Activities

District	Scheme	Women Groups		Men Groups	
		No.	Main Activities	No.	Main Activities
Nyeri	Island Farm	6	Promoting saving habits; Group arrangement for input credit	0	None
Kirinyaga	Kibirigwi	13	Same as above	2	Mutual assistance for school fees and burial expenses
Embu	Rupingazi	18	Promoting saving habits for buying domestic utensils and assisting each other during emergencies	6	Same as above
Mbeere	Mashamba	17	same as above	3	same as above
Tharaka Nithi	Ruungu	20	Same as above; Helping each other in field activities; Buying a maize mill	18	Same as above; Promoting savings for starting trade
Meru	Nkui	5	same as above	7	Promoting savings and mutual assistance
Nyambene	Kiorimba	9	Promoting saving habits; Helping each other in emergencies,	6	Same as above
Totals		88		42	

Source; JICA Study Team, Socio-Economic and PRA Surveys, November 1997

Apart from self-help groups, there are a number of water development groups and Water User Associations whose management committees work mainly on a voluntary basis. There was, however, little evidence of other local voluntary groups within the Study Area.

5.1.6 Christian Churches

The Study Area accommodates several mainstream Christian churches (Catholic, PCEA, CPK, Baptist and Methodist) as well as a large number of small local sects. These churches provide an institutional framework not only for spiritual well-being but, in case of the mainstream Christian churches, also for developmental activities. Since these churches bring together members of the same faith, they provide a focal point for group loyalty and group mobilization. In this regard, a number of development activities have been implemented by the Catholic and Protestant Churches in such areas as education, health, domestic water supplies, irrigation, and agricultural extension support, within the Study Area.

5.2 Farm Household

5.2.1 Homestead

The siting of the homestead (average size = 0.1 ha) and arrangement of building units within a farm plot depend on topography of the farm plot, size of adult household members, traditional norms as well as wealth status and preference of the household head. The homestead is usually located at the top end of the farm plot a little distance away from the boundary road.

Typically, the homestead consists of the following:

- The main house which accommodates husband and wife, young children as well as grown up daughters (sometimes, if he can afford it, the man of the house may occupy a separate house opposite the main house)
- One or two small satellite houses which are used by young boys (over 15 years old) or by other adults members of the extended family (grandmother, cousins, others)
- Other ancillary houses such as grain store, chicken house, goat house, rabbit house, pit latrine and in some cases a zero grazing shed or cattle boma

Where the head of the household is polygamous, each wife has an independent main house as well as grain store while other satellite and ancillary buildings are operated in common. Traditionally, the configuration of the buildings within the homestead have a pattern which nowadays may or may not be observed depending on the household-head's preference. The perimeter of the homestead area is also likely to be marked by a live or barbed wire fence. In the past, satellite buildings occupied by sons and other young male adults tended to be located near the entrance of the homestead while the main houses were sited a little further from the entrance.

On the basis of PRA homestead sketches, there is little cultivation within the homestead apart from a few fruit trees and grass. However, where the farm plot is very small, attempts are made to cultivate kitchen gardens within the homestead area although the risk of damage by chicken and other domestic animals is considerable.

5.2.2 Typical Membership and Their Roles within a Household

The general structure of farm households within the Study Area is similar in all seven districts. While most of the households are male-headed, a small but significant number are female-headed. Female-headed families occur because the husband is dead, is employed far away from home or the female-head never married in the first place. In any event, the household embraces not only the basic nucleus family (parents and children) but also members of the extended family (husband's mother, brothers, sisters, cousins etc.). At the time of the socio-economic survey, the number of members within a house-hold ranged from 5.1 in Nkui to 11.1 in Kibirigwi while the mean for the seven sites was 7.8. Normally, the number of members in a household is in a state of flux and is likely to fluctuate between 5-10 as extended family members come and go.

Average Number of Household Menbers

Survey Site	Island Farm	Kibirigwi	Rupingazi	Mashamba	Ruungu	Nkui	Kiorimba	Mean
Average No of Household Members	9.4	11.1	6.3	9.2	7.0	5.1	6.7	7.8

Source; JICA Study Team, Socio-Economic Survey, November 1997

All members of the household have right of access to available food and other home amenities. Depending on the cash income level of the household, all the members expect to be assisted to buy such other basic requisites as clothes, and personal hygiene items, so long as they do not have alternative income sources outside the household. On the other hand, they are expected to contribute unpaid labor for discharging various household chores (with the exception of very young children) in keeping with their age and gender.

On the basis of field surveys, a summary of main tasks performed by different members of the household are as follows;

Profile of Main Household Tasks

Main Household Task	Husband/Other Adult Male	Wife/Other Adult Female	Male Adolescent	Female Adolescent
1. Land opening	XX		X	
2. Buying inputs	XX	X	X	
3. Planting	X	XX	X	XX
4. Weeding	X	XX		XX
5. Spraying	XX		XX	
6. Harvesting		XX	X	XX
7. Selling in open market		XX		XX
8. Fetching groceries	X	X	XX	XX
9. Cattle grazing	X		XX	
10. Goat grazing	X		XX	
11. Stall feeding			XX	
12. Milking	X	XX	X	X
13. Milk delivery		X	X	X
14. Irrigation	XX	X	XX	X
15. Firewood collection		XX		XX
16. Water collection		XX		XX
17. Cooking		XX		X
18. Cleaning		XX		XX

key ;X = contributes sometimes
;XX = main responsibility
Source; PRA Survey, JICA Study Team, November 1997

5.2.3 Property, Its Ownership, Right of Use and Right of Disposal

A household is both a social as well as an economic unit. In this regard, a typical household has a mix of fixed and loose assets upon which the household subsists. Using information collected from the PRA surveys, a description of the way these properties are owned, used and disposed is summarized as follows;

