

Chapter 2 The Environment for Development of the Nyeri District

2-1 Position of the Nyeri District

The industrial economy of the Republic of Kenya is most densely congregated in the corridor from Mombasa to Nairobi, Nakuru, and Kisumu, and in the surrounding region. Thirty-two percent of the total population of Kenya is concentrated in the two cities and six districts of the corridor region shown in Fig. 2-1 (1969 census figures), and 94 percent of the total population inhabits the 24 districts of this and adjacent areas which comprise the southwestern part of the Republic.

Fig. 2-2 shows the location of the traditional Nyeri district within this economic region. Two definitions of the Nyeri district have been adopted in this figure: in the narrow sense, the Nyeri District, Central Province (referred to hereinafter as "the Nyeri District proper"), and in the broad sense, the area which is formed by adding thereto the six districts shown in Fig. 2-1 (referred to hereinafter as "the extended Nyeri region"). It has been advocated that the effects of development be considered in a framework extending as far as the northern districts of this area, but we have concluded that the development program for small- and medium-scale industry could initially be limited to the four districts shown in Fig. 2-2 which belong to the Central Province. Of course, as the development of the Nyeri District envisaged here progresses, there is a definite possibility of a more extensive program for resource use taking shape in the next stage, which would include opening up the underdeveloped districts of the north.

The Nyeri District proper has a population of 360,000; however, the extended region, i.e., the economic region which includes the environs of Mount Kenya and the Nyandarua Range, contains a population of two million or 19 percent of the total population of Kenya.

In the regional progress of industrialization, development of industrial estates can be seen to have originated in the districts located in the central economic corridor shown in Fig. 2-1 (i.e., Mombasa, Nairobi, Kakuru, Kisumu, etc.), and then to have shifted in emphasis toward surrounding area such as Eldoret and Nyeri. This gives an indication of the basic policy on regional development as the Republic of Kenya enters its second decade of independence. This policy, of discouraging overconcentration and redressing the regional imbalance of industry while making the fullest use of the economic center, can be evaluated as a highly rational planning strategy. The area which lies to the west of the extended Nyeri region, including Eldoret and Kitale, has a population of 2,256,000, or 21 percent of the total, and is thus of approximately the same scale as the Nyeri district. However, this western area borders on Uganda, and its hinterland has richer potential than does the Nyeri district. On the other hand, the latter has the advantage of proximity to the Nairobi urban area.

Nyeri City is situated 145 km from Nairobi, and has access to the Nanyuki-Nairobi railway and trunk road. Within the extended Nyeri region, the highest population density occurs in the southern most Muranga district, followed by Kirinyaga, Nyeri, Embu, Meru, Nyandarua, and Laikipia, in that order, reflecting a trend gradual decrease from south to north. This trend also indicates a characteristic of the districts adjoining the capital region.

Fig. 2-1 Economic Region

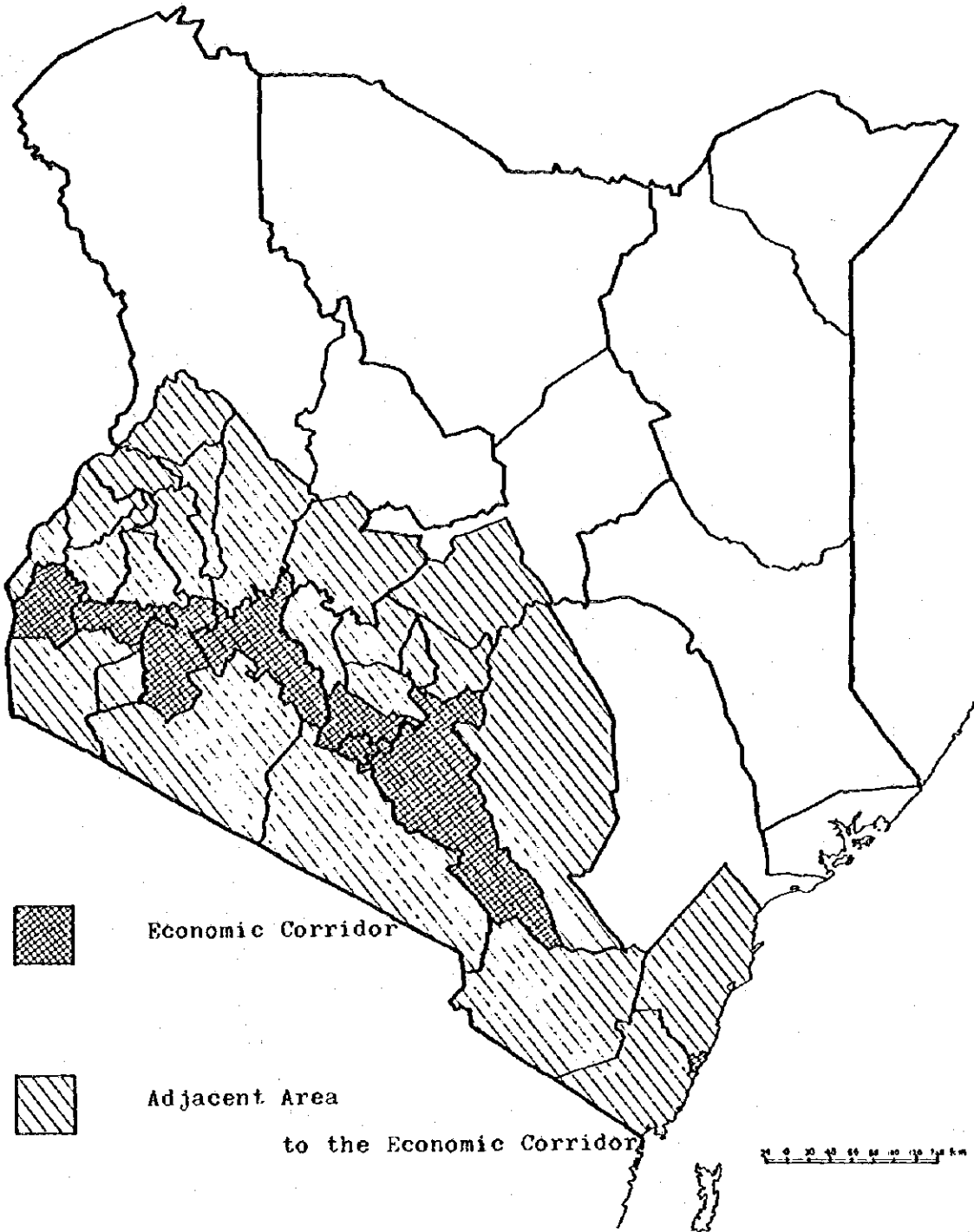


Fig. 2-2 Location of Nyeri Region

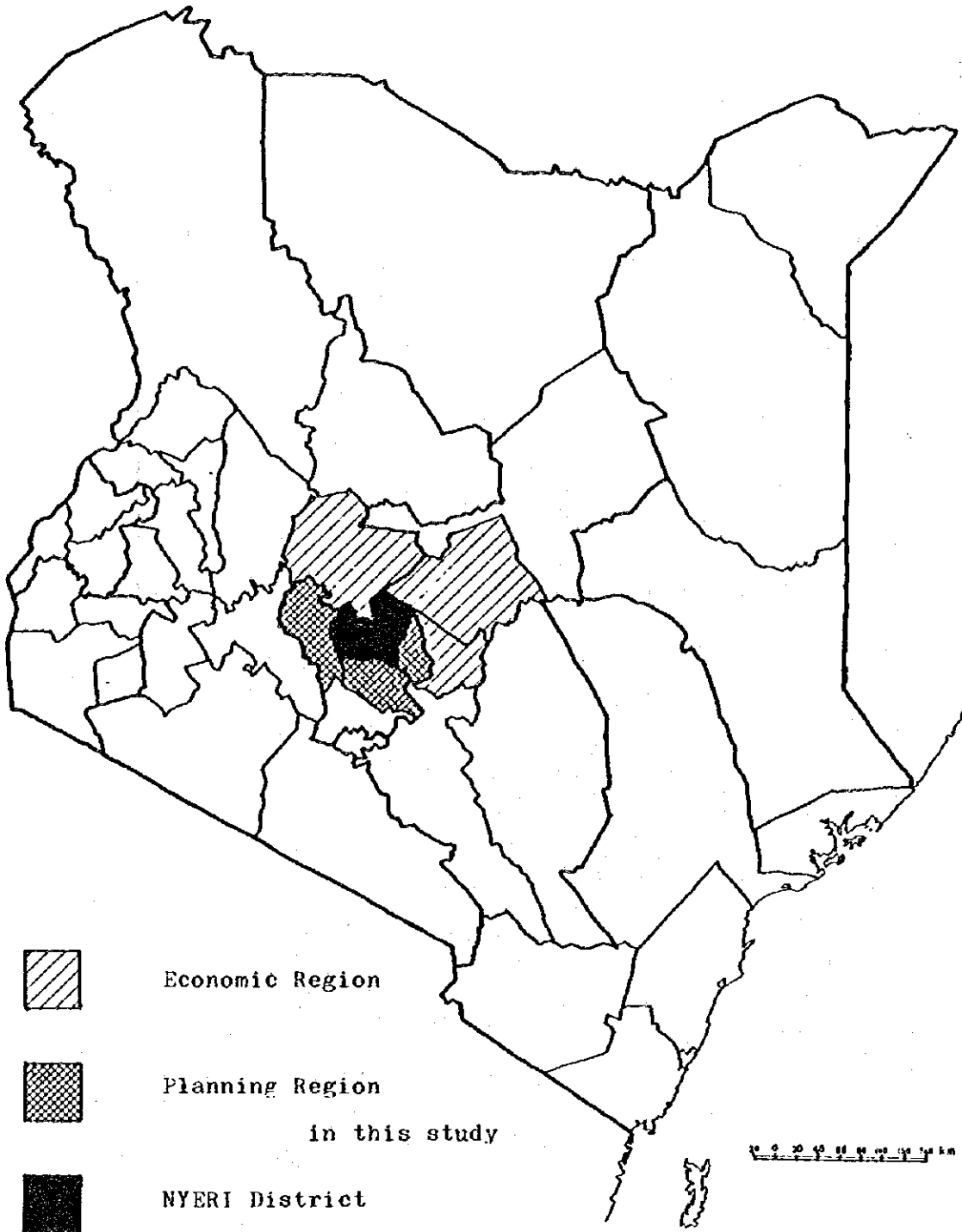


Table 2-1 Population by Districts (1969 census)

		Districts	Population		Remarks	
Sourthwestern Part of Kenya	Economic Corridor (E.C.)	Nairobi	509,286	A	A/F = 0.32	
		Siaya	383,188			
		Kisumu	400,643			
		Kericho	479,135			
		Nakuru	290,853			
		Kiambu	475,576			
		Machakos	707,214			
		Mombasa	247,037			
	Sub Total	3,492,932				
	Adjacent Areas to E.C.	E	West Pokot	82,458	B	E = 2,256,227
			Trans Nzoia	124,361		
			Elgeyo Marakwet	159,265		
			Baringo	161,741		
			Bungoma	345,226		
			Busia	200,486		
			Kakamega	782,586		
			Nandi	209,068		
			Uasin Gishu	191,036		
			Kitui	342,953		
			South Nyanza	663,173		
Kisii			675,041			
Narok	125,219					
Kajiado	85,903					
Taita	110,742					
Kwale	205,602					
Kilifi	307,568					
Sub Total	4,772,428					
Nyeri Economic Region	C	Laikipia	66,506	C	E/F = 0.21 C/F = 0.19	
		Nyandarua*	176,928			
		Meru	596,506			
		Nyeri*	360,845			
		Embu	178,912			
		Kirinyaga*	216,988			
		Murang'a*	445,310			
		Sub Total	2,041,995			
Total (above)		10,307,355	D	D/F = 0.94		
Total (Kenya)		10,942,705	F			

*Asterisks indicate the districts included in the Nyeri District Industrial Development Plan (i.e., those which belong to the Central Province).

Table 2-2 Area and Population of Extended Nyeri Region

District	Area sq. km	Population and Density			
		1969 Actual		1975 Est.	
		Total Pop '000	No per sq. km	Total Pop '000	No per sq. km
Nyeri*	3,284	361	110	440	134
Muranga*	2,476	445	180	530	214
Kirinyaga*	1,437	217	151	261	182
Nyandarua*	3,528	177	50	222	63
Meru	9,922	597	60	724	73
Embu	2,714	179	66	227	84
Laikipia	9,718	66	7	71	7
Total	33,079	2,042	62	2,475	75

* Districts in Central Province (Planning Region in this Study)

In 1975, the population of the Nyeri district was estimated at 440,000. This figure includes 35,000 in Nyeri City, of which 11,777 were estimated to reside within the Nyeri urban center. Thus, this area contains the highest population density within the extended Nyeri region, and since Nyeri City is also the site of the provincial government of the Central Province it fulfils the requirements of the central city of the extended region. It is therefore appropriate to assign the role of nucleus of development of the Nyeri district to Nyeri City, establishing the regional development management center there, and giving it the function of coordinating development projects in various localities within the region.

2-2 Environment for Development of the Nyeri District

In this section, the natural, social and economic environment of the Nyeri District proper, i.e., as an administrative division, is outlined.

2-2-1 The Natural Environment

The Nyeri District is situated on a plateau 1,520 meters above sea level. Favored with relatively fertile soil and an annual rainfall of 900 mm or over, it is naturally suited to agriculture. Furthermore, although it lies directly below the equator, because of its altitude it is relatively cool, and also has a splendid view of Mount Kenya and the Aberdare Range, affording an excellent residential environment. Its features are also worthy of consideration as resources for tourism.