Property Ownership, User and Disposal Rights

Property Category	Ownership	User Rights	Disposal Rights
1.Land	Husband	All in the household	Husband but consent of other members necessary
2. Buildings	Husband, wife	All in the household	Husband with consultation of wife
3. Domestic utensils	Wife	All in the household	Husband consent necessary
4. Permanent tree crops (coffee, tea, macadamia etc.)	Husband	Mostly sold for cash and not used at home	Husband with occasional consultation of wife
5. Bananas	Husband or wife or both	All in the household	Wife in consultation with husband
6. Maize	Husband or wife or both	All in the household	Wife in consultation with husband
7. Beans & other legumes	Wife	All in the household	Wife in consultation with husband
8. Sweet potatoes	Wife or husband or both	All in the household	Wife with or without consultation of husband depending on ownership
9. Horticultural cash crops	Husband	Mostly not used at home	Husband with or without consultation of wife
10. Horticultural crops for home use	Wife	All in the household	Wife without consulting anybody
11. Cattle	Husband	All in the household	Husband with consultation of wife but her consent not necessary
12. Goats	Husband or wife	All in the household	Husband's consultation required before wife disposes
13. Rabbits	Young male/boy	All in the household willing to use it	Young male/boy
14. Chicken	Husband, wife, other members	All in the household	Each owner has sole disposal rights

Source; JICA Study Team, PRA Survey, November1997

It can be seen from the table that the role of the husband is dominant in determining or influencing how most household resources are managed or disposed of. Indeed, in one PRA session, it was stated that in the rare event of divorce, the wife is only permitted to "walk away only with her clothes". This is so inspite of her disproportionately high contribution to the household's physical capital formation.

5.2.4 Household Daily Activities

Members of a rural household engage in a variety of daily activities depending on the time of the year, age and gender as well as location. To get an insight into the nature and extent of household activities within the Study Area, two samples of time profiles are presented in the following tables for Rupingazi (high rainfall, high potential area) and Ruungu (semi-arid, marginal area).

Daily Activities of Household Members in Rupingazi

Men			Women			Youth		
6.30	am,	Wake up	5.30	am,	Wake up and light fire	7.00	am,,	Wake up
7.00	am,	Check condition of cowshed	5.45	am,	Milk cows, cook tea	7.30	am,	Take breakfast
7.30	am,	Take breakfast	6.15	am,	Take milk to daily	8.00	am,	Help in washing utensils
8.00	am,	Work in coffee plot	7.30	am,	Serve breakfast	9.00	am,	Pick tea or Feed animals
12.00	pm,	Take lunch	9.00	am,	Prepare food (maize &beans)	12.00	pm,	Take lunch and deliver tea to buying center
2.00	pm,	Work in the farm	10.00	am,	Work in the farm	3.00	pm,	Clean house and clothes
4.00	pm,	Rest/wash	12.00	pm,	Prepare lunch	4.00	pm,	Water seedings
9.00	pm,	Sleep	12.30	pm,	Serve lunch, clean utensils and clothes, feed and water cows	7.00	pm,	Take bath and relax
			3.00	pm,	Milk cows	8.00	pm,	Takes supper
			3.30	pm,	Take milk to dairy, wash dairy utensils, Prepare supper	9.00	pm,	Supper
			9.00	pm,	serve supper	9.30	pm,	Sleep
			10.00	pm,	Wash utensils			
			10.30	pm,	Sleep			

Source; JICA Study Team, PRA Survey, November 1997

Daily Activities of Household Members in Ruungu

Men			Women			Youth		
6.00	am,	Wake up	5.00	am,	Wake up	6.00	am,	Wake up
7.00	am,	Take breakfast and delegate duties	5.20	am,	Prepare breakfast, Feed children	7.00	am,	Take breakfast and Receive directives on work arrangements
8.00	am,	Attend to field activities	5.40	am,	Serve breakfast and Prepare children for school	8.00	am,	Attend to field activities
12.30	am,	Take lunch	6.00	am,	Attend to general cleanliness of the house	10.00	am,	Take care of livestock
2.00	pm,	Attend to field activities	7.00	am,	Attend to field activities	1.00	pm,	Take lunch
5.00	pm,	Take bath	10.00	am,	Prepare lunch	2.00	pm,	Attend to field activities or livestock
6.00	pm,	Visit shop centre	12.30	pm,	Serve lunch	5.00	pm,	Take bath
9.00	pm,	Take supper	2.00	pm,	Attend to field activities	7.00	pm,	Girls help in cooking
10.00	pm,	Sleep	5.00	pm,	Milk, get water or, fetch firewood	9.00	pm,	Take supper
			7.00	pm,	Start cooking	9.30	pm,	Sleep
			9.00	pm,	Serve supper, clean utensils			
			10.00	pm,	Bath small children			
			11.00	pm,	Take bath			
			12.00	am,	Sleep			

Source; JICA Study Team, PRA Survey, November 1997

The two sets of daily activity schedules illustrate, yet again, that the woman's daily program is fairly crowded. Her work load implies she has to balance between her domestic duties (cooking, fetching water and firewood) on one hand and field activities (planting, weeding, harvesting) on the other. At the same time, she has to find time to discharge such other broader social obligations as meeting other women or paying visits to relatives, etc.

5.2.5 Farm Plot and Mode of Utilization

The main factors determining the size of farm plots is agro-ecological potential and population density. On the upper lying wind-ward slopes of Mount Kenya and Nyambene Hills, where rainfall is high and soils fertile, population densities are high and farm plots are small, averaging about 1.0 ha/household.