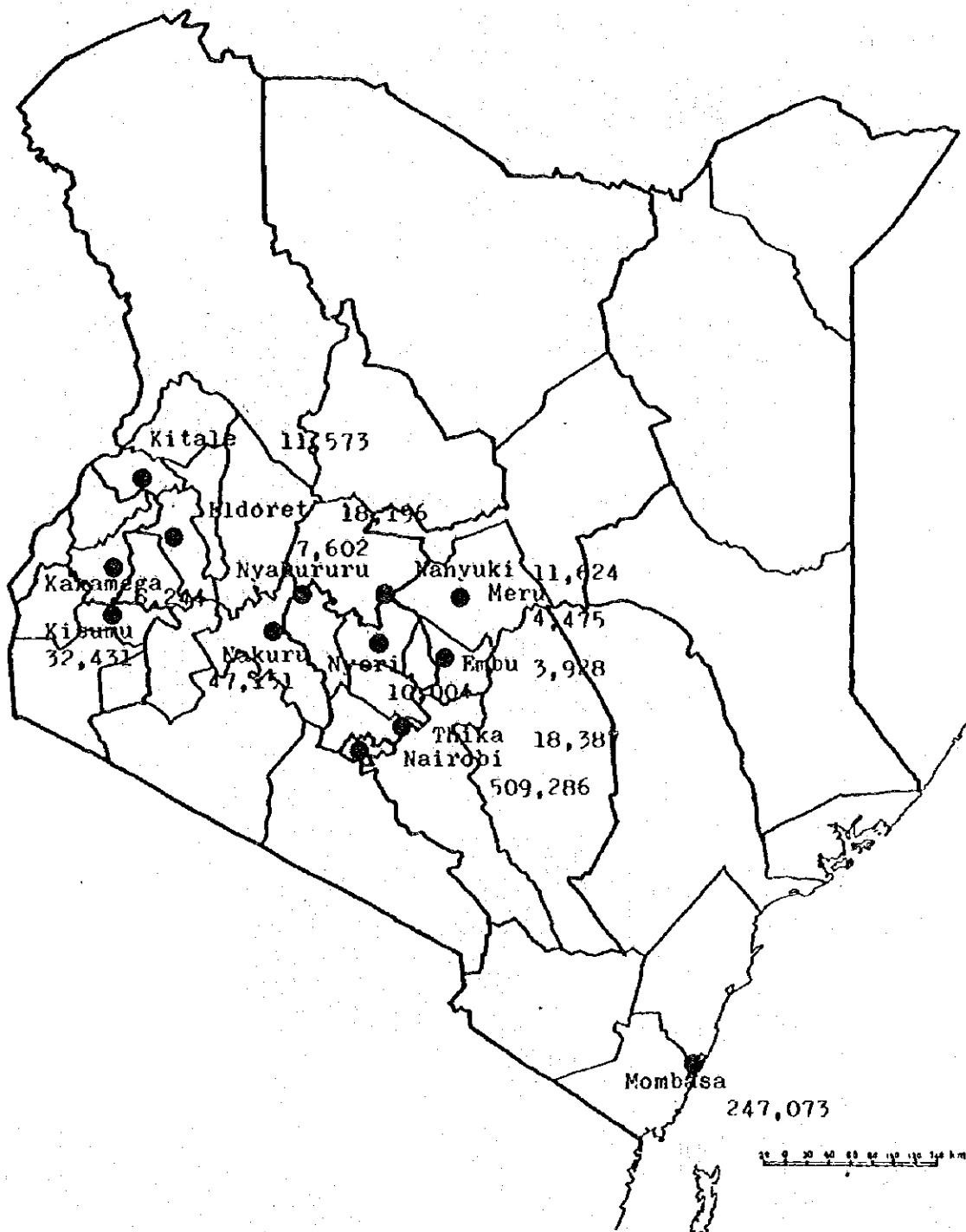
(1) Topography

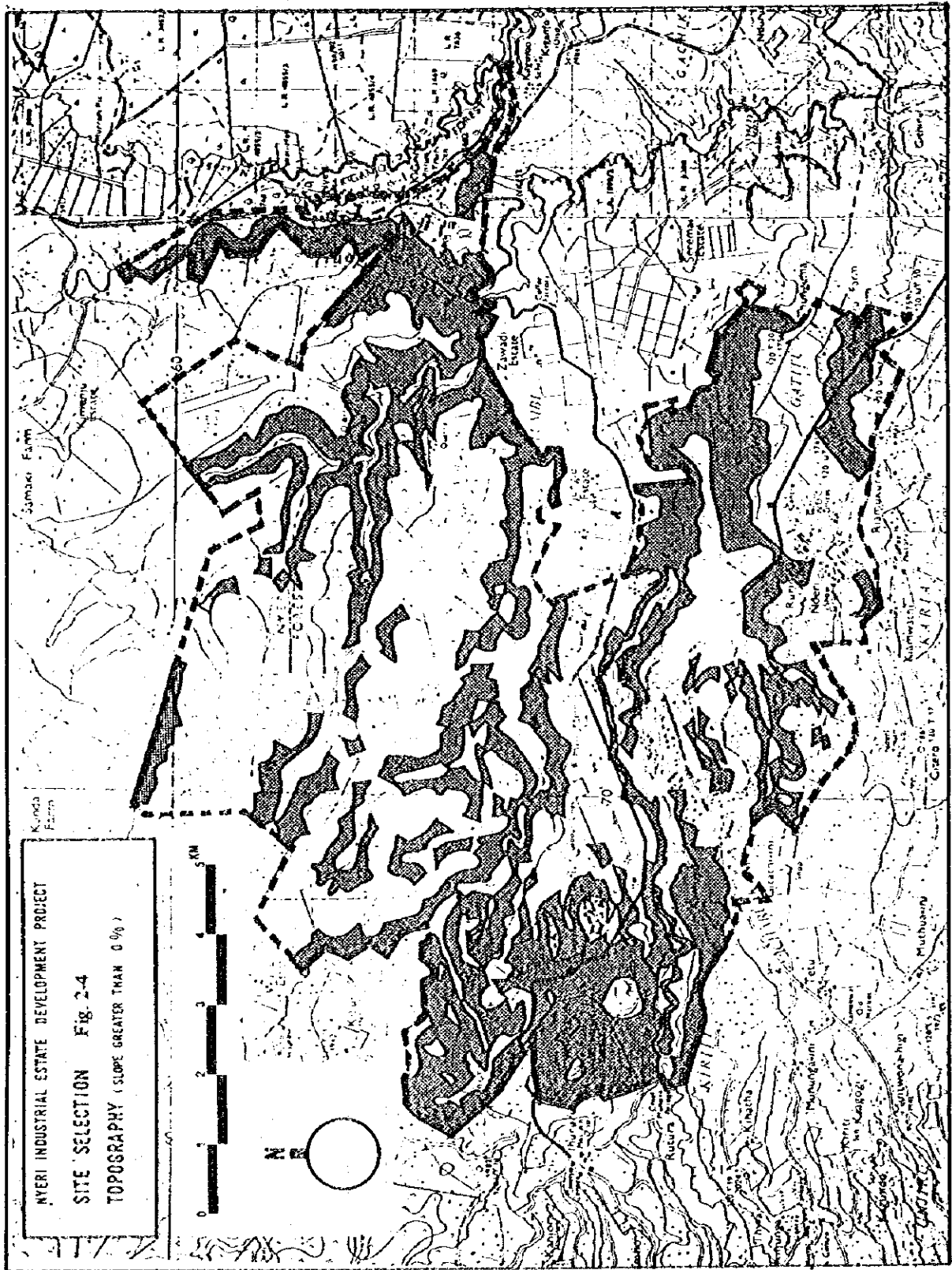
The Nyeri Municipality (referred to hereinafter as Nyeri) is situated on the foothills of the Aberdare Range. This land is complex in topography, being crossed by many tributaries of the Tana River, the largest in Kenya, which is fed by the Aberdare Range and Mount Kenya; these rivers have formed complex valleys among the hills. Fig. 2-4 shows the areas for which development is considered feasible in terms of topography, i.e., on the premise that land of a gradient of 10 percent or less can be developed for industrial estate use.

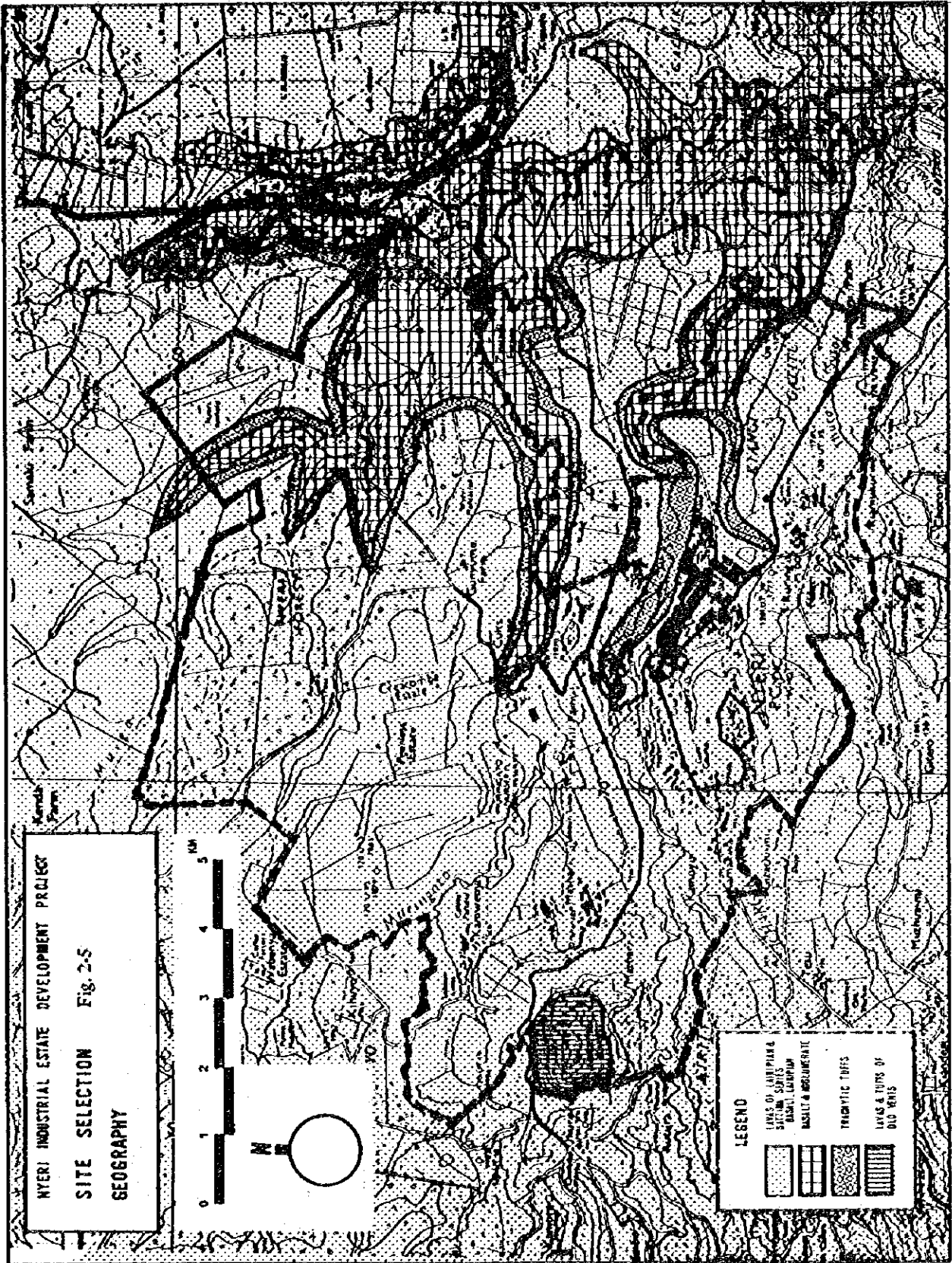
(2) Geology

Geologically, Nyeri consists of volcanic rock of Cenozoic or Mesozoic origin, distributed as shown in Fig. 2-5. Some agglomerate (and a certain amount of tuff) is seen along the rivers, and tuff also occurs in the Nyeri Hills, but other areas consist

Fig. 2-3 Major Cities and their Populations







of basalt. Exposure of rocks at the surface is seen only in part of the Nyeri Forest.

(3) Rivers

Three major rivers, the Chanya, Muringato, and Ambon, which are fed by the Aberdare Forest, and many small rivers flow through Nyeri. Shortly after leaving this region they combine as the Sagana River, then further as the Tana (Kenya's largest river), which flows into the Indian Ocean. (Fig. 2-6).

The water level, speed, flux, etc., of these rivers were surveyed on March, 1977, with following results. As the survey was made in the dry season the volume of water was extremely small, at approximately $2 \text{ m}^3/\text{sec}$. in the Muringato and $13 \text{ m}^3/\text{sec}$. in the Chanya. (As the Ambon was not included in the survey no precise data are available, but its volume is probably greater than that of the Chanya.) The other rivers contained an almost negligible volume of water.

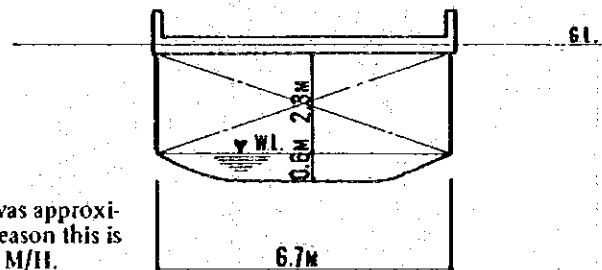
According to information obtained from the Ministry of Water Development, the water quality of these rivers is extremely good, the BOD density being almost zero. From the above survey results, the possibility of using river water to supply an industrial estate is thought to be limited to three rivers, the Muringato, Chanya, and Ambon. Further, in view of the small volume and very high water quality of these rivers, in studying the method of disposal of liquid wastes, both industrial and domestic, from an industrial estate adequate consideration must be given to the degree of water pollution which would result if wastes were discharged into the rivers.

No.1

1. Water temperature: 20°C
2. Water temperature: 15°C
3. Transparency: 9 cm
4. pH: 6
5. Water surface slope: $\pm 3.5\%$
6. Flow rate: 0.5 m/sec.
7. Water level:

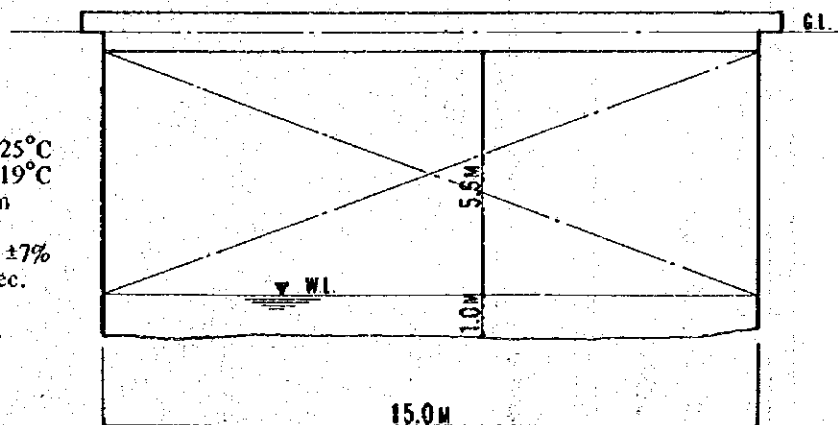
At the time of the survey water depth was approximately 600 M/H, but during the rainy season this is estimated to rise by approximately 700 M/H.

8. Flux: $1.83 \text{ m}^3/\text{sec}$.



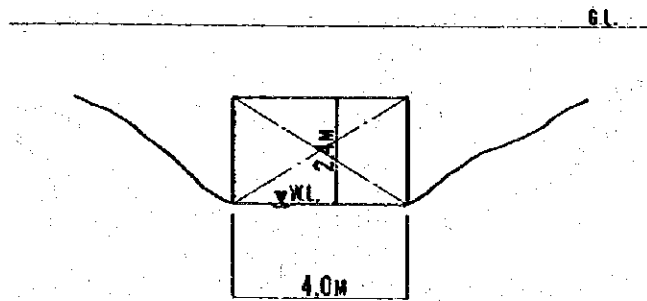
No.2

1. Water temperature: 25°C
2. Water temperature: 19°C
3. Transparency: 15 cm
4. pH: 6
5. Water surface slope: $\pm 7\%$
6. Flow rate: 0.85 m/sec.
7. Water level:
8. Flux: $12.75 \text{ m}^3/\text{sec}$.



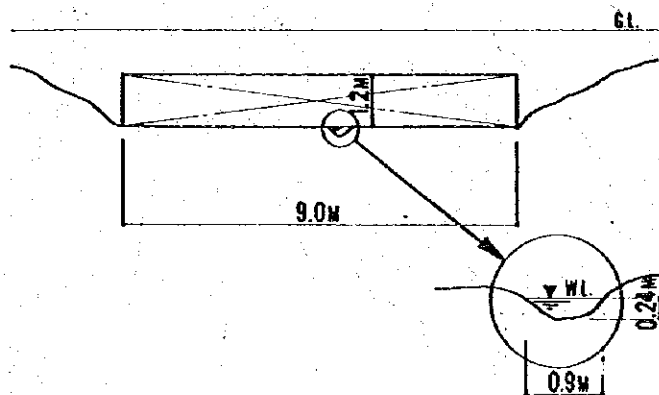
No.3

1. Water temperature: 25°C
2. Water temperature: 23°C
3. Transparency: 5 cm
4. pH: 7
5. Water surface slope: ±3.8%
6. Flow rate: 0.5 m/sec.
7. Water level: Almost no water
8. Flux: Almost zero



No.4

1. Water temperature: 27°C
2. Water temperature: 20°C
3. Transparency: 2 cm
4. pH: 7
5. Water surface slope: ±3%
6. Flow rate: 0.5 m/sec.
7. Water level:
8. Flux: 0.078 m³/sec.

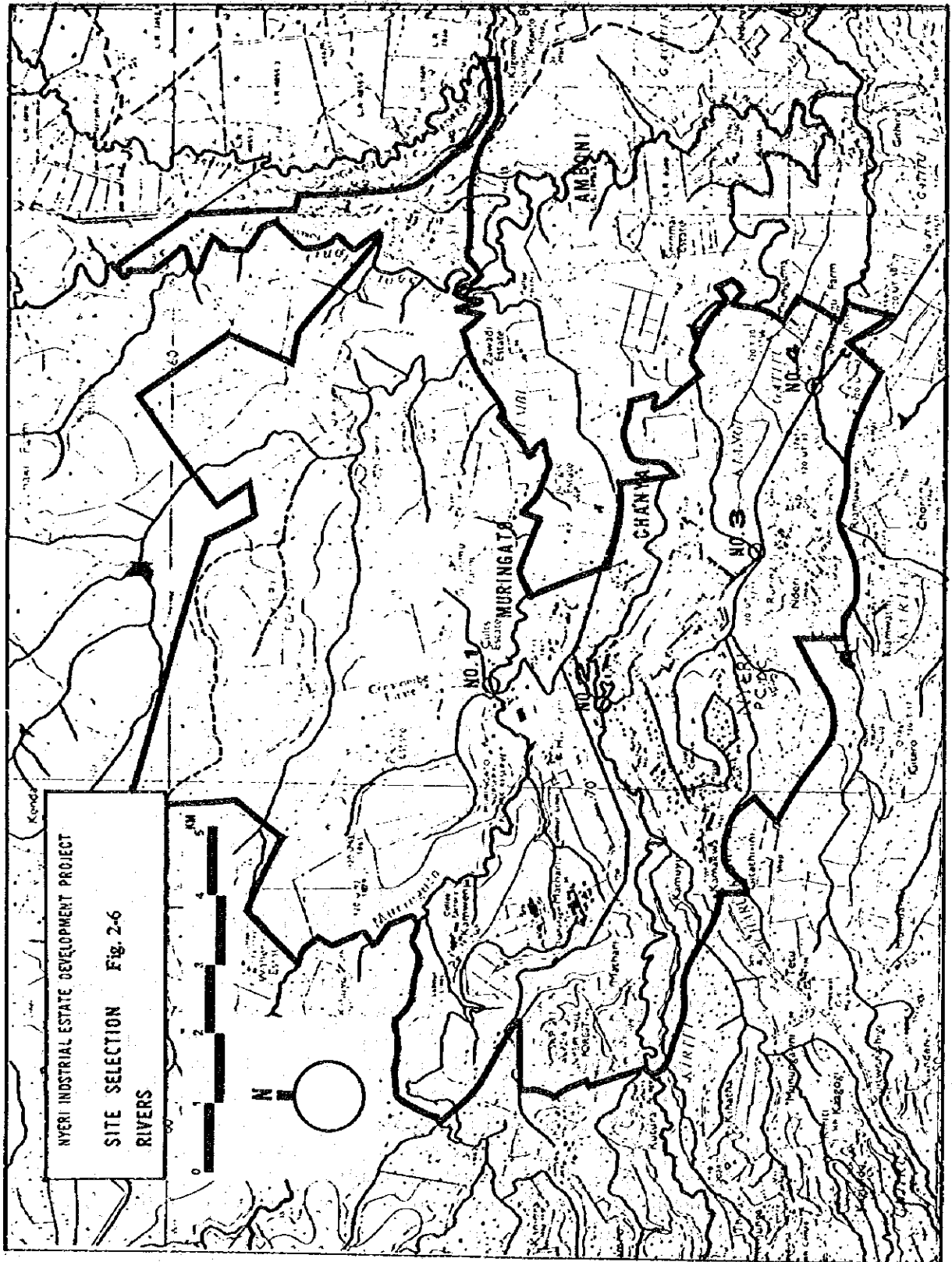


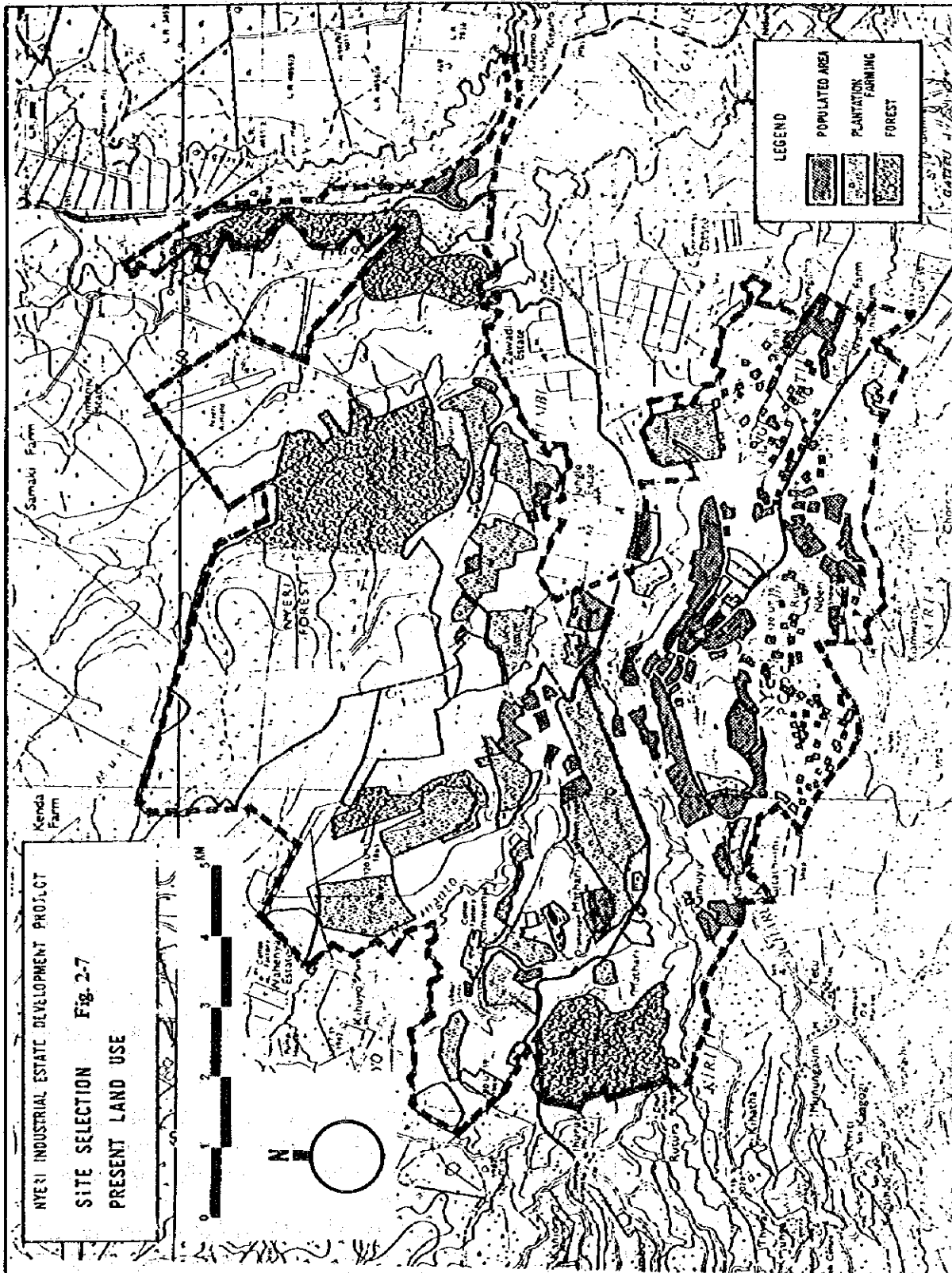
(4) *Present State of Land Use*

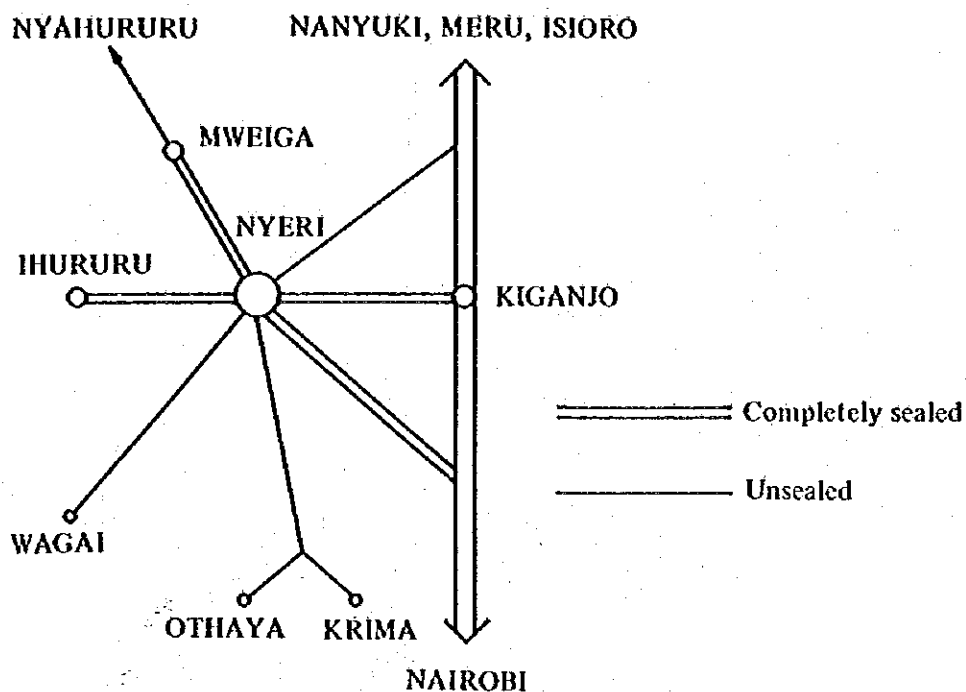
On dividing Nyeri and its environs broadly into a northern and a southern half centered on the Nyeri urban center, we find that many large-scale coffee and tea plantations are distributed in the northern area, while in the southern almost all arable land is occupied by small-scale farms with scattered villages of farmhouses. The Old Municipality, which forms the center of Nyeri, is almost entirely urbanized, and building of housing, public facilities, etc., is being extended even onto the steep slopes (with gradient of about 10% or over) of the valley of the Chanya and other rivers which pass through the urban area. The western side of Nyeri borders on the Aberdare National Park, with forest above 1900-1200 meters a.s.l. Fig. 2-7 shows the distribution of urban areas, villages, large-scale plantations, and forest.

(5) *Present State of Roads*

The Nyeri urban area is at a distance of about 10 kilometers from Main National Route A-2, which links Nairobi with the major cities to the north of Mount Kenya, such as Nanyuki, Meru, and Isiolo, (and is expected to become an international main route in the future by extension to connect with roads in neighboring Ethiopia). However, the Nyeri urban area is connected to the Nation-wide highway Network by two all-weather sealed roads, B5 and C75, and there are good road conditions between the main cities such as Nairobi, Nanyuki, Meru, Muranga, and Thika. However, between Nyeri and other towns or villages there are only seven all-weather roads, as shown following; all other roads are likely to be impassable to vehicles during the rainy season.







Also, an on-the-spot survey of the present traffic volume, measured at two points (A and B), one on each of the roads (B5 and C75) which connect the Nyeri urban area with the Nation-wide Highway Network (A2) (see Fig. 2-8), gave the following results. The cross-sectional traffic volume at point A at the peak times (7:30-8:30 and 14.00-15.00) was approximately 400 vehicles (converted to ordinary passenger cars), and the 24-hour total approximately 3,000-3,500. At point B at the peak time of 12.30-13.30 there was a volume of approximately 420 vehicles (converted as at A), and a 24-hour total of about 2,500-3,000. Compared to the road capacity, the present volume of traffic is extremely small, and the extra volume generated by development of an industrial estate would have very little effect on the existing road traffic of Nyeri.

(6) *Electric Power Supply*

Nyeri obtains its electric power supply from the Sagana Power Station. Transmission voltage is 11 kV line, along the route shown in Fig. 2-9.

The possibility of supplying the power demand of the industrial estate must be discussed with the East African Power and Lighting Company, Ltd. (E.A.P.L.). If supply from the existing transmission lines should not be possible, transmission will probably be made from the Kiganjo Sub-station.

(7) *Water Supply*

The only parts of Nyeri presently supplied with city water are the Old Municipality and a very limited part of the surrounding area. Fig. 2-10 shows the layout of the water supply pipes. The source of supply is the Chanya river in all cases, the the daily supply capacity is approximately 2,700 m³.

The actual volumes supplied in recent years have been: 1974, 763,255 m³/year; 1976, 904,446 m³/year. On conversion to daily volumes, these become 2,091, 2,295, and 2,478 m³/day, respectively, so that the surplus supply capacity in 1976

Table 2-3 Results of Recording Cross-sectional Traffic Volume (Point A)

Traffic Time	(-) Ped.	(0.5) Bic.	(1.0) M.B.	(1.0) T.C.	(1.0) Pas.	(2.0) Pic-Up	(3.0) Bus	(2.5) Rolly	(3.0) Trailer	(0.5) Carriage	*Total
7:25 - 8:30	69	11	2		254	14	11	31		1	400.5
8:30 - 9:30	35	13	1		188	24	3	31	2		336
9:30 - 10:30	23	14	5		160	21	2	27	1		290.5
10:30 - 11:30	25	10	6		158	23	2	37	2		319.5
11:30 - 12:00	5	3	1		63	13	2	11			125
14:00 - 15:00	16	11	2		150	30	7	62			393.5
15:00 - 16:00	20	4	1		117	26	6	11			217.5
16:00 - 17:00	30	11			210	19	9	29			353
17:00 - 18:00	91	16	2		188	18		17			276.5
18:00 - 18:30	31	3			75	5		13			119
Total	345	96	20		1,563	193	42	269	5	1	2,831

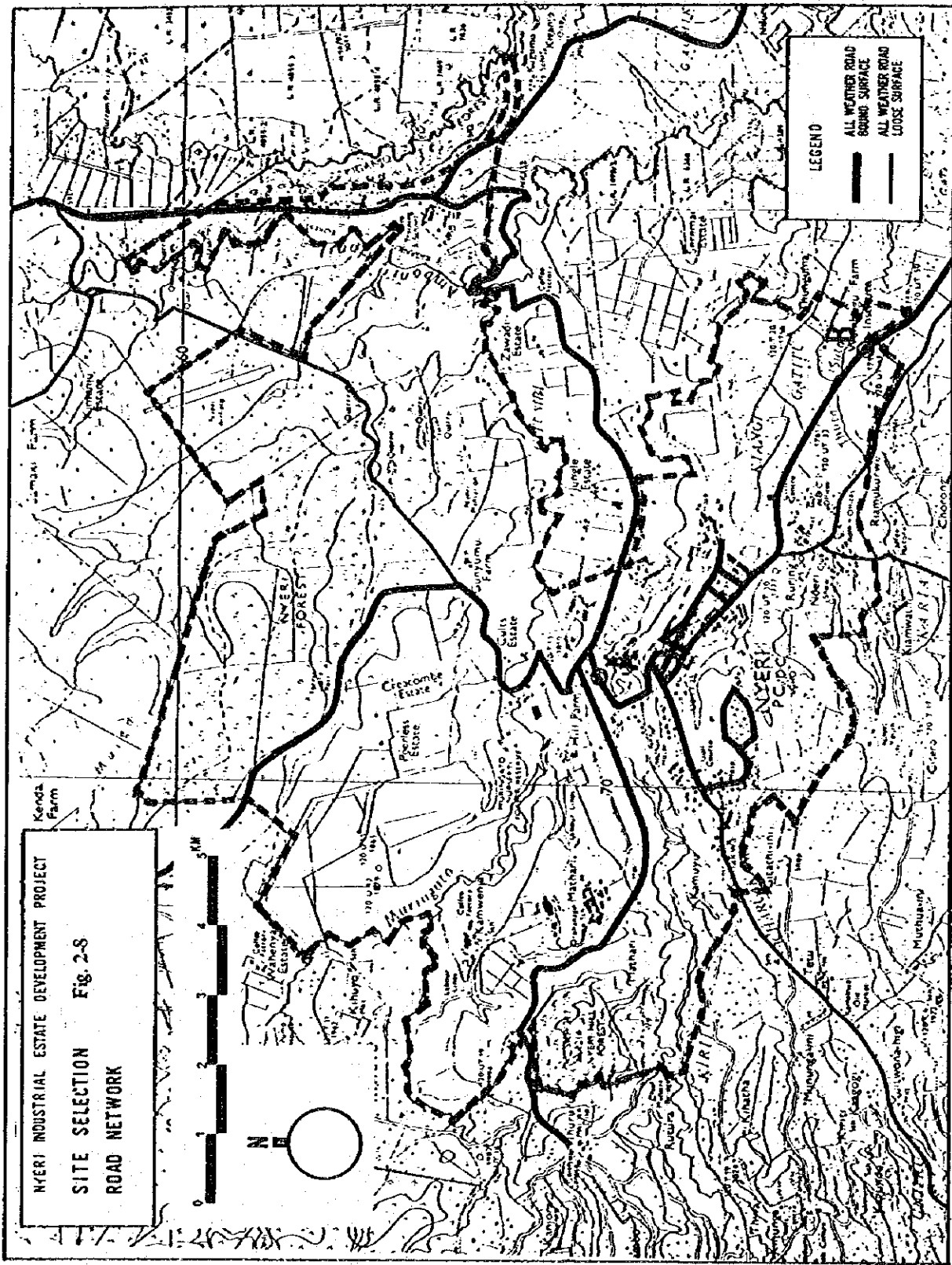
Table 2-4 Results of Recording Cross-sectional Traffic Volume (Point B)