On the other hand, the low lying areas receive relatively scarce and unreliable rainfall and have poor agricultural potential. Population is sparse and farm plots are therefore comparatively

large, averaging about 4.0 ha/household. However, there is increasing immigration from the upper-lying high potential zones to the lower marginal areas and plot sizes can be expected to decrease in the future.

Similarly, the mode of plot utilization is influenced by agro-ecological potential, availability of irrigation water, availability of marketing opportunities and status of access roads.

In the high potential Agro-Ecological Zones, where rainfall is adequate, land utilization is characterized by a mix of subsistence crops (maize, beans etc.) and cash crops (coffee, tea, and dairy). In the low potential Agro-Ecological Zones, rainfall is both insufficient and unreliable. In these areas, the farming system consists of a wide range of drought-tolerant crops such as sorghum, millet, cow peas, green grams etc. as well as extensive rearing of cattle and goats.

In both the high potential and low potential areas, availability of irrigation has permitted further diversification of the farming system to include a wide variety of horticultural crops. Irrigation serves to supplement rainfall in the high potential areas particularly during the two dry seasons of January-March and August-October. In the drier low potential Agro-Ecological Zones, irrigation may substitute rainfall altogether.

On the basis of the socio-economic and PRA surveys, the farming systems of the seven survey sites can be summarized as follows;

Summary of Farm Enterprises at Various Survey Sites

Survey Site	Subsistence Food Enterprises	Export Cash Enterprises	Domestic Market Cash Enterprises
1. Island-Farm	Maize, ordinary bean, kale, spinach, peas, irish-potato, dairy cows, chicken, fuelwood 1 tree	French bean,	Cabbage, carrot, irish-potato, dairy cow
2. Kibirigwi	Maize, ordinary bean, kale, sweet-potato, banana, irish-potato, napier grass, dairy-cow, chicken, fuelwood tree	Coffee, French-bean	Sweet-potato, banana, paw-paw, passion-fruit, cucumber, onion, cabbages, dairy-cow, chicken
3. Rupingazi	Maize, ordinary bean, irish-potato, sweet-potato, kale, bananas, cassava dairy-cow, goats, chicken, fuelwood tree	Coffee, French bean	Coffee, cabbage, kale, tomato, banana
4. Mashamba	Maize, ordinary bean, sorghum, millet, pigeon-pea, black-beans, sweet-potato, cassava, cow-pea, green-gram,		Cotton, chick-pea, coriander, sisal, castor, tobacco, mangoe,
5. Ruungu	Maize, ordinary bean, cow pea, green-gram black-gram, millet, sorghum, cow, goat, chicken, beehive,		Millet, sorghum, green-grams, black-grams
6. Nkui	Maize, o rdinary beans, kale, millet, sorghum, pigeon-peas, green grams, cow-peas, banana, cow, goat, chicken	Kallera, okra, French-beans, brinjals, chillies, other asiatic vegetable	Mango, banana, citrus
7.Kiorimba	Maize, ordinary bean, black bean, ground-nuts, cassava,cow, goat, chicken		Tobacco,

Source; JICA Study Team, Socio-Economic and PRA Surveys, November 1997

5.2.6 Land Tenure Systems

In areas that have been settled for a longtime, farm land is held on a "freehold" basis and each owner has a registered land title. However, in recently settled areas, (lower areas of Embu, Tharaka Nithi, Mbeere and Nyambene) the land is "trust land" implying it is held by the local county council in trust for the local people. This form of land tenure is decreasing since there is increasing social and political pressure to convert trust land into individual "free hold". For instance, in Kiorimba all the formalities (arbitration of boundaries, survey, demarcation, registration) of converting trust land to individual freehold status have been completed and only title deeds are awaited.

5.2.7 Seasonal Farming/Household Activities and Seasonal Labor /Cash Requirements

Seasonal farming pattern and associated farm activities are influenced by the agro-ecological potential, onset of the rains as well as market opportunities. In most of the sites investigated, two major activity peaks are August-September and December-February. These two peaks coincide with land preparation before the rains and also with overseas market opportunities for horticultural crops.

December and February are particularly critical months. This period coincides with a number of important events all requiring cash expenditure i.e. land preparation and purchase of farm-inputs prior to the rains, Independence Day celebrations, Christmas and New year festivities and opening of schools. A typical rural household is therefore under enormous pressure to find cash to finance these events. Cash requirements therefore reach a peak around this time.

5.2.8 Type of Risks and Risk Coping Mechanisms

Rural households, in the Study Area, are exposed to a range of risks in relation to their general livelihood and welfare. The sources of risks facing these households and their coping mechanisms are summarized as follows;

Household Risks and Coping Mechanisms

Source of Risk	Coping Mechanism
1. Rainfall unreliable	- Self help group for constructing irrigation furrows - Diversification of planted crops to include drought tolerant varieties
2. Bad roads	- Use of donkey or oxen drawn carts - Community initiative (e.g. Island Farm) to carry out road repairs - Walking and carrying goods on shoulders or on back
3. Diseases	- Local commercial clinics - Consulting local herbalists - Initiate mutual help groups
4. Lack of water supplies	- Form self help group for constructing water supply furrows or pipes - At individual level, install small rain-catchment tanks made of GCI or old oil tanks
5. Lack of cash resources	- Form self-help groups for promoting savings and attracting cash grants from outside
6. Unemployment	- Engaging in petty trade, hawking, tailoring,
7. Fluctuation of produce prices	- Crop diversification; in a few places forming marketing groups

Source; JICA Study Team, PRA surveys,November 1997

5.2.9 Farm-Related or Non-Farm Employment Opportunities

Apart from agriculture, some members of the household engage in other farm related or non-farm employment opportunities. These include:

- Formal employment (government and private sector) at local market centres and other urban areas outside the district
- Making handicrafts for sale or home use such as baskets
- Providing casual labor to neighbouring farms
- Engaging in local petty trades (selling vegetables, groceries, broker for export produce, etc.)