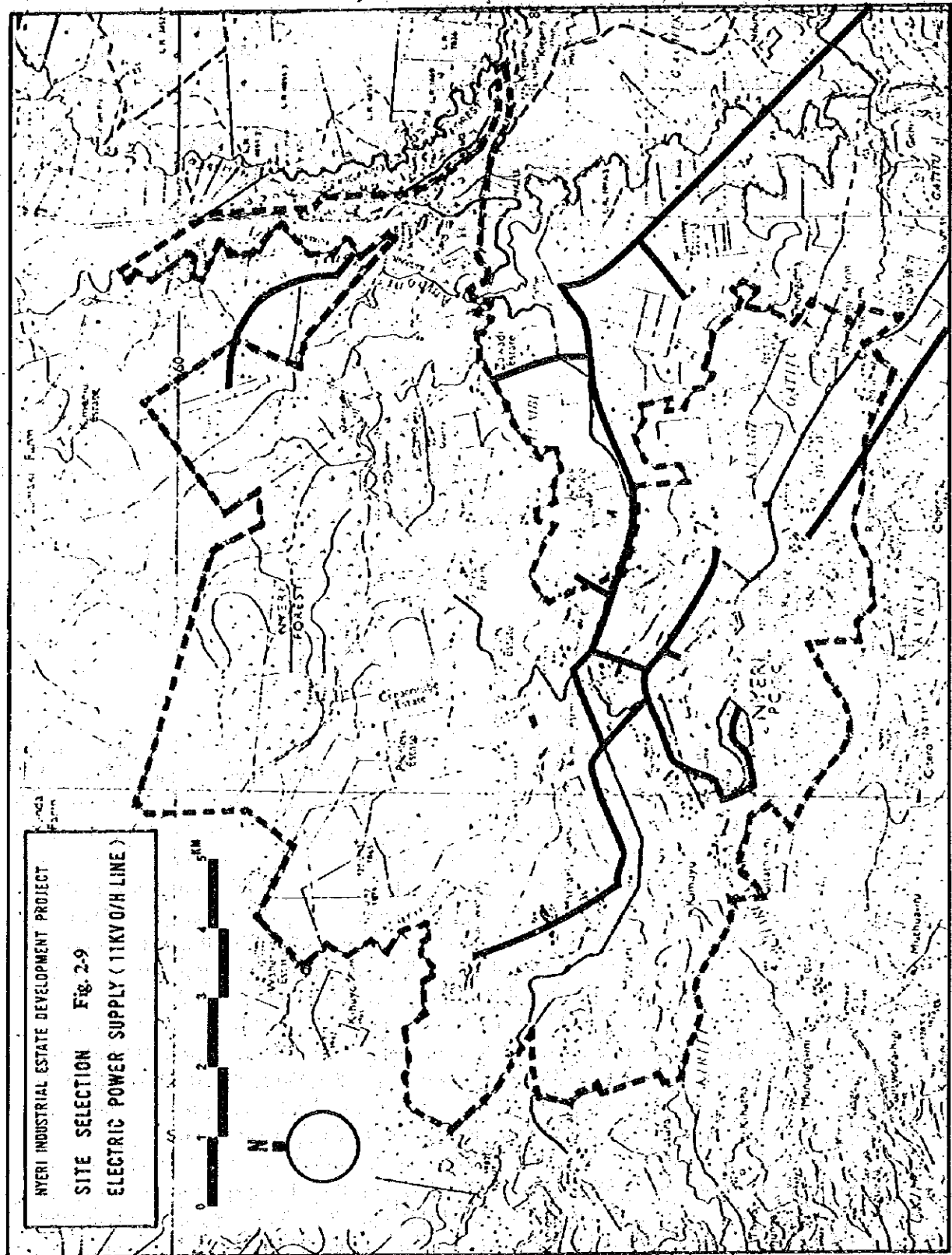
Traffic Time	(-) Ped.	(0.5) Bic.	(1.0) M.B.	(1.0) T.C.	(1.0) Pas.	(2.0) Pic-Up	(3.0) Bus	(2.5) Rolly	(3.0) Trailer	Carriage	*Total
7:30 - 8:30	23	5	1		112	6	12	10			188.5
8:30 - 9:30	15	5	6		103	12	8	9			182
9:30 - 10:30	11	3	4		97	22	6	14	1		202.5
10:30 - 11:30	13	5	3		91	4	8	16			168.5
11:30 - 12:30	28	5			75	15	12	22			198.5
12:30 - 13:30	23	15			128	60	38	20	1		422.5
13:30 - 14:30	22	2	1		55	7	12	16	1		150
14:30 - 15:30	10	2	2		101	6	5	15			168.5
15:30 - 16:30	10	4	4		132	11	6	12	1		211
16:30 - 17:30	24	16	3		136	15	8	15	3		247.5
17:30 - 18:30	29	11	1		104	4	4	14			165.5
Total	208	73	25		1,134	162	119	163	7		2,305

*Converted to Passenger Cars

Table 2-5 Power Generation and Transmission Facilities of Nyeri District

1. Generating Plants			
Name of Plant	Location (Name of River)	Max. Output (kw)	Annual Power Production
1. Sagara Power Station	Nyere district (Sagana)	1,500	10,087,860 (MWH)
2. Tana Power Station (export)	Muranga district (Tana)	3,700	
2. Electric Transmission Facilities			
Name of Sub-station	Location	Installed Capacity	
1. Sagana Sub-station	Nyeri district	2,250 kw	
2. Kiganjo Sub-station	Nyeri district	2,500 kw	
3. Karatina Sub-station	Nyeri district	2,500 kw	
4. Tumu Tumu Sub-station	Nyeri district	150 kw	





stood at only about 200 m³/day. There is a plan to raise the supply capacity to 3,000 m³/day in the future, but in view of the rate of population increase in the Nyeri urban area (about 15% annually) there is an obvious need to further expand the supply.

If it should prove impossible to supply the extra demand for tap water and industrial-use water created by the industrial estate development, the use of river water or ground water must be studied.

Present State of Water Supply for Nyeri:

1. Source:	Chanya River
2. Supply capacity:	2,802 m ³ /day
3. Actual supply, 1974:	763,255 m ³ /year
1975:	837,813 m ³ /year
1976:	904,446 m ³ /year
4. Districts supplied:	Nyeri Old Municipality and part of surrounding area

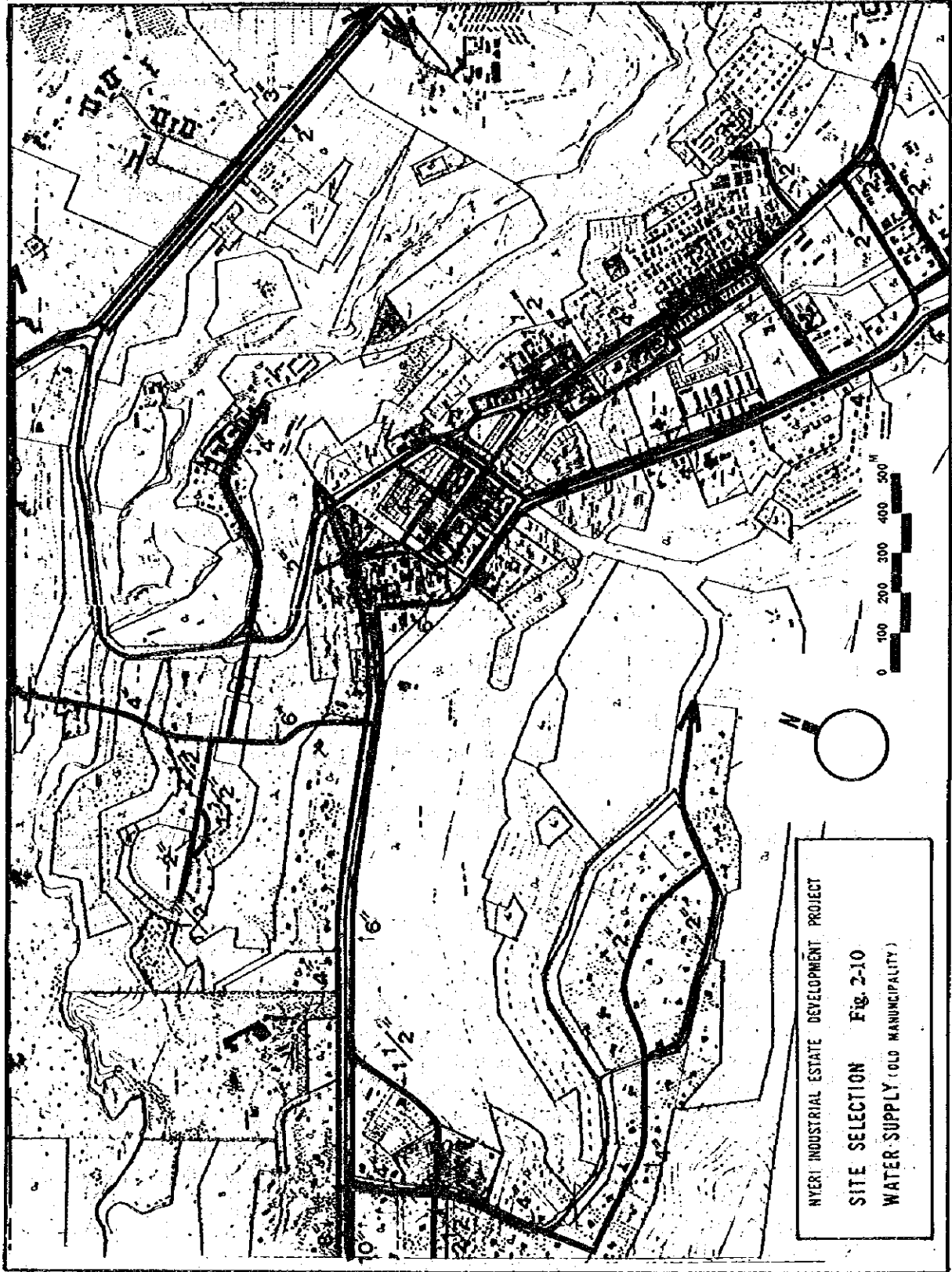
(8) Land Use

All land in the urban area of the Old Municipality is state-owned, private land ownership not being permitted in this area. Outside of the Old Municipality, the form of land ownership can be divided broadly into two types along the Chanya River. The land to the south of the river is privately owned, subdivided into small-scale farms, and dotted with countless villages of farmhouses. To the north of the Chanya River, on the other hand, the land is rented from the government, and is used for large-scale coffee and tea plantations. The Chanya River thus forms a dividing line not only between the types of land ownership, but also, as a result, between types of land use.

2-3 Future Population of Nyeri District

When future population increase is estimated at a low rate for the Nyeri urban area (7.5% during 1969-1980, and 7.85% during 1980-2000), population figures of approximately 22,700 in 1980 and 104,700 in 2000 are obtained. When the same estimates are made assuming a high rate of growth (i.e., 9.6% during 1969-1980, and 10.3% during 1980-2000), the 1980 population becomes approximately 27,400 and that of 2000 becomes approximately 122,900. These figures represent increases over the present population (estimated as 20,000) of some 3,000 to 7,000 by 1980, 25,300 to 27,900 by 1990, and 74,800 to 83,800 by the year 2000. On the other hand, however, the development plan calls for approximately 84 ha of new residential land, which can accommodate only about 16,000 to 25,000 people, assuming a population density of 200 to 300, so that there is a risk of a housing shortage arising as early as 1980.

Further, if an area of approximately 30 ha were newly developed for industrial use, the expected new labor demand would require approximately 3,000 to 4,000 persons (assuming a labor demand of 100 to 150 persons per hectare of industrial land). The predicted new working population in the Nyeri urban area, estimated from the future population increase figures on the basis of one worker per three persons in the population, amounts to 1,000 to 2,300 in 1980, 8,400 to 9,300 in 1990, and 24,900 to 27,900 in 2000. Further, the surplus working population that would be generated in the Nyeri District is estimated at 40,000 in 1980, 105,000 in 1990, and 250,000 in 2000. This demand for employment opportunities would be extremely difficult to fill on the present scale of industrial development.



As seen above, urban development within the existing Old Municipality is expected to reach the limits of accommodating population increase and meeting the demand for employment by 1980, after which urban and industrial development outside the Old Municipality will become necessary.

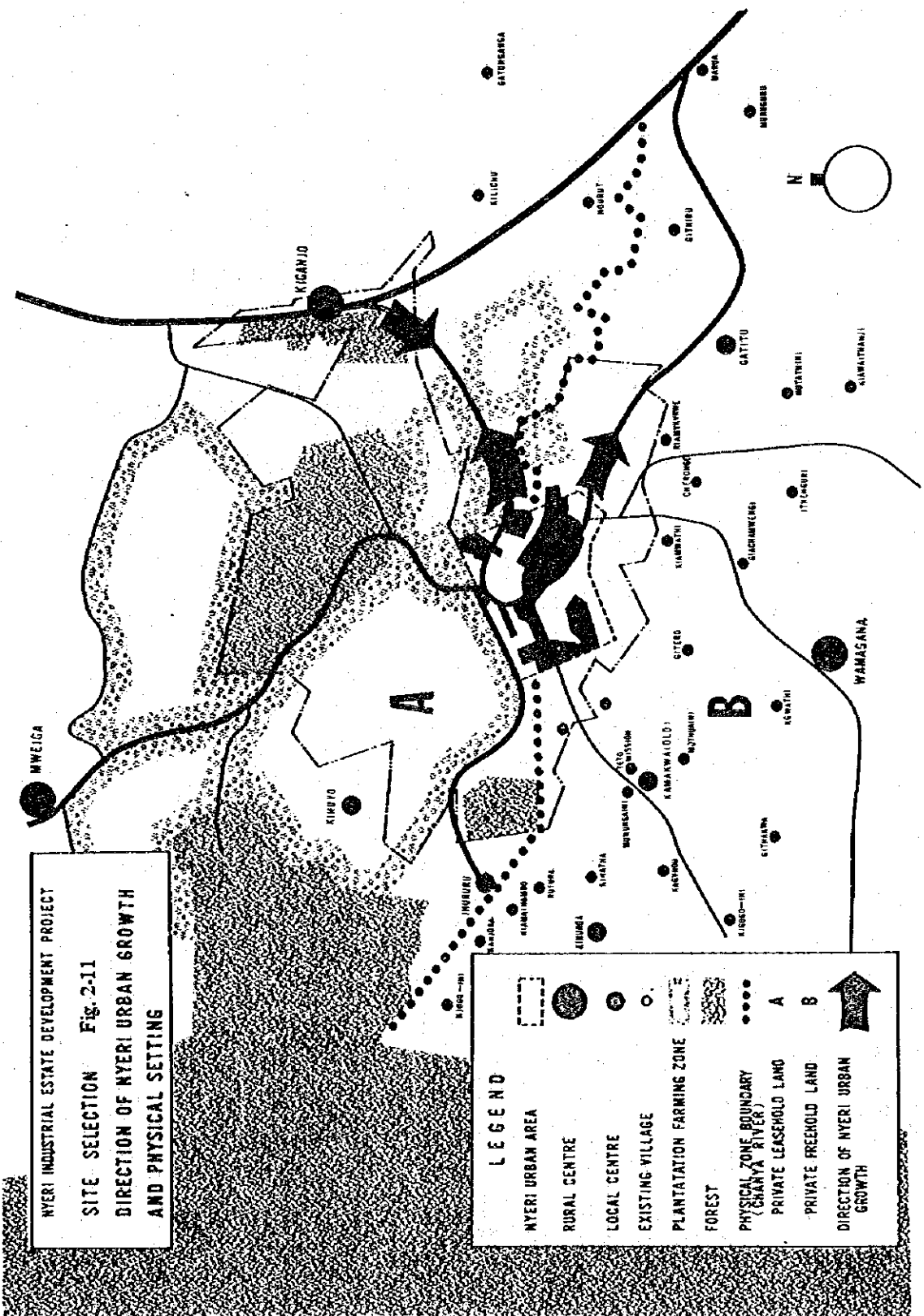
Future urban growth beyond the Nyeri Old Municipality is expected to advance toward the axis of development of the Central Province, i.e., the Nation-wide Highway Network (A2) which links Nairobi and Nanyuki, Meru, etc., and the land alongside the two roads which connect with the trunk road, i.e., Kenyatta Road (B5) and Wangombe Waihura Road (C75), has high development potential. The latter road, in particular, has high potential for industrial development from the standpoint of distribution, since it gives access to the rural center, Kiganjo, and also to a railway station. Urban and industrial development along this road is considered desirable for the future. (See Fig. 2-11.)

2-4 State of Urban Development and Town Planning in Nyeri

Up to 1960, urban development consisted mainly of the formation of the central urban area around the framework of Route B5 (Kenyatta Road, which is connected to Route A2 which links the major cities north of Mount Kenya such as Nairobi, Nanyuki, and Meru), and the Kimathi Way, which runs parallel with B5 and is the main urban route of Nyeri. Mainly residential development also took place along Baden Powell Road, which extends to the north of the urban center. Further, on the Chanya Road (B5) and Wangombe Waihura Road (C75), which run from the urban center around the Chanya River Valley to Kiganjo, are situated two public facilities, namely a government nursery school and a prison. However, there are no business premises, dwellings or factories, (except for one sawmill and two flour mills in the Chanya River Valley), as the valley forms a barrier to urbanization. Further, by 1960 almost all of the flat land available for development (with gradient of 10% or less) within the Old Municipality had already been built on, and no land on which large-scale development was possible was left even at that stage.