5.2.10 Major Concerns of Household Members

Although minor differences are to be found from district to district, the main household concerns within the Study Area, as revealed by PRA surveys, are generally similar. These are:

- Education of the young and availability of school fees
- Health of household members
- Food and clothing for the household
- Employment of young people who have finished school
- Good and reliable prices for agricultural produce
- Adequate water for irrigation and good water for domestic use
- Credit at affordable access interest rates for procuring inputs
- Roads and water supply services
- Reliable visits and training by agriculture extension

While the general concerns of household members may be similar, their priorities may be somewhat different. For instance women, are likely to place a high priority on health and domestic water supplies while the youth are more worried about lack of cash or employment opportunities. An illustration of different concerns of three broad categories of household members is given in below;

Major Concerns of Family Members at Different Survey Sites

Survey Site	Men	Women	Youth
1. Island-Farm	1. Water supply 2. General knowledge 3. Marketing	1. Health facilities 2. Roads 3. Water supply	1. Water supply 2. Roads 3. Markets
2. Kibirigwi	1. Marketing 2. Irrigation pipes 3. Low incomes	1. Fatherless children 2. Lack of money 3. Youth unemployment	1. Insufficient land 2. Poor roads 3. Irrigation expansion
3. Rupingazi	1. Marketing 2. Irrigation water 3. Inadequate social cooperation	1. Lack of freedom at home 2. Domestic water expensive 3. Lack of men support	1. Irrigation water 2. Road improvement 3. Unemployment
4. Mashamba	1. Low agricultural production 2. Poor roads 3. Inadequate health facilities	1. Low agricultural production 2. Poor health facilities 3. Unemployment	1. Unemployment 2. Poor health facilities 3. Poor roads
5. Ruungu	1. Lack of finance 2. Lack of irrigation 3. No cattle dips	1. Schools distant 2. Duty of carrying heavy loads 3. Low agricultural Production	1. General poverty 2. Illiteracy 3. Poor health facilities
6. Nkui	1. Irrigation water 2. Low incomes 3. Poor roads	1. Irrigation water 2. poor health facilities 3. poor roads	1. Irrigation water 2. Poor community cooperation 3. Poor extension
7. Kiorimba	1. Irrigation water 2. Poor roads 3. Low income	1. Poor health facilities 2. Irrigation water 3. Low income	1. Low income 2. Irrigation water 3. Agricultural inputs

Source; JICA Study Team, PRA Surveys, November 1997

5.3 Farming Community

5.3.1 Community Setting and Communally Owned Resources

Apart from minor differences induced by variation in agro-ecology, topography and market opportunities, the community settings within the Study Area are generally similar. During the PRA sessions, each community at various investigation sites was facilitated to prepare a map showing the boundaries of the community area as well as depicting important local features (rivers, hills, roads, churches, schools etc.). What was amazing was to witness some illiterate members of the community making a substantial contribution to the map making process.

In addition, a group of members of the community were requested to take a walk along an agreed transect and note important aspects relating to soils, physical features, type of houses, and cropping pattern. This contributed to an understanding of the cropping systems prevailing in the survey area, as discussed earlier.

5.3.2 Community Resources

During the PRA sessions, local communities were encouraged to take stock of their joint resources and indicate how such resources are owned and managed. An example of the results of such a stocktaking exercise is presented as follows;

Communally Owned Resources

Type of Community Resource	Ownership, Right of Use and Disposal	Type of Management Body and Its Functions
1. Primary school (All sites)	- Owned by the local community through their school committee - All children of primary school-age within the community have a right to use the resource subject to payment of specified charges	- School committee in consultation with the headmaster responsible for managing the school - Functions include: • establishing level of charges per child prior and after admission • preparing development and maintenance plans
2. Community dispensary (Island Farm)	- Owned by the local community through their dispensary committee	- Dispensary committee in conjunction with Ministry of Health
3. Church (All sites)	- Owned by the local community through their church committee	- Church committee in conjunction with Priest in charge
4. River	- Owned by the government but all members of the local community have right of use	- Community not aware of which body is responsible for river management
5. Cattle Dip	- Owned by the local community through a dip committee	- Dip committee responsible for: • preparing rules for dip membership and general operation • ordering acaricides • specifying charges for dipping services
6. Irrigation intake and supply canal/pipe	- Owned by members of the Water Users Association/Group	- Management committee responsible for: • preparing association operational rules/by-laws • operation and management of main irrigation works

Source; JICA Study Team, PRA Surveys, November 1997

5.3.3 Accessibility to Major Social Services within the Community

All the government ministries aim at providing their services to rural communities. However, only three ministries appear to have an appreciable presence among the communities covered by the socio-economic and the PRA surveys.

These ministries are;

- Ministry of Education which provides teachers to primary and secondary schools (for 7-20 year olds) built by local communities
- Ministry of Agriculture which has deployed extension staff down to sub-location level and supervises operation of community-owned cattle dips
- Ministry of Health which operates health clinics at the Divisional level and hospitals at the District level with services supposed to be available to both children and adults

Access to potable domestic water supply is limited and in those sites where irrigation facilities exist, abstracted water is conjuctively used for irrigation and home use without chemical treatment (Kiorimba, Rupingazi Ngerwe, Kibirigwe, Nkui, Island farm). Women members of the PRA sessions were particularly vocal on the need to have access to potable domestic water supplies.

Non-Government at Organizations (NGOs) and the private sector also provide some social services. Examples of NGOs providing services include the Christian Churches and Plan International (Schools, health services, agricultural extension, irrigation). Provision of social services by the private sector is confined to operation of commercial health clinics and hospitals as well as provision of veterinary services.

Among the priority needs of the surveyed communities, improved access roads were placed among the top three. The obvious conclusion is that both the Ministry of Public Works & Housing as well as the County Councils are perceived by the communities to be ineffective in servicing the road network.

5.3.4 Social Stratification and Its Possible Causes

Using wealth as the criteria, the surveyed communities display considerable social stratification. Three wealth strata were distinguished and corresponding attributes documented during the PRA sessions. There was a fair amount of agreement in the way all the seven survey sites perceived social stratification on the basis of wealth as shown below:

Social Stratification and Associated Attributes

Strata	Attributes
Rich	- Good permanent house (stones & iron sheets roof) well furnished - Piped water or use of roof catchment with a storage tank - Relatively large agricultural land (>3 ha) in high potential zones, >8 ha in marginal and medium potential areas - Plots/buildings at market centres - Children going to school without any problem of school fees - Food eaten at home sufficient and nutritionally balanced and regularly includes meat - A motor vehicle - Members of the household well clothed - Livestock comprises more than 5 cows, chicken etc.
Medium	- A semi-permanent house (iron sheet roof) - Size of agricultural land modest - Children going to school (primary & secondary) but considerable strain in raising school fees - Food eaten at home sufficient, mostly based on traditional dishes and occasionally includes meat - A bicycle - Modestly clothed - Livestock comprises 1-5 cows, some goats and chicken
Poor	- Rudimentary/temporary house (grass thatch roof) - Size of africultural land small (owned or rented) - Children hardly finish primary school and major problems with raising school fees - Food eaten at home inadequate, based on traditional dishes, rarely includes meat and children at times malnourished - torn clothes, 2nd hand clothes, no shoes, shoes made from old vehicle tyres - Livestock comprises only a few chicken (less than 5)

Source; JICA Study Team, PRA Surveys, November 1997

Percentage Break-down of the Community on Basis of Wealth as Per PRA Surveys

(unit : %)

Wealth Strata	Kiorimba	Nkui	Ruungu	Rupingazi	Mashamba	Kibirigwi	Island farm
Rich	5	13	4	3	5	15	5
Middle Class	70	48	30	50	25	35	25
Poor	25	39	66	47	70	50	70
Total	100	100	100	100	100	100	100

Source; JICA Study Team, PRA Surveys, November 1997

Percentage Break-down of the Community on Basis of Wealth as Per Socio-Economic Surveys

(unit : %)

Household	Kiorimba	Nkui	Ruungu	Rupingazi	Mashamba	Kibirigwi	Island Farm
('000 Ksh)							
50 – 80	3	0	3	10	1	1	5
10 – 50	24	22	7	19	18	9	19
Under 10	73	78	90	71	81	90	76
Total	100	100	100	100	100	100	100

Source; JICA Study Team, Socio-Economic Surveys, November 1997

5.3.5 Factors Underlying Social Stratification

During the PRA sessions, a number of factors were cited as having an influence on the way the local community is stratified on the basis of wealth. It was quite striking that communities in the seven survey sites had an almost identical perception of the attributes of a wealthy household or a poor one. From the output of the PRA sessions, the following factors contribute to social stratification:

- Size and quality of agricultural land
- Proximity to a permanent river or access to irrigation water
- Education and skills which in turn determine access to regular employment and efficiency with which available agricultural land is used
- Reliability of rainfall which determines crop failure or success
- General farm-gate prices for agricultural produce
- Number of children and relatives within the household
- Farm location in relation to access roads

5.3.6 Poverty Assessment and Other Disadvantaged Groups within the Community

1) Poverty Assessment

Assessment of poverty in not always an easy thing. Although the two survey methods made an attempt to classify the local communities along a wealth-poverty continuum, neither method is fully satisfactory in giving a picture in line with a visitors general impression. To illustrate the point, a comparison of Kibirigwi and Mashamba can be made. The PRA sessions assessed the incidence of the poor in Kibirigwi to be 50 percent and in Mashamba to be 70 percent. Using annual income of under Ksh 10,000/annum as defining the poor, the socio-economic survey suggests the incidence of poverty in Mashamba to be 81 percent and that in Kibirigwi to be 90 percent. According to the socio-economic survey, there is a higher incidence of poverty in Kibirigwi than in Mashamba. Yet such a conclusion does not fit well with the contrasting visual impressions of the two survey sites i.e. Kibirigwi with obvious evidence of consumer durable (iron-sheet roofs, stone houses etc.) and bursting trading centre as compared to the grass thatch houses, dull trading centre and a history of famine relief operations in Mashamba.

In spite of the above weaknesses, other survey data and information (cropping patterns, problem analysis, informal discussions) suggest that even in the high potential areas, there are members within local community who are severely deprived and who barely meet basic needs (food and clothing). In order to have a more precise assessment of the incidence of poverty in the survey sites, a more focused investigation may be required, more than was possible with the broadly based socio-economic survey.

In all the survey sites, households regarded as poor were either landless or did not have one or more household members with marketable skills. The association of poverty with relatively large families compound the problem further.

Thus it would appear that the proximate causes of poverty are lack of access to productive

land, technical know-how and possibly capital. Looking at the Study Area as whole, the low altitude marginal areas with, their unreliable rainfall, are likely to have a relatively higher incidence of poverty.

2) Other Disadvantaged Groups

Within the survey sites, other disadvantaged groups include the disabled and young female household heads. The disabled include the blind, the deaf, the crippled, who because of their disability cannot master the skills and concerted effort required in performing most agricultural tasks. Because of their disability, they are also more likely to be denied such self-improvement opportunities as education and other formal training.

From a poverty perspective, household heads have two main disadvantages: (a) They have relatively low education and training because of culturally determined bias (b) Their access to land is likely to be limited or denied because they have been divorced, widowed, or never married. These disadvantages are compounded by their having to support many children without male assistance.