Consequently, the urban area has shown very little change between 1960 and the present day, apart from some new urban construction extending toward the valley. (See Fig. 2-12.)

In the new urban development plan for the Old Municipality established by the Physical Planning Department of the Ministry of Land Settlement (Fig. 2-13), the future trend of new urban development includes, as large-scale features, residential development (approximately 35 ha) and the establishment of a technical secondary school (approximately 18 ha) alongside the golf course to the west of the central urban area. There are also a residential land development on flat land in the Chanya River Valley (7 ha), and a total of about 30 ha of industrial land development and 11 ha residential land development (including 1.4 ha for a primary school) dispersed in several lots along the Chanya Road and Wangombe Waihura Road to Kiganjo, and also within the existing factory sector. Apart from the above, only the very small remaining area of flat land (including some of over 10% gradient) adjacent to the existing urban area is being brought in as residential land.



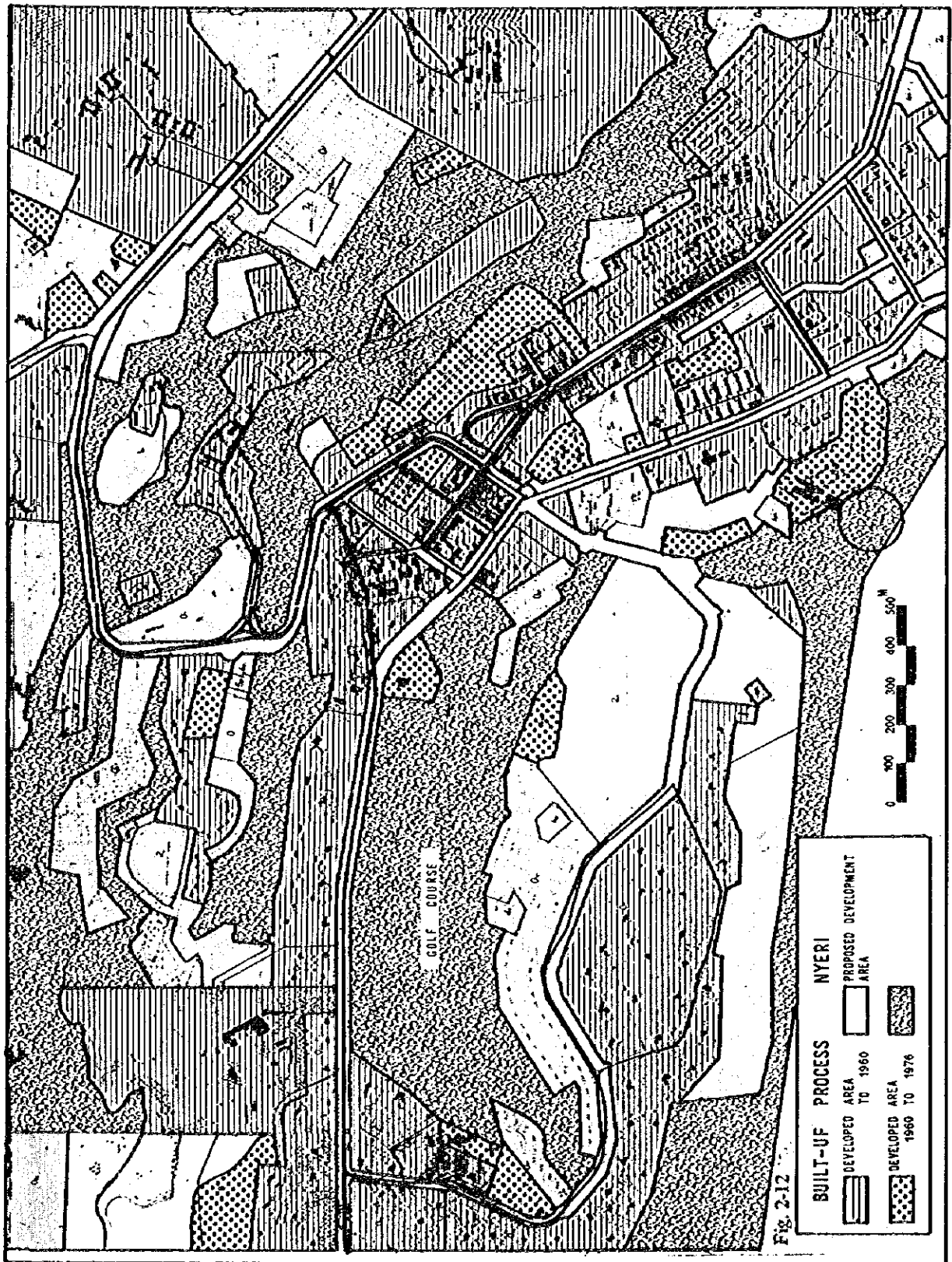


Fig. 2-12

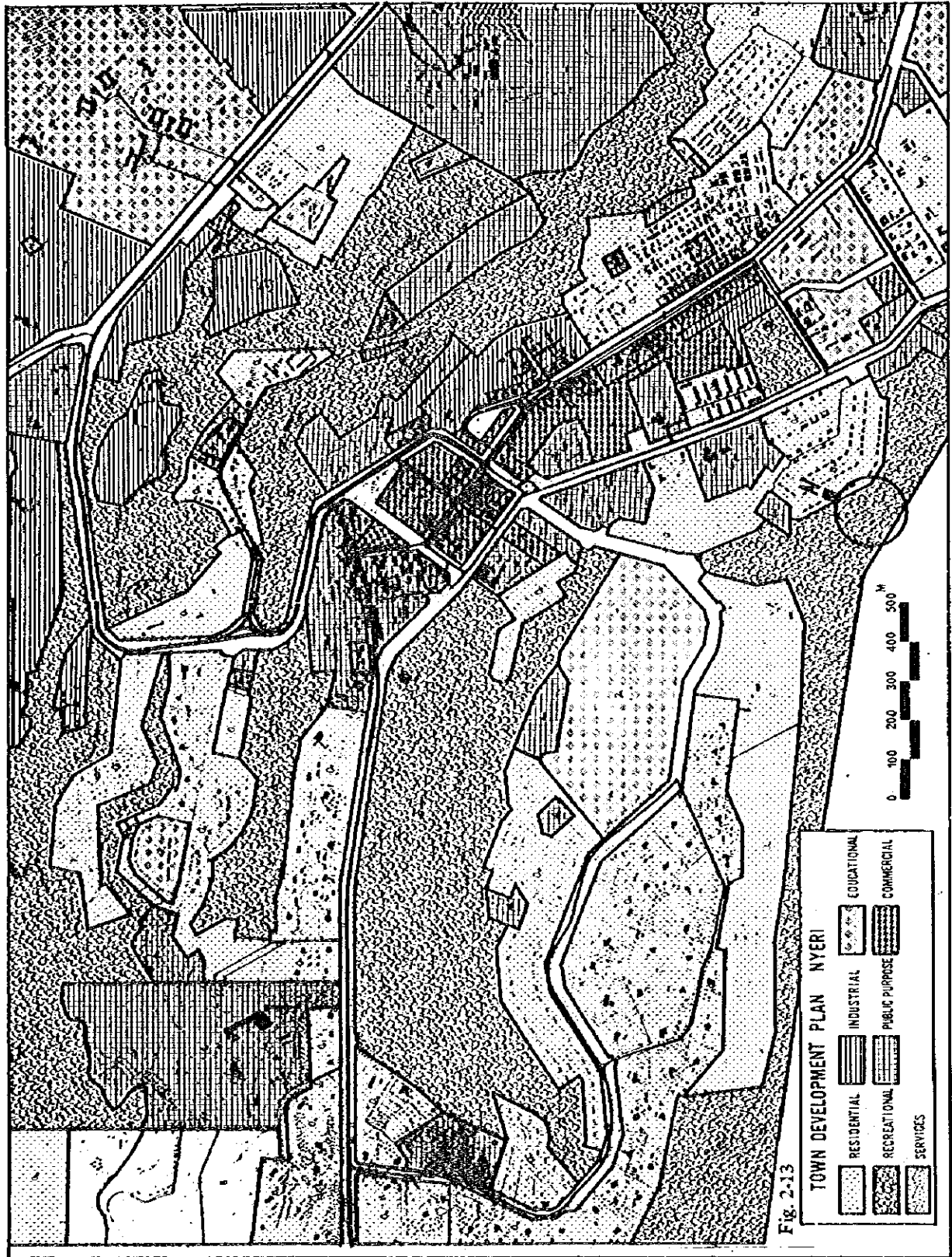


Fig. 2-13

When the above-mentioned new development areas have been urbanized, there will be no further land available for this purpose (i.e., with a gradient of 10% or less) within the Old Municipality.

Sizes of New Residential Land Development, by Intended Use

1. Residential	84 ha
2. Industrial	30 ha
3. Educational	22 ha
– Technical Secondary School (1)	18 ha
– Primary Schools (2)	(2.4 ha) (1.4 ha)
– Nursery Schools (2)	(0.4 ha) (0.2 ha)
4. Recreational	0 ha
5. Public Purpose	9 ha
6. Commercial	3 ha
7. Service	0 ha
8. Total	148 ha

2-5 Long-Distance Interurban Connections

The relationships between Nyeri and other cities were studied from the results of an on-the-spot traffic survey. The following main cities were found to have a large number of motor vehicles traveling to or from Nyeri; (total number of vehicles at two survey points: 2,236).

As shown in Table 2-6, the greatest traffic flow is that on the Nyeri-Karatina route, which suggests that Karatina is the largest center of commercial distribution activities in the vicinity of Nyeri. The next largest flow is that to and from Nairobi, showing the very great influence of Nairobi on Nyeri. The flow to and from Kiganjo, which is the third largest, is unexpectedly small for the closest rural center to Nyeri. The greatest connection with Nyeri among the urban centers of the Central Province is shown by, in descending order, Nanyuki, Meru, Muranga (which is outside the Central Province), Embu, Nyahururu, and Thika. Among the rural centers, the order is Karatina, Kiganjo, Mweiga, Mukuruweini, Naromoru, Sagalki, and Kerugoya.

Classified by region, the traffic within the Nyeri Municipality makes up approximately 27% of the total, while that within the Nyeri District accounts for approximately 71%. Well-traveled routes outside of the Nyeri District are those of the Muranga and Kirinyaga Districts, whereas there is very little traffic in the Kianbu and Nyandarua Districts.

Classified by purpose of travel, the proportions of the total number of trips are as follows: business, 70.4%; returning home, 9.3%; amusement and sightseeing, 3.8%; attending school, 3.0%; shopping, 1.2%; and commuting, 1.0%. By far the highest proportion is that of business trips. Shopping and commuting by car is seen only rarely, even less often than travel by car to attend school. By region, the distribution of business trips is almost the same as that of the regional relationships of the total traffic flow, but trips for school attendance, shopping, and commuting occur mostly within the Nyeri District as a whole (with practically no travel of this kind in rural areas), and to a lesser extent in the range of Sagana, Muranga, and Nanyuki. (Travel to school is also seen from Nyahururu, Meru, Kerugoya, and Kianyaga, indicating the wide degree served by the educational facilities of Nyeri.) Fig. 2-14 shows the estimated distribution of the

Table 2-6 Cities with Large Traffic Flow to or from Nyeri

Name of Cities	To Nyeri	From Nyeri	Total
1. Karatina	162	181	343
2. Nairobi	110	147	257
3. Kiganjo	118	113	231
4. Kingougo	67	94	161
5. Mweiga	95	61	156
6. Ihururu	89	61	150
7. Mathari	56	54	110
8. Nanyuki	55	40	95
9. Mukurweini	30	41	71
10. Meru	32	18	50
11. Muthinga	22	24	46
12. Muranga	14	18	32
13. Embu	15	15	30
14. Naro Moru	19	10	29
15. Nyahururu	10	18	28
16. Sagana	5	16	21
17. Nakuru	1	16	17
18. Kerugoya	-	12	12
19. Thika	4	5	9
Total	904	944	1,848

Total: 2,236

Table 2-7 Number of Trips by Purpose

	Total Number in Survey	Number Valid (%)	Number Invalid (%)	
Number of Vehicles	2,546	2,236 (87.8)	310 (12.2)	
Number of Vehicles by Purpose	A Commuting	39 23 (59.0) (1.0)*	16 (41.0)	
	B Attending School	85 68 (80.0) (3.0)*	17 (20.0)	
	C Returning Home	239 209 (87.4) (9.3)*	30 (12.6)	
	D Shopping	35 26 (74.3) (1.2)*	9 (25.7)	
	E Amusement, Sightseeing	97 85 (87.6) (3.8)*	12 (12.4)	
	F Business	1,871 1,573 (84.1) (70.4)*	298 (15.9)	
	Sub-total	2,366	1,984 (83.9)	382 (16.1)
	Others	180	252 (11.3)*	-72
Number of Passengers	13,001	11,750 (90.4)	1,251 (9.6)	

Number Valid: Number of vehicles or passengers whose trip started and ended within the map area.

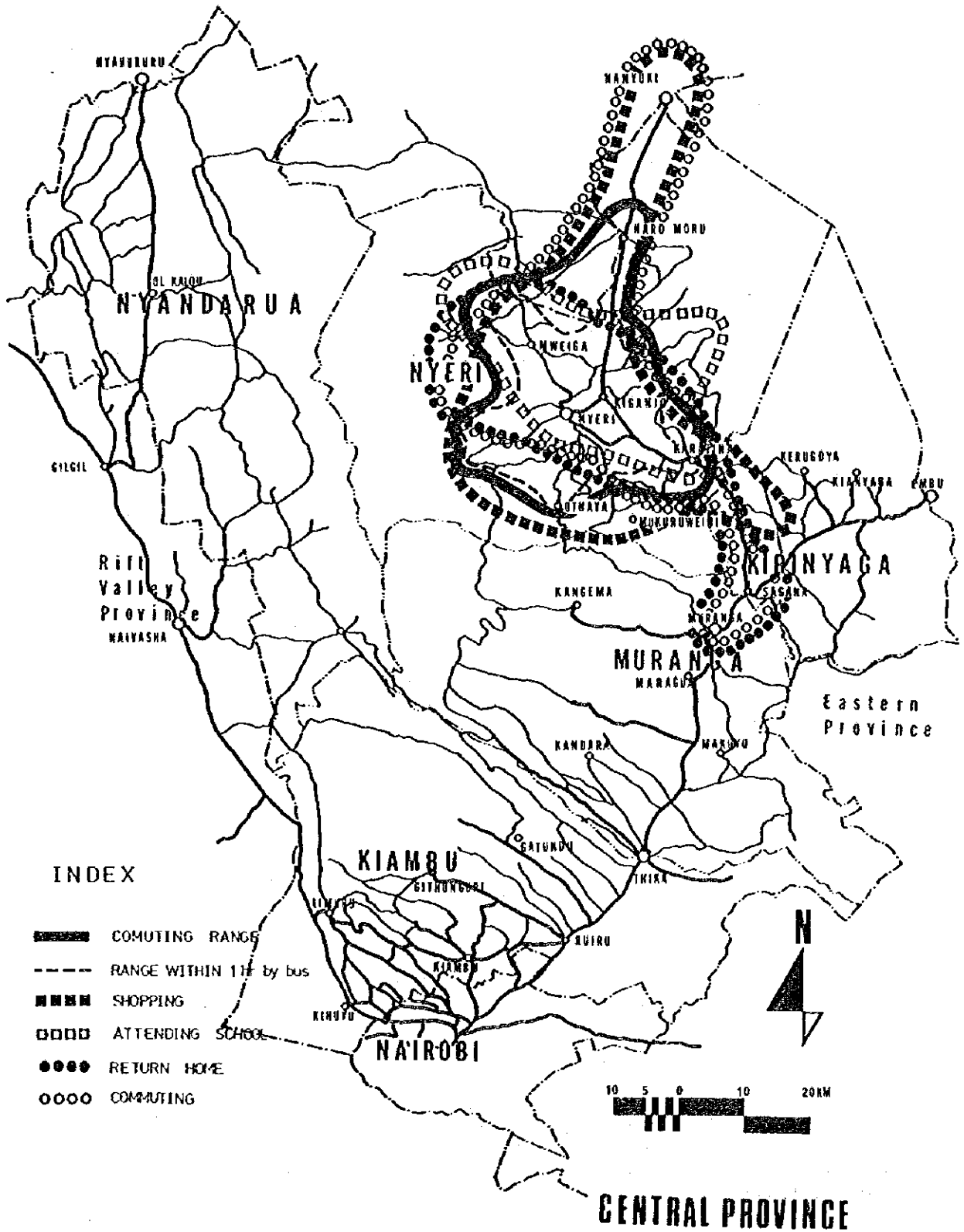
Number Invalid: Number of vehicles or passengers whose trip did not start and end within the map area.

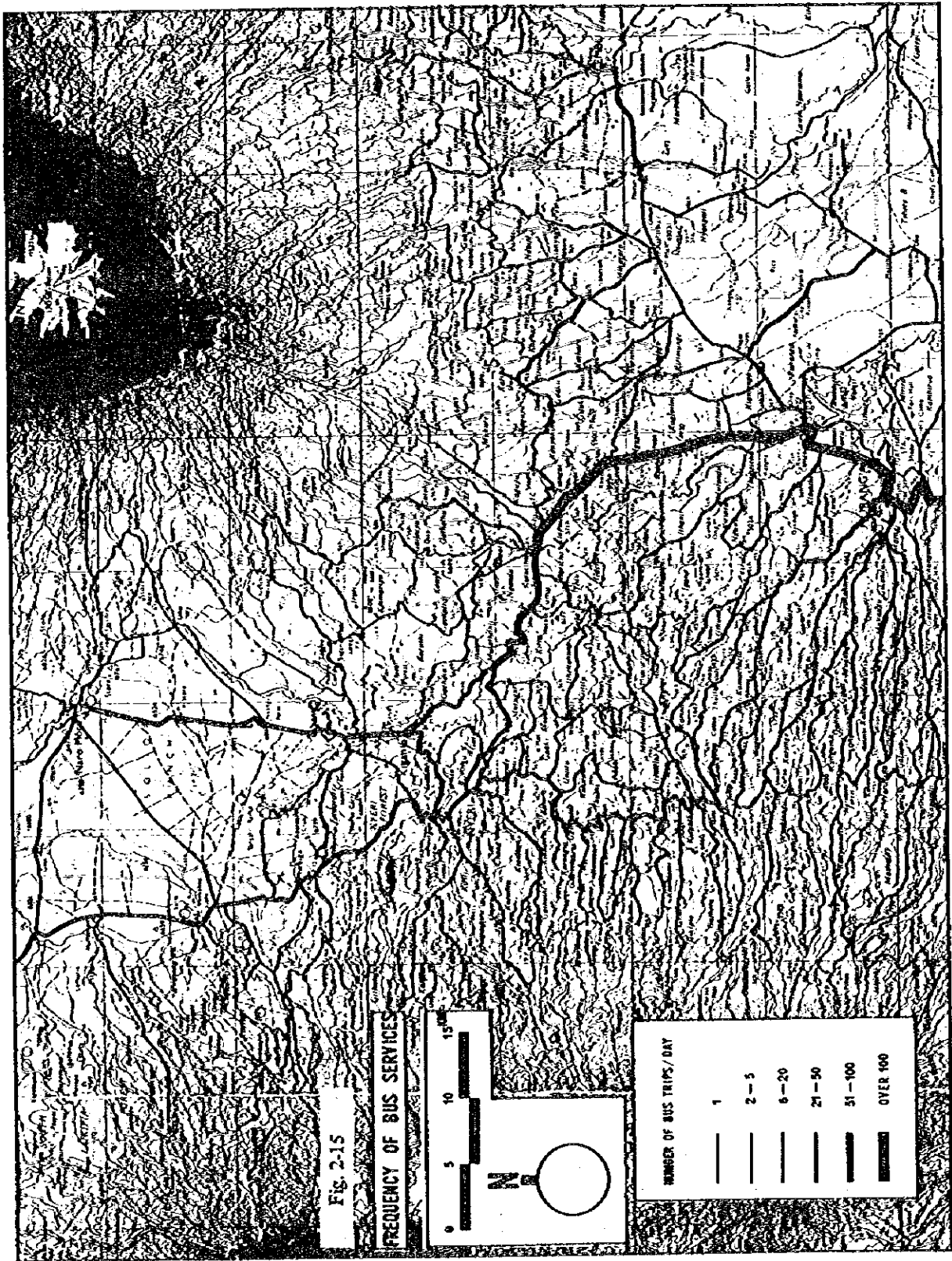
()*: Percentage of total number of vehicles, by purpose.

The imbalance of total figures is due to the fact that all subjects who replied to any part of the survey were included as valid numbers.

(Purpose and number of passengers were not investigated during the rush hours.)

Fig. 2-14 Ranges of Daily Activities (Centered on Nyeri)





main areas of departure for trips with each of these purposes, and can be taken to represent the range of service areas for daily activities in Nyeri. Further, the range within one hour of Nyeri by bus (given a speed of approximately 40 km per hour) has been added, based on the state of bus services shown in Fig. 2-15; the average of all of these ranges was taken to represent the range within commuting distance of Nyeri. The results show that this range includes Naro Moru and Mweiga to the north, Karatina and Othaya to the south, and approximately 80% of the population distribution districts of the Nyeri District (i.e., the districts south of Nyeri).

2-6 Industry in the Nyeri District

The economy of the district is based on agriculture, predominantly in the form of small farming. The main cash crops are coffee, tea, and Pyrethrum, and dairy farming is also most developed in this district. Forestry, supported by a systematic afforestation plan, and inland fisheries are also important industries. Active commerce is carried on in the district's market centers (Nyeri, Karatina, Othaya, Mukurweini, etc.), of which the Karatina market is especially prosperous as a material receiving and distributing center. As for manufacturing industries, while there is a basic complement of local-market-type industries, the level of industrialization is extremely low, with the only basic industries being some of the local resource processing type.

Agriculture

In agriculture, the district's basic industry, the farmers' purchasing power is improving due to increased production of cash crops and increase of livestock herd size, and the market for industrial products and services is therefore growing.

Coffee is the most important crop; coffee processing factories are scattered throughout the district. The next major crop is tea, which is produced by 8,963 farming households. Production shows an upward trend, as follows:

1971	4,574,740 kg
1972	9,029,108 kg
1973	9,823,933 kg
1974	10,980,250 kg

Pyrethrum is also an important crop, but the yield has levelled off.

Cattle farmers are in the process of converting from the indigenous breed to improved breeds for milk production, with the dairy industry showing corresponding growth. A cooperative dairy factory, the most modern exporting factory, has been established in the district. Other domestic animals raised, though on a small scale, are sheep, goats, pigs, poultry, donkeys, etc. Crops grown for home or local consumption include maize, beans, potatoes, and cabbage.

Considerable leeway remains for development of the relationship between these agricultural sectors and industry. The growth of agriculture means, at the same time, the growth of the market for industrial products, and the stepwise progress of industrialization of this district must go hand in hand with agriculture.

Forestry

The forest resources of Mount Kenya and the Aberdare Range are under the management of the governmental Forestry Administration. The utilization of these timber resources forms an important industry of the district. The trees are softwoods such as cypress and pine. The development and use of these resources constitutes another important part of the industrialization plan.

Manufacturing Industries

Manufacturing industry in the Nyeri district is still at an elementary stage. Existing industries are outlined below:

- Lumber Industry:** Based on the above-mentioned lumber resources, there are a number of scattered small sawmills. There are also several large milling factories such as the Yacob Dean (Karatina), Wananchi Sawmills (Nyeri) and the Aberdare Sawmills.
- Dairy Factories:** The Kenya Co-operative Creameries have plants at all of the major centers throughout the country. One of these is located within this district at Kigango. It collects milk from both within and outside the district, and ships it mainly as milk powder.
- Tea Processing:** Tea factories are located at Chinga and Ragati, and a third is now under construction.
- Bakeries and Cake Manufacturers:** There are two plants in Nyeri and one in Karatina, all on a small scale; with the expansion of demand, however, the demand for establishment of more plants is increasing.
- Printing:** Printing and bookbinding firms suited to the demand in the district are in operation.
- Beverages:** A mechanized and automated factory is located in the district, with a relatively extensive market.
- Furniture:** A medium-sized company with a registered factory and a staff of over 50 is located in the district, but apart from this the workshops are on a cottage industry scale, leaving scope for development.

Tourism

The Nyeri district contains two national parks: Mt. Kenya National Park and Aberdare National Park. These are well provided with facilities suitable for an international tourist area, especially the famous "Treetops." There are popular tours, particularly around the foot of Mt. Kenya or combined with Thompson's Falls in Nyahururu and other features; there is considerable scope for future development in this field.

Commerce

Nyeri and its sister city Karatina form the hub of commercial distribution in the district around Mt. Kenya. Many large enterprises have depots here, and further development as a distribution center can be expected. The Karatina market is active as one of the largest markets in the Central Province.

2-7 Social Environment

As the heart of the area inhabited by the Kikuyu tribe, which forms the political and economic leadership stratum of Kenya, the Nyeri district has produced many prominent figures. From the viewpoint of labor supply also, it has adequate potential for furthering industrial development in terms of both quality and quantity.

This district also has a high motivation toward Kenyanization and investment in industry.

2-8 Conditions for Industrial Development

The consumer market consists of 440,000 persons in the Nyeri District proper (1975 estimate), and 2.475 million persons in the extended Nyeri district. The purchasing power for industrial goods based on this population forms one of the basic conditions for industrial development.

The basic industry supporting the district economy is agriculture; the regional market discussed above will expand together with the development of agricultural production. Consequently, industrial development will gain effectiveness by encouraging the development of agriculture. It is desirable to establish a project which integrates the following three elements: (1) industrial production for the agricultural market; (2) industrial projects which use agricultural products as raw materials; and (3) development of new agricultural production.

We shall now discuss the conditions of industrial location for two types of industrial grouping. The first type, shown in Fig. 2-16 (1), is industry of the local market type, such as cereal milling, bread and cake manufacture, etc. The distribution of this type of industry is dispersed according to the size of the regional market. However, study of the location of the second type, the machinery industry (Fig. 2-16 (2)) shows it to be restricted to limited areas such as Mombasa, Nairobi, Nakuru, Kisumu, Eldoret, and Kitale. In the case of the Nairobi district, the phenomenon of dispersion of industrial location into the adjacent Kiambu district to the north and Machakos district to the south has appeared. When the development of export-type industry in the Nyeri district, which is still very weak, is viewed in the light of such a trend in location, the first signs can be seen of a trend of entry of basic industries which can be expected to lead to the establishment of related industries, as is shown by the recent location of a polyester textile factory in Nanyuki and a Coca-Cola bottling plant and regenerated tire factory in Nyeri. The conditions for such establishment of small-scale industry in connection with the basic industries (i.e., supporting industries) are expected to improve in the future.

Although there are few resources worthy of special mention in regard to high-level processing of regional resources, full use of the forestry resources will serve as a basis for establishment of small-scale industry.

2-9 Forestry Resources of Nyeri District

The resources of this district which are worthy of special mention are those of its forests. In considering these, the areas to be studied are those shown in Fig. 2-17. In the following pages, these forest areas are classed as natural or artificial forest and are discussed and assessed in terms of lumber resources for industrial use.

Fig. 2-16 (1) Distribution of Factories (Grain Milling, Bread, Cocoa, Sugar, Cake)

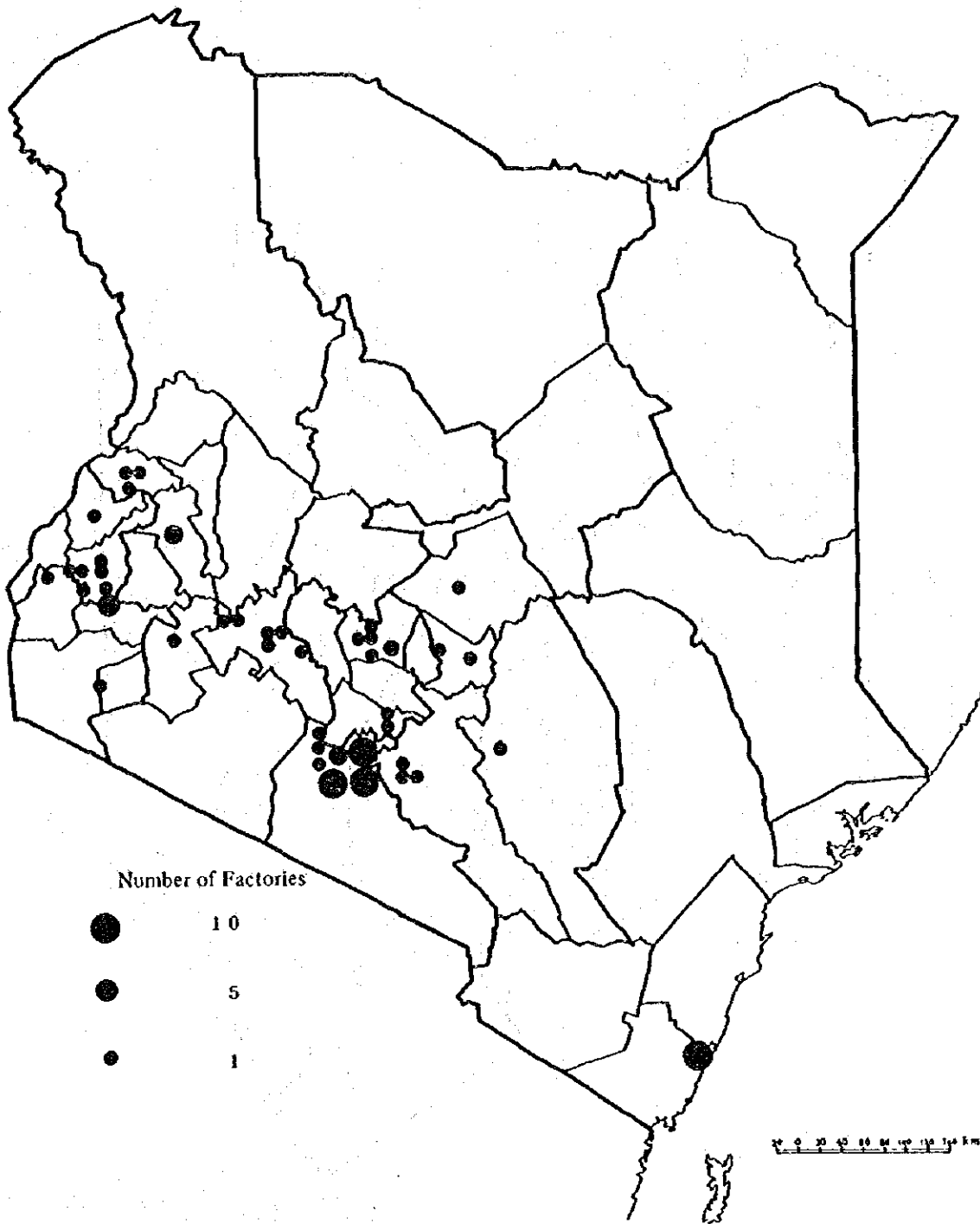
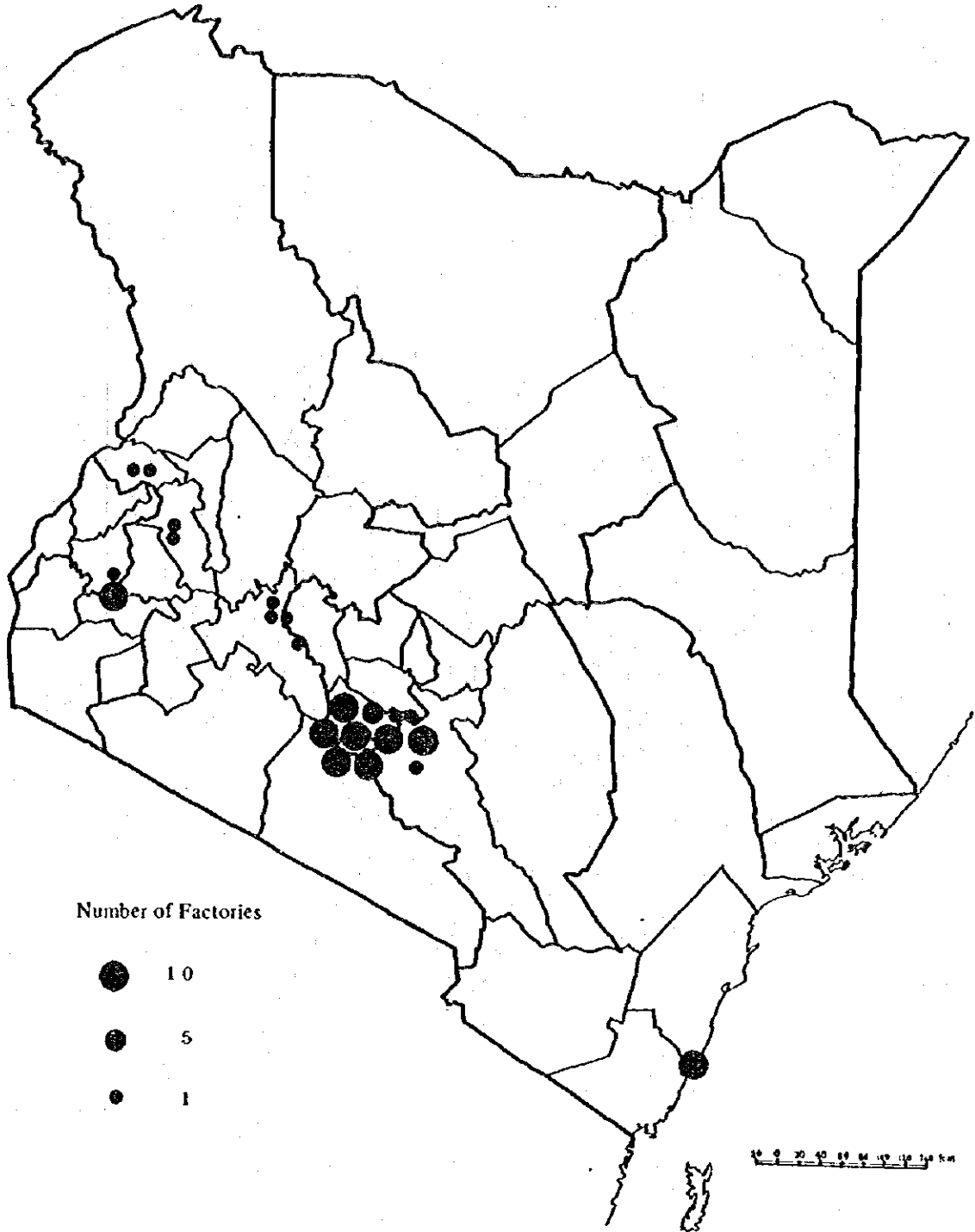
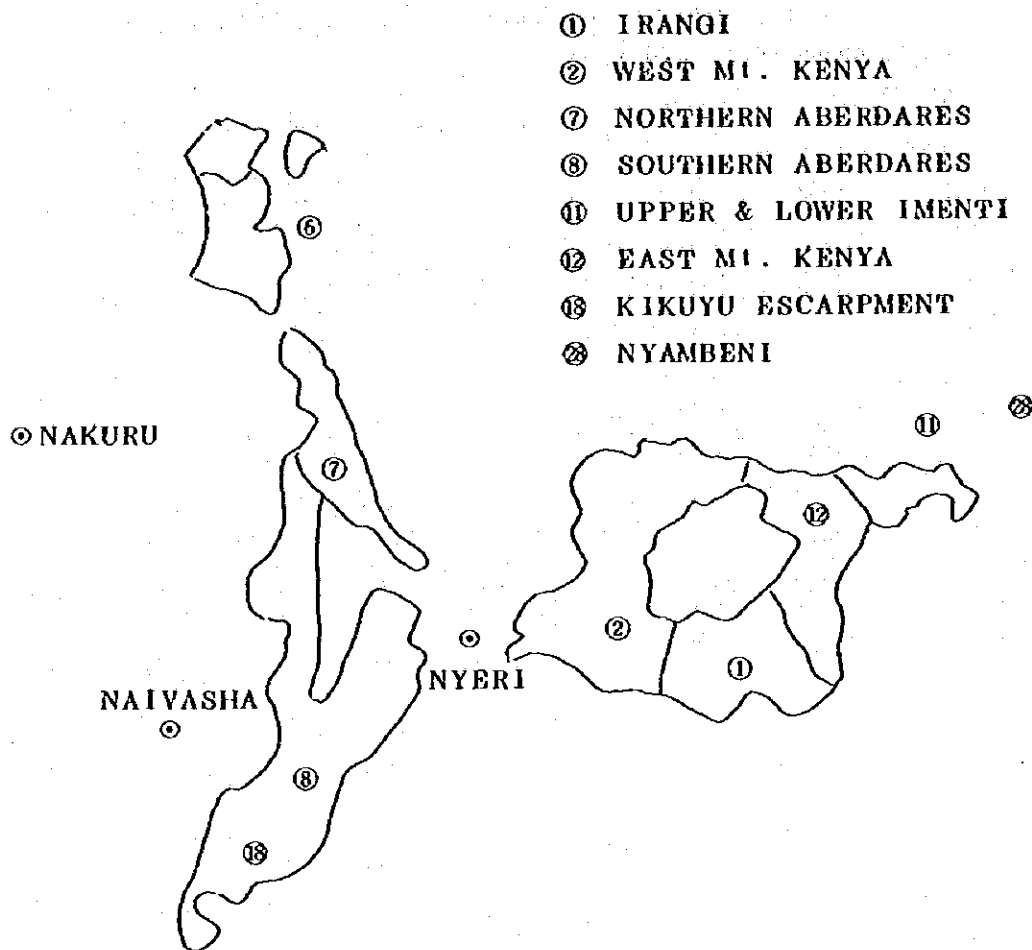