With a little starter-up capital, however, this group has demonstrated resilience and is the driving force behind marketing of grains and vegetables in local open air markets.

5.3.7 Community Time and Trend Lines

With the exception of Rupingazi, settlement of the other survey sites is relatively recent (less than 50 years). During the PRA sessions, main events that had an impact on the community were documented such as the introduction of tobacco growing in Kiorimaba or the settlement history in Ruungu. Similarly, change trends in key community resources were discussed. Apart from minor variation in emphasis, there was a general awareness of positive and negative trends that have occurred. In particular, the PRA sessions highlighted the following trends:

- Availability of education has greatly expanded since most young children now go to school
- Health facilities have expanded although the quality have not been maintained recently.
- Population has increased as compared to the 1960's when one had to walk a considerable distance before seeing another homestead.
- The size of individual farm plot has become smaller as a result of sub-division for sale or allocation to children.
- Vegetation cover has decreased from the original dense bush or forest, when wild-life could easily be spotted, to the present situation where more than 70 percent of the land is under cultivation and women have to go farther to collect firewood.
- Flow of rivers has reduced and some streams have become seasonal while rivers that used to change only a little at the time of the rains now look brown with silt when the rains come.

5.3.8 Conflicts and Conflict Management

The nature of conflicts in nearly all seven sites appears to be similar as summarized as follows;

Type of Conflicts and Conflict Management

Type of Conflict	Mechanisms for Conflict Management
Dispute on farm boundaries	- Meetings presided over by the sub-chiefs and village elders in presence disputants - District surveyor's arbitration
Crop damage by livestock	- Arbitration by sub-chief and elders - Prosecution in a court of law
Dispute over irrigation water	- Intervention by management committee by deciding how water will be allocated - Written warning or imposition of sanctions (fine, denial of water)
Stealing of livestock (cattle, goats, chicken)	- Arbitration by sub-chief and elders - Prosecution in a court of law
Disputes based leadership competition for local institutions	- Meetings presides by chiefs or other Government officers

Source; JICA Study Team, PRA Surveys, November 1997

5.3.9 Major Problem Areas within the Community

During the PRA sessions, the communities were facilitated to identify, analyse and prioritize their problems. In order of decreasing importance, major problem areas for the seven survey sites are presented as follows;

Main Problem Areas as Perceived by the Community

Survey Site	Problem Areas
Kiorimba	- Inadequate irrigation water - Inadequate certified seeds - Lack of loans - Poor access roads - Lack of hospital facilities
Nkui	- Inadequate irrigation water - Poor access roads - Lack of maternity facilities - No farm input shop - Farmers not adequately trained in good farming method - Lack of market centre
Ruungu	- Inadequate irrigation water - Poor health services - Poor transport and communication services - Inadequate agricultural skills

Survey Site	Problem Areas
Rupingazi	- Inadequate irrigation water - Poor market for horticultural goods - Lack of skills and technology - Poor access roads
Mashamba	- Lack of irrigation water - Inadequate education facilities (polytechnic and secondary school) - Youth unemployment - Poor roads and communication - Lack of health facilities
Kibirigwi	- Poor farm produce prices - Poor marketing arrangements - Lack of public land for expansion of development - Lack of suitable irrigation pipes
Island Farm	- Inadequate irrigation water - Poor marketing system - Poor health services - Poor access roads - Lack of youth employment - Wildlife menace to agricultural produce

Source; JICA Study Team, PRA Surveys, November 1997

5.3.10 Status of Women

All the communities within the seven study sites, practise patri-lineal system where lineage inheritance are male centred. Consequently, ownership of key resources such as land and cattle is past from father to son. Women (wives and daughters) have user rights to these assets because of their relationship with the owner i.e. as wife, daughter, mother or sister. Hence, in spite of contributing an estimated 70 percent of agricultural labor, women have rather limited control over land.

There is also the traditional requirement that a young woman must relocate to the husband's homestead after marriage. This transfer requirement has two implications which tend to reduce a woman's control over land. First, in the home of her birth, she is seen as a temporary resident who sooner or later will go away to her home. Secondly, in her new marital home, she will initially depend on her husband as well as her mother-in-law for direction regarding the management of key household resources including land. Traditionally, only when she has attained the status of a mother (preferably of a son) is she in a position to contribute to household decision making.

At the household level, a wife nominally owns all the household utensils and furniture irrespective of how they were acquired. However, the disposal of these assets normally require a husband's consent. Women also have ownership rights for small livestock such as goats and chicken but their disposal, some times, requires a husband's consent. With regard to agricultural crops, a woman has ownership and disposal rights for legumes, sweat potatoes and unimproved bananas.

The status of women is however, changing and in Nyeri, Kirinyaga and Embu districts, it was stated that daughters are able to acquire user rights for land where they control ownership and

disposal of crop produce. In these three areas, wives were stated to be routinely consulted on matters relating to land use although the husband still makes the final decision. It must be appreciated that these three districts have historically been affected more by education, modernisation as well as urban influence. This is in contrast with Mbeere District, as well as the lower parts of Tharaka Nithi and Nyambene where the husband retains almost exclusive authority on land matters and where traditional value systems are still upheld.

Apart from the influence of tradition, the distribution of tasks and benefits within the household depend on types of crops grown. Benefits arising from cash crops (coffee, tea, tobacco, cotton, horticulture) tend to be controlled by the man of the house although the wife and other members of the household contribute the bulk of labor requirements. During the field surveys, it was reported that inequitable distribution of cash crop proceedings was a significant source of family disputes.