Fig. 2-16 (2) Distribution of Factories (Machinery, Electrical Machinery, Transportation Machinery)





2-9-1 Trees of Natural Forests

Although these forest areas are in the tropical region, those in the vicinity of Mt. Kenya include upland species, and the flora shows much resemblance to that seen in cold-temperature forests.

Fewer species are found in these forests than in rain forest zones; survey reports estimate the number as about 60. Viewed overall, broad-leaved species (angiosperms) are dominant in the tropical forest flora of low to medium altitudes, and needle-leaved species (conifers) are dominant in the high-altitude warm-temperate forest type of flora.

Although these trees have been used by the inhabitants since the days of subsistence living, they have only a brief history of economic (commercial) use, and much of the forests remains in its natural state.

In a sampling survey conducted by the Kenyan government, the tree species and their cumulative amounts have been divided into those for "commercial use" and "noncommercial use." Table 2-8 shows the species and cumulative amounts in the areas intended for development as reported by this survey.

Table 2-8 Cumulative Amounts of Tree Species in Each Forest Area

1) Cumulative Amounts of Economic Forest

Forest Area No.*

(Unit: m³)

	1	2	7	8	11	12	18	28	Total Species
<i>Ocotea usambarensis</i>	1,518,575 (24.6%)	189,064 (3.2)	—	108,664 (4.5)	—	811,934 (16.9)	119,652 (8.7)	214,609 (16.5)	2,962,498
<i>Juniperus procera</i>	—	746,175 (12.8)	1,680,820 (51.7)	622,134 (25.8)	10,988 (0.9)	401,266 (8.4)	26,649 (1.9)	—	3,488,032
<i>Podocarpus milarjianus</i>	667,162 (10.8)	1,966,626 (33.8)	617,772 (19.0)	211,012 (8.7)	53,610 (4.3)	1,590,310 (33.2)	109,513 (7.9)	89,605 (6.9)	5,305,610
<i>Podocarpus gracilior</i>	—	141,430 (2.4)	25,630 (0.8)	—	—	—	—	—	167,060
<i>Ocotea kenyensis</i>	—	7,986 (0.1)	—	—	—	—	—	—	7,986
<i>Olea hochstetteri</i>	65,929 (1.1)	298,096 (5.1)	144,036 (4.4)	9,176 (0.4)	4,276 (0.3)	55,479 (1.1)	15,349 (1.1)	23,959 (1.9)	616,300
<i>Olea welwitschii</i>	—	—	—	—	41,461 (3.3)	—	—	—	41,461
<i>Ekebergia rueppelliana</i>	11,130 (0.2)	41,319 (0.7)	7,703 (0.2)	17,134 (0.7)	12,291 (1.0)	30,189 (0.6)	10,733 (0.8)	7,108 (0.5)	137,607
<i>Aningeria adolfi-friederici</i>	33,248 (0.5)	24,553 (0.4)	—	39,535 (1.6)	18,096 (1.4)	38,883 (0.8)	119,794 (8.7)	68,251 (5.3)	342,360
<i>Casearia battiscombei</i>	113,705 (1.9)	3,144 (0.1)	—	4,050 (0.2)	4,673 (0.4)	2,889 (0.1)	4,333 (0.3)	5,721 (0.4)	138,515
<i>Fagraea macrophylla</i>	31,945 (0.5)	—	—	—	—	510 (0.0)	—	—	32,455
<i>Vitex kenyensis</i>	56,074 (0.9)	—	—	—	33,701 (2.7)	5,352 (0.1)	—	16,171 (1.3)	111,298
(same species as <i>V. fischeri</i>)	—	—	—	—	—	—	—	—	—
<i>Dombeya goetzei</i>	453 (0.0)	5,494 (0.1)	26,762 (0.8)	53,723 (2.2)	7,278 (0.6)	9,770 (0.2)	—	—	103,480
<i>Prunus africanum</i>	131,716 (2.2)	102,858 (1.8)	1,359 (0.1)	7,703 (0.3)	203,309 (16.2)	147,236 (3.1)	15,916 (1.2)	21,693 (1.7)	631,790
(similar species to <i>P. lusitanica</i>)	—	—	—	—	—	—	—	—	—
<i>Hegenia abyssinica</i>	—	8,496 (0.1)	47,832 (1.5)	595 (0.0)	23,562 (1.9)	152,277 (3.2)	—	—	232,762
<i>Polyscias kikuyuensis</i>	—	1,133 (0.0)	—	13,905 (0.6)	—	—	56,244 (4.1)	14,726 (1.1)	86,008
<i>Azella quanzensis</i>	—	—	—	—	—	—	—	3,228 (0.2)	3,228
<i>Celtis africana</i>	—	1,841 (0.0)	793 (0.0)	425 (0.0)	127,950 (10.2)	3,965 (0.1)	—	708 (0.1)	135,682
<i>Brachylaena hutchinsii</i>	—	42,140 (0.7)	793 (0.0)	—	—	—	—	—	42,933
<i>Premna maxim</i>	—	—	—	—	38,657 (3.1)	9,600 (0.2)	—	—	48,257
<i>Cordia abyssinica</i>	—	—	—	—	127,950 (10.2)	—	—	—	127,950
<i>Chlorophora excelsa</i>	—	—	—	—	651 (0.0)	—	—	—	651
Total m ³	2,629,937 (42.7)	3,580,355 (61.3)	2,553,500 (78.5)	1,088,056 (45.0)	708,453 (47.9)	3,259,660 (68.0)	478,183 (34.7)	465,779 (35.9)	14,763,923
m ³ /ha	83.49	109.83	162.64	59.45	67.46	187.33	35.42	97.04	

2) Cumulative Amounts of Non-economic Forest

Forest Area No.	1	2	7	8	11	12	18	28	Total for Species
Total m ³	3,534,700	2,242,000	699,800	1,323,800	654,600	1,535,300	902,100	319,900	11,212,200

Note:

No.	Name of Forest Area	Total Area of Forest Area 1,000 ha	Area of Economic Forest 1,000 ha
1	Irangi	48.7	31.5
2	West Mt. Kenya	114.8	32.6
7	Northern Aberdares	43.4	15.7
8	Southern Aberdares	87.7	18.3
11	Upper & Lower Imenti	13.1	8.9
12	East Mt. Kenya	52.4	17.4
18	Kikuyu Escarpment	40.8	13.5
28	Nyambeni	5.6	4.8

According to a report in *World Timber Vol. 1*, Europe and Africa, (B.J. Rendle, 1969), there are excellent high-class species (e.g., *Dalbergia melanoxylon*) other than those listed in Table 2-8 also present in small quantities.

The various species continue to be used for home consumption as in the past, but the greater part is now being used commercially, both within the country and for export.

Most of the commercial species yield timber of good appearance or hardness which is in demand on overseas markets also, and some is being exported as raw materials (logs or semiprocessed lumber).

Even for species classed as noncommercial, uses are now being developed as raw materials for the pulp and chipboard industries together with timber from artificial forests, and these are expected to become economic in the future.

(1) *Simulative Amounts of Tree Species in Each Forest Area, by Sampling*

Table 2-8 shows the cumulative amounts of tree species in each forest area. It should be noted that the sampling took place from 1963 to 1965, and that only trees with a chest-height diameter of 33 cm or more (with bark) were included.

(2) *Commercial Tree Species of Natural Forest*

1) *Podocarpus procera* (Podocarpaceae)

Distribution: Uplands of East Africa

Size Class: Medium-diameter species, reaching 30m in height and 0.65m in chest-height diameter.

Timber: Specific gravity (air-dried) approximately 0.51. Bright yellowish brown, sometimes with dark streaks. Large-diameter trees have dark heart. Straight-grained, fine-textured, without distinct annual rings. Mechanical strength medium; durability poor; not suited to outdoor use, but easily injected with preservative. Relatively fast-drying, but

with some warping and splitting. Easily worked; suitable also for bent-wood work. Gluing easy, but some difficulty in nailing.

Uses: Essentially a fitting material for building, but also suitable for carving.

2) *Juniperus procera* (Cupressaceae)

Distribution: Uplands of East Africa, especially Kenya

Size Class: Large-diameter species, reaching 37m in height and 1.5 m in chest-height diameter. Sometimes hollow-centered.

Timber: Specific gravity approximately 0.58. Scented like cedar-wood; heart-wood yellowish brown to reddish brown; straight-grained, fine-textured, annual rings not very distinct. Medium strength, good durability against fungal and termite damage, but rather difficult to inject with preservative. Slow-drying, and susceptible to butt splitting and cracking. Easily worked, but needs a sharp blade for a clean finish of planed cut surfaces. Gluing easy but nailing and drilling relatively difficult.

Uses: Cabinetmaking, fittings, interior decoration. Also, cedarwood oil is obtained from the wood.

3) *Ocotea usambarensis* (Lauraceae)

Distribution: Mountain rain forests

Size Class: Height up to 15 m. Diameter up to 1.0 m. Old trees sometimes rotten or hollow at center.

Timber: Specific gravity approximately 0.6. Heartwood light greenish yellow to brown when living; (sapwood lighter in color); gradually becomes dark brown. Cross-grained; texture uniform; good strength and durability (but easily damaged by termites and marine fouling organisms). Is not injected with preservative before use. Relatively slow-drying; some cracking and butt splitting, and also twisting. In working, easily sawed but planing tends to go against the grain. If planed along the straight grain takes polish, and gives off fragrance like that of eucalyptus oil. Painting easy but requires filling.

Uses: Rough cabinet work and furniture making; floors, ceilings, beams, shop fittings, center-material of plywood. Also, by lathe turning, can be used in chairs, railings, balustrades, etc.

4) *Olea hochstetteri* (Oleaceae)

Distribution: Also found in Mediterranean regions, but especially abundant in Kenya.

Size Class: May reach 27 m in height and 1.0 m in diameter, but is usually about 8 m in height and 0.6 m in diameter. Trees of this species are more regularly shaped in Kenya than in the Mediterranean regions.

Timber: Specific gravity approximately 0.88. Light brown with irregular dark-brown pattern (stripes or streaks). Straight-grained; characteristic beautiful texture. Extremely strong. Durability also; is not treated with preservative before use. Slow-drying; susceptible to cracking and also to warping. Relatively easily worked, and suitable also for bent-wood work.

- Uses: Is known in other countries as a high-class flooring wood; high-class carving and bent-wood material.
- 5) *Prunus africana* (Rosaceae)
 Distribution: Throughout Africa. Grows especially well on fertile soil.
 Size Class: Height, 15 m. Diameter, 0.6 m. Trunk occasionally irregular.
 Timber: Specific gravity approximately 0.68. Hard heartwood pale pink; (sapwood less pale). Straight and fine grain; texture fine; annual rings indistinct; medium strength; durability poor for wood of this specific gravity, but resistance to insect damage good. Injection of preservative difficult. Dries quite readily, but liable to warp or twist. Easily worked, but boards taken from lower part of trunk may split finely. Suitable for carving; good for polishing and painting, but requires care in nailing.
- Uses: High-class furniture, carving, handcrafting.
- 6) *Aningeria adolf-freiderici* (Sapotaceae)
 Distribution: Abundant in rain forest zone.
 Size Class: Large-diameter species, reaching 45 m in height and 1.2 m in diameter, with large-lower part of trunk.
 Timber: Specific gravity approximately 0.55. Sometimes hard, containing silicon. Pale pink, opale-greyish brown tinged with pink. Straight or wavy grain; fine to coarse texture. Living wood has a characteristic smell. High strength, but poor durability, being susceptible to damage by termites, marine fouling organisms, pinholes, and blue-stain fungi. Not particularly difficult to dry. Also easy to work, and gives good finish.
- Uses: Plywood, veneer slicer, large furniture, interior decoration; also, seeds yield an edible oil.
- 7) *Ilagena abyssinica* (Rosaceae)
 Distribution: Abundant in high-altitude alpine forests; also found in bush and pine forests.
 Size Class: May reach 21 m in height and 1.2 m in diameter, but typically growth form is nontapered and draft. Trunk is twisted and pitted, sometimes with long nodes. Contains insect holes.
 Timber: Specific gravity approximately 0.66. Hard sapwood white; heartwood dark brown to dark red; boundaries indistinct. Grain straight or irregular; texture fine; silver grain pattern appears on straight grain. Annual rings indistinct. High strength but poor durability; susceptible to termites and marine fouling organisms. Difficult to inject preservative. Relatively fast-drying, but liable to split, and to warp in low temperatures (especially large rectangular timbers). Easy to saw, but surfaces with irregular grain tend to develop nap. Easy to drill. Gives beautiful finish in carving.
- Uses: Furniture, cabinetmaking, carving.
- 8) *Casearia battiscombel* (Flacourtiaceae)
 Distribution: Abundant in high-altitude rain forests.