There are, however, crops that are normally controlled by women such as sweet potatoes, bananas and kales. For these crops, women are responsible for making decisions on production, marketing as well as management of accruing cash benefits.

5.4 Agricultural Production and Sale System

5.4.1 Agricultural Production

1) Agricultural Production

Major agricultural production of the Study Area is given in Table 4.4-1 mentioned previously.

2) Post-Harvest Handling and Processing Facilities

In the Study Areas the post-harvest handling of horticultural produce is composed of grading and packaging. The quality control by size, cleanliness and maturity is one of the key factors in farmgate prices and poor graded produce are often rejected by buyers. The packaging materials are sisal sack, plastic crates, nets bag and wooden box for domestic markets, and re-cycled carton boxes, or plastic crates for foreign markets are used. Most exporters re-grade and re-package at their facilities located in the export processing zone nearby Jomo Kenyatta International Airport (JKIA). Chemical treatment such as polishing of fruits and processing for juice, syrup and slices is not operated in the Study Areas, but mostly processed at Thika industrial zone.

The number of post-harvest facilities operated by farmers' groups or cooperative societies are limited due to financial sources and difficulty of sustainable operation. The export-oriented produce of Asian vegetables (chilies, okra, brinjar, karella and capsicum), fresh beans (French bean, snow pea and snap pea), fruits (avocado and mango) and miraa herb are graded and packed in sacks at collecting points in production areas. A few irrigation schemes own stores and grading sheds for domestic markets such as white/red potatoes, spring/dry onions, carrot, tomato and others. But, the utilization of the facilities is influenced by the existence of core marketing routes and skills of

farmers' marketing groups.

In terms of operating the facilities, farmers groups have been faced with the following problems; a) loss of core marketable crop production due to continuous cropping damage and drastic changes of marketing situations especially for export produce, b) difficulties of sustaining-advantages to member farmers in group forwarding, c) excessive leadership and none economically-based operations especially in cooperative societies, d) lack of useful market information for farmers' decision-making in cropping, e) unattractiveness for traders in quality, quantity and prices and f) weakness in negotiation position for selling prices with middlemen due to lack of post-harvest facilities such as cold storage.

Other post-harvest facilities operated by large-scale farming companies or exporters are depots for collection, grading and inspection which are located in Timau (Meru District), Nyanyuki (Laikipia District), Naromoru (Nyeri District) and Gachoka (Mbeere District). Three exporters possess cooling facilities with small capacity at their own farms in Timau, Naromoru and Gachoka. The exporters purchase the produce from contract farmers, non-contract farmers and middlemen at exporters' depots, or other collecting points, by dry-van trucks.

For export-oriented produce, the post-harvest facilities for grading, collecting, precooling and loading facilities are going to be constructed by Horticultural Produce Handling Project funded by OECF at Nkubu, Mwea, Sagana and four other production concentrating sites as satellite depots together with the establishment of Nairobi Horticultural Center. Fresh vegetables, fruits and cutflowers will be transported from the satellite depots to cold storage at the Nairobi Center by insulated-van trucks and auctioned by the management body of the Horticultural Crops Development Authority (HCDA). The capacities of cold storage and precooling and target produce are as follows :

Capacity of Cold Storage and Precooling Facilities

Facility	District	Capacity	Target Produce
Nairobi Horticultural Center	Nairobi	100 ton	All horticultural produce
Nlkubu Satellite Depot	Meru	10 ton	French bean, snow pea, snap pea, etc.
Mwea Satellite Depot	Kirinyaga	20 ton	Avocado, mango, Asian vegetables etc.
Sagana Satellite Depot	Kirinyaga	20 ton	French bean, snow pea, snap pea, etc.
Limuru Satellite Depot	Kiambu	15 ton	Cut-flowers, etc.
Yatta Satellite Depot	Machakos	10 ton	Asian vegetables, mango, etc.
Machakos Satellite Depot	Machakos	10 ton	French bean, snow pea, avocado, etc.
Kibwezi Satellite Depot	Makueni	10 ton	Asian vegetables, etc.

Note ; The capacity shows cold storage volume for Nairobi Center and precooling volume for Satellite Depots. For the precooling, differential pressure air-forced cooling system will be introduced.

The Eastern Province Horticulture and Traditional Food Crops Project initiated by IFAD is covering the project areas of existing irrigation smallhoders' farms (1,475ha) in Nyambene, Meru, Tharaka Nithi, Embu, Mbeere Districts and also in Machakos and Makueni Districts. Regarding post harvest facilities, the new construction of approximately 45 collection centers in the irrigation schemes to be rehabilitated is proposed. Each center will furnish simple grading and packaging sheds and allow for inspection and collection of produce by traders and exporters.

Post harvest technology of horticultural produce is researched at KARI at Thika, but they have constraints in terms of lack of technical advice, poor laboratory equipment and budget limitation. IFAD recommends improving them and incorporating extension methods.

3) Loss Incurred

The post-harvest losses are quite large. According to exporters' experiences, the losses are estimated at 15 to 65 percent in fresh beans and Asian vegetables purchasing from smallholders. For domestic consumed produce, the losses are estimated at 10 to 30 percent, but the figure varies with production areas, farming technique, quality of seeds and seedlings, crop and its varieties, season, road conditions, market facilities, market demands, packing methods, application of cooling system and others.

At the farm stage, the produce harvested during over-supplied period, is in excess therefore, farmers are forced to sell at lower prices or to give up selling to middlemen. Poor harvesting technique and grading can also cause the losses in quality resulting in buyers' reject. At transportation stage, road conditions affect on quality losses. When once damaged physically, crops such as fruit, fruit vegetables and root vegetables emit ethylene gas to stimulated maturing plant cells. The gas spoils other loading produce and the lives of plants become shortened. At stages to the markets, storage methods cause losses in quality and quantity. As most local markets do not facilitate roofs, heating of produce in the open-air produces high respiration of produce such as fruit and leaf vegetables and root crops, which are finally spoiled in spite of the produce being covered by vinyl or sisal sheets.

5.4.2 Sale Systems of Agricultural Production

1) Mode of Sales and Transaction

The marketing channel of horticultural produce is shown on the next page and can be divided into two routes for domestic consumption and export. Some export-oriented produce such as French beans, snow peas and Asian vegetables do not meet domestic demands due to Kenyan taste preference. Main horticultural produce for domestic consumption are white/red potatoes, spring/dry bulb onions, cabbage, tomato, carrot, sukuma wiki, spinach, fresh peas, dry beans of Canadian wonder/rosecoco/mwitemania/njahi/cow peas, cassava, avocado, ripe/cooking bananas, pawpaw, mango and others.

a) Domestic Marketing

The stakeholders in horticultural produce transactions are a) individual farmers, cooperative societies and farmers' marketing groups at production level, b) middlemen, wholesalers, retailers and processing companies at marketing level and c) consumers in urban area, large-scale purchasers such as hotels in Nairobi and Mombasa and supermarkets at consumption level.

Most individual farmers sell to middlemen. Some individual farmers, who have farms at

favorable location where low cost public transportation is available, bring produce by themselves and sell at road sides or local markets, while paying cess levy to county, municipality or town councils as Jua Kali hawkers. Generally, farmers who organize active marketing groups sell produce to wholesalers or middlemen at better prices than individual farmers do due to the merit in quantity for buyers and the bargaining power. It is reported that the trade by cooperative societies has been declining since 1993-94 in Kirinyaga and Embu Districts.

Middlemen deliver commodities from production areas to local markets and sell produce to wholesalers. In some cases, middlemen can play the part of wholesalers themselves through selling to retailers and even to consumers by means of loading lorries into wholesale sections at the major local markets at Nyeri, Karatina, Meru, Nkubu, Embu, Kutus and Kagio. The acting areas of middlemen are beyond seven districts of the Study Areas to Isiolo, Laikipia, Nakuru, Thika, Mombasa Districts and Nairobi Area. The mode of sale is only in cash.

The definitions between wholesalers and retailers are in compliance with the trading units, but they are ambiguous. Wholesalers in local markets sell produce to retailers, middlemen as well as wholesalers forwarding to urban markets in Nairobi, Mombasa and other major towns. Basically the mode of sale is in cash. In trading with large-scale purchasers such as supermarkets and hotels, bank cheques are accepted depending on sellers' request or the degree of reliability between them. In the market facilities, wholesalers and retailers are charged the cess for facility use by municipality, town or county councils.

b) Foreign Marketing

Exporters can be classified into two operating methods. Some exporters own large-scale farms or hold shares of farm owners' companies. They have facilities of drip irrigation system, glass or net houses, nursery shed, cooling system, grading shed, security system, communication system with the main processing plant located nearby Jomo Kenyatta International Airport (JKIA). Other exporters do not own farms, but collect produce from individual farmers, farmers' marketing groups and middlemen through local depots or directly from Nairobi. They have their own marketing routes to importing agencies and supermarkets in United Kingdom, France, Germany, Holland, Switzerland, Saudi Arabia and other countries.

Some exporters contract small-scale farmers in specific crop production, provide them farm inputs of high quality seeds, fertilizers and chemicals, and deduct farm input costs from value of harvested and inspected produce. The payment is done by cash or bank cheque depending on farmers' requests. But the number of contract farmers are quite limited due to exporters' past experiences; a) low quality of produces as a result of poor farming management in application of chemicals, harvesting technique, and pre-grading at farms, b) drastic change in marketing conditions; e.g. fall of French beans' prices in 1995-96 due to high exchange rate of local currency and excessive costs of air cargo freight, which was more expensive than those from Johannesburg or Harare to European major cities, and c) loss of farmers' reliability by selling to other exporters. Therefore, exporters purchase produce from non-contract farmers and middlemen in most cases.

2) Price Determination Factor

Factors at production stage

- Technical levels of grading in size, cleanliness, maturity and contamination of impurity
- Continuous supply of produce
- Storing methods
- Introduction of new varieties and quality of seeds and seedlings
- Acquirement of market information for farmers
- Activity of farmers' marketing groups
- Farmers' poverty lowering his/her bargaining power
- Proper chemical application and its recording for EU markets to clear maximum residue levels for export produce

Factors at transportation stage

- Access road conditions and distance to paved roads and markets
- Price escalation of fuel reflecting on transportation costs

Factors at marketing stage

- Seasonal fluctuation determined by demand and supply
- Market facilities, which can maintain produce quality such as cold storage, concrete floors, roof, hygienic facilities, etc.
- Production places (creation of brand), e.g. tomato in Karatina, red potato in Meru and miraa herb in Nyambene
- CIF prices of imported produce of neighboring countries, especially from Arusha in Tanzania
- Exchange rate of local currency, charges and capacity of air cargo freight and shipping day for export produce

5.5 Household Economy

The economic status of the farm households in the Study Area was described by using the District Development Plan (1997-2001), district statistics, PRA and farm economic survey. Although the results of the PRA and farm economic survey do not represent a current status of district-wise farm households concerned, status of the typical farms could be known.

5.5.1 Family Composition

The averaged family size in the Study Area is estimated at 5.66 persons per family which is bigger than 5.2 persons of the national average. The size is also varied by district, ranging from 6.2 persons in Tharaka Nithi to 5.1 persons in Kirinyaga district. Some 98.7 percent of the total number of farm households in the seven (7) districts concerned is categorized as the smallholders.

Figure 5.4-1 Marketing Channels of Horticultural Produce