- Size Class:** Reaches 30 m in height, 0.9 m in diameter. Has distinct lower part of trunk. Trunk straight and cylindrical.
- Timber:** Specific gravity approximately 0.61. Hard sapwood, white to pale yellowish brown, sometimes with red stripes; heartwood dark brown. Straight-grained; fine-textured; living wood has unpleasant odor. Annual rings indistinct. High strength but relatively poor durability. No particular difficulty in working, but important to ensure that drying is not too fast.
- Uses:** General building material
- 9) *Celtis africana* (Ulmaceae)
- Distribution:** Abundant in mountain forests
- Size Class:** May reach 25 m in height and 0.9 m in diameter, but growth form differs markedly depending on location.
- Timber:** Specific gravity approximately 0.68. Medium hardness. Pale brown to brown with vivid green streaks; (sapwood pale with indistinct boundary). Irregular dark stripes; sometimes heart contains dark brown to black rotten portions. Living wood has scent of apple. Straight or sometimes wavy grain; in straight grain soft tissue stands out clearly. Texture fine or rough; strength medium; toughness good. Durability poor; susceptible to termites and marine fouling organisms, and to rust fungi. Drying not particularly difficult, but tends to split or crack in black to brownish region near heart. Good properties for all types of working (using cut surface) except carving, but needs care in drilling. Difficult to inject preservative into heartwood.
- Uses:** Material where toughness is required; furniture.
- 10) *Ekebergia rueppeliana*
- Distribution:** High-altitude forests; occasionally grasslands.
- Size Class:** May exceed 30 m in height and 1.0 m in diameter, but usually trunk is short and twisted with groove-like indentations.
- Timber:** Specific gravity approximately 0.42. Hard. Living wood white to pale pink; old wood greyish white to pale brown. Straight-grained; texture fine or rough; distinct annual rings; surface sometimes shows a pattern. High strength and durability, but susceptible to termites, marine fouling organisms, pinholes, and rust fungi. Dries rapidly, with some warping and splitting. Good for all types of working.
- Uses:** Not suitable as building material, but used for furniture, carving and handcrafting.
- 11) *Dombeya goetzeni* (Sterculiaceae)
- Distribution:** Abundant in high-altitude coniferous and pine forests.
- Size Class:** May reach 25 m in height and 1.2 m in diameter, but usually has short and twisted trunk.
- Timber:** Specific gravity approximately 0.65. Pale brown; sometimes has dark brown heart patterned like that of olive tree. Grain usually straight; texture coarse. Strength medium but toughness excellent. Durability average or below; susceptible to termites and marine fouling organisms.

- Tends to crack on drying. Easy to work (except for carving); injection of preservative also reasonably easy.
- Uses: Material where toughness is required; handcrafting. In the local district is used to make bows.
- 12) *Vitex kenyensis* (Verbenaceae)
- Distribution: Grows sparsely on rocky ground and lake shores.
- Size Class: May reach 30 m in height and 2.0 m in diameter, but often has twisted trunk with hollow center.
- Timber: Specific gravity approximately 0.51 (but varies widely). Hard. Pale-greyish brown, sometimes beautifully patterned. Straight or wavy grain; coarse texture; distinct annual rings. Strength generally high, but durability said to be relatively poor. Reasonably easy to inject preservative. Splitting, but not warping, may occur during drying. Easy to work but requires filling.
- Uses: Interior decoration; furniture; plywood.
- 13) *Cordia caffra* (Boraginaceae)
- Distribution: Abundant in low-lying upland forest.
- Size Class: Reaches 15 m in height and 1.0 m in diameter; trunk usually short twisted.
- Timber: Specific gravity approximately 0.60. Sapwood grey to greyish brown; heartwood light brown. Grain straight and fine; texture coarse. Strength medium; durability good (rarely affected by termites, but susceptible to marine fouling organisms). Slight splitting and warping on drying. Easily worked but requires filling.
- Uses: Timber of good appearance is used for furniture and interior decoration.
- 14) *Polyscias kikuyuensis* (Araliaceae)
- Distribution: Abundant on sandy soil in mountain rain forests.
- Size Class: May reach 30 m in height and 1.2 m in diameter.
- Timber: Specific gravity approximately 0.41. White to pale yellow; (sapwood pale). Grain straight and fine; texture coarse. Strength high in proportion to specific gravity. Durability poor; susceptible to termites, marine fouling organisms and pinholes. Some difficulty in injecting preservative. Relatively easy to work, but tends to form a nap when sawed, and to split when nailed. Requires care in felling as trunk tends to split.
- Uses: Building and crate material.
- 15) *Brachylaena hutchinsii* (Compositae)
- Distribution: Abundant in lowland area forests in coastal regions and semi-evergreen forests at high altitudes.
- Size Class: Reaches 30 m in height and 1.0 m in diameter. Trunk has groove-like indentations, and may be hollow.
- Timber: Specific gravity approximately 0.9. Sapwood greyish white; heartwood bright yellowish brown when living, dark to greenish brown when dead. Grain usually straight; texture fine; annual rings distinct; scented like mustard. Strength average or below; durability good. Injection of preservative into heartwood difficult. Thick timber slow

to dry, and tends to split unless dried gradually. Easy to work, except that resin adheres to teeth of saw.

Uses: Not suitable as plywood material; used in furniture and interior decoration.

16) *Premna maxim* (Verbenaceae)

Distribution: Native to Kenya; grows in semi-evergreen forests at high altitudes.

Size Class: Reaches 30 m in height and 1.0 m in diameter. Trunk usually twisted with groove-like indentations.

Timber: Specific gravity approximately 0.68. Greyish brown to grey streaked with green. Straight-grained and fine-textured. Strength not high in proportion to specific gravity. Durability good, due to oil content. Little difficulty in drying (but excessively rapid drying will impair the quality of the wood). Good for working.

Uses: Suited for use in humid places. Roots and leaves are used for medicinal purposes.

17) *Fograea macrophylla* (Loganiaceae)

Distribution: Grows in upland forests. Also suited for natural regeneration.

Size Class: Reaches 35 m in height and 1.2 m in diameter. Trunk is straight and cylindrical, and contains semitransparent resin.

Timber: Specific gravity approximately 0.65. Bright to pale yellow, with streaked pattern. Wood becomes darker with age. Fine-grained, with striped or sometimes fiddle-back pattern in straight grain. Texture fine or coarse. Living wood has sweet smell. Strength relatively high, but durability poor in proportion to specific gravity; (new wood susceptible to rust fungi). Tends to warp on drying (especially in the dark heartwood region). Easily worked; good for bent-wood work, but liable to split if drilled by machine. Slight difficulty in injecting preservative into heartwood.

Uses: Furniture, cabinetmaking, heavy structural material.

18) *Azalia quanzensis* (Leguminosae)

Distribution: Throughout East Africa

Size Class: Reaches 25 m in height and 0.9 m in diameter.

Timber: Specific gravity approximately 0.8. Hard. Sapwood pale yellow, heartwood golden brown becoming brown streaked with red. Wood may contain stony crystals. Grain straight, texture fine, sometimes with pattern. Strength good; durability also good, especially in outdoor use. Is not injected with preservative before use. Drying good if done artificially or if allowed to dry naturally at a slow rate. Working difficult when the above-mentioned stony crystals are present, and often dulls blades of tools used on it. (Not suitable for bent-wood craft.) Also good for rotary lathe working.

Uses: Heavy structural material; shipbuilding; outdoor materials; wood of good appearance is used for furniture and veneer material.

2-9-2 Tree Species of Artificial Forests

As shown in Table 2-9, artificial afforestation has been carried out in this district, with the aims of increasing timber production and controlling floods and stabilizing the soil.

The afforested area has increased since the end of World War II (1945), and the government plans to continue with this work in the future.

Some endemic species are found in parts, but the greatest area is occupied by exotic species, among which the softwoods by far outnumber the hardwoods. The main softwoods are the conifers *Cupressus* spp. and *Pinus* spp., while the main hardwoods seem to be the broad-leaved *Eucalyptus* spp.

Although details of these trees used in afforestation are not available, most of the species are faster-growing than the native species, and some have already reached the usable size class. According to the description of the contents of the five-year plan, it is intended to make commercial use of them as industrial raw materials.

Table 2-9 Afforested Area of Districts Included in Study, by Tree Species and Period of Planting

	Period	Years	Exotic Softwood					Exotic Hardwood			Indigenous Species		Total	
			Cupressus		Pinus			OT	Eucalyptus		OT	Soft-wood		Hard-wood
			C.S.	OT C.S.	P.P.	P.R.	OT	Ex	Tr	Fu				
North West Mt. Kenya	I	1925-29	-	-	-	-	-	-	10	10	-	20	-	40
	II	1930-34	-	10	-	-	-	-	-	20	-	30	-	60
	III	1935-39	-	-	-	-	-	-	-	-	-	40	-	40
	IV	1940-44	20	-	-	-	-	-	10	-	-	40	-	70
	V	1945-49	210	70	-	-	-	-	-	-	-	20	50	350
	VI	1950-54	120	-	30	-	50	-	-	-	-	30	60	290
	VII	1955-59	70	-	50	260	50	-	-	-	-	-	-	430
	VIII	1960-64	40	-	80	910	40	-	-	-	-	-	-	1,070
	IX	1965-67	200	-	160	-	-	-	-	-	-	-	-	360
Sub-total			660	80	320	1,170	140	-	20	30	-	180	110	2,710
North East Mt. Kenya Meru	II	1930-34	10	-	-	-	-	-	-	-	10	-	-	20
	III	1935-39	-	-	-	-	-	-	-	-	-	-	40	40
	IV	1940-44	20	-	-	-	-	-	-	10	-	-	120	150
	V	1945-49	20	-	-	-	-	-	-	-	20	-	20	60
	VI	1950-54	50	-	40	30	-	20	-	-	20	-	20	180
	VII	1955-59	30	-	200	-	-	20	-	-	-	-	30	280
	VIII	1960-64	300	-	60	20	10	-	-	-	-	-	60	450
	IX	1965-67	100	-	30	-	-	-	-	30	-	-	80	240
	Sub-total			530	-	330	50	10	40	-	40	50	-	370
South East Mt. Kenya	V	1945-49	-	-	10	-	-	-	-	-	-	-	-	10
	VI	1950-54	10	-	20	10	20	10	-	-	-	-	20	90
	VII	1955-59	-	-	70	-	-	-	-	-	-	-	10	80
	VIII	1960-64	-	-	250	30	10	-	-	-	-	-	100	390
	IX	1965-67	-	-	-	-	-	-	-	10	-	-	-	10
Sub-total			10	-	350	40	30	10	-	10	-	-	130	580
North Kinangop Geta		1920-24	-	-	-	-	-	-	-	-	-	10	20	30
	I	1925-29	10	-	-	-	-	-	-	-	-	40	-	50
	II	1930-34	-	-	-	-	-	-	-	-	-	-	-	-
	III	1935-39	-	-	-	-	-	-	-	-	-	40	-	40
	IV	1940-44	-	-	-	-	-	-	-	-	-	20	-	20
	V	1945-49	140	-	-	40	-	-	-	-	-	-	-	180
	VI	1950-54	120	-	20	70	20	-	-	-	-	-	-	230
	VII	1955-59	10	-	50	50	-	-	-	-	-	-	-	110
	VIII	1960-64	330	-	240	250	-	-	-	-	-	-	-	820
IX	1965-67	230	-	330	-	-	-	-	-	-	-	-	560	
Sub-total			840	-	640	410	20	-	-	-	-	110	20	2,040

	Period	Years	Exotic Softwood						Exotic Hardwood			Indigenous		Total
			Cupressus		Pinus		OT		Eucalyptus		OT	Species		
			C.S.	OT C.S.	P.P.	P.R.	OT	Ex	Tr	Fu		Soft-wood	Hard-wood	
South Kinangop Kimakia	I	1920-24	-	-	-	-	-	-	-	-	-	10	-	10
		1925-29	-	-	-	-	-	-	-	-	-	110	-	110
	II	1930-34	50	-	-	-	-	-	-	-	10	40	10	110
	III	1935-39	10	-	-	-	-	-	-	-	-	-	-	10
	IV	1940-44	30	-	-	-	-	-	-	-	-	40	-	70
	V	1945-49	80	-	-	10	10	-	10	-	20	-	-	130
	VI	1950-54	30	-	80	60	20	-	10	-	-	-	-	200
	VII	1955-59	230	-	410	10	130	70	-	-	10	-	-	860
	VIII	1960-64	480	-	700	80	10	30	-	-	10	10	10	1,330
IX	1965-67	240	-	230	-	20	20	-	-	-	-	-	510	
Sub-total			1,150	-	1,420	160	190	120	20	-	50	210	20	3,340
Kiandongro Kabage	I	1925-29	30	-	-	-	-	-	10	10	-	40	-	90
	II	1930-34	50	-	-	-	-	-	20	10	-	120	40	240
	III	1935-39	40	-	-	-	-	-	-	-	-	140	20	200
	IV	1940-44	170	-	-	-	-	-	-	-	-	80	10	260
	V	1945-49	310	-	40	20	-	-	-	-	-	-	-	370
	VI	1950-54	50	-	170	10	10	10	-	-	-	-	-	250
	VII	1955-59	130	-	190	20	10	-	-	-	-	-	-	350
	VIII	1960-64	270	-	100	30	20	-	-	-	-	-	-	420
	IX	1965-67	-	-	30	-	-	-	-	-	-	-	-	30
Sub-total			1,050	-	530	80	40	10	30	20	-	380	70	2,210
South West Mt. Kenya	I	1925-29	50	-	-	-	-	-	-	-	-	70	10	130
	II	1930-34	10	-	-	-	-	-	10	-	10	40	50	120
	III	1935-39	30	-	-	-	-	-	-	30	-	110	60	230
	IV	1940-44	100	-	-	-	-	-	-	150	-	110	50	410
	V	1945-49	440	-	60	40	10	-	-	30	10	10	110	710
	VI	1950-54	250	30	60	20	-	-	-	-	20	-	60	440
	VII	1955-59	90	-	320	120	70	-	-	10	-	-	50	660
	VIII	1960-64	240	-	320	580	-	-	-	-	-	-	140	1,280
	IX	1965-67	120	-	140	-	-	-	-	10	-	-	80	350
Sub-total			1,330	30	900	760	80	-	10	230	40	340	610	4,330

Afforested Area, by Period of Planting

	Period	Years	Exotic Softwood					Exotic Hardwood			Indigenous		Total		
			Cupressus		Pinus			OT	Eucalyptus		OT	Species			
			C.S.	OT C.S.	P.P.	P.R.	OT	Ex	Tr	Fu		Soft-wood		Hard-wood	
Seven districts listed above Total (i.e., districts included in study)	I	1920-24	-	-	-	-	-	-	-	-	-	-	20	20	40
	II	1925-29	90	-	-	-	-	-	20	20	-	280	10	420	
	III	1930-34	120	10	-	-	-	-	30	30	30	230	100	550	
	IV	1935-39	80	-	-	-	-	-	-	30	-	330	120	560	
	V	1940-44	340	-	-	-	-	-	10	160	-	290	180	980	
	VI	1945-49	1,200	70	110	110	20	-	10	30	50	30	180	1,810	
	VII	1950-54	630	30	420	200	120	40	10	-	40	30	160	1,680	
	VIII	1955-59	560	-	1,290	460	260	90	-	10	10	-	90	2,770	
	IX	1960-64	1,660	-	1,750	1,900	90	30	-	-	10	10	310	5,760	
		1965-67	890	-	920	-	20	20	-	50	-	-	160	2,060	
		Sub-total	5,570	110	4,490	2,670	510	180	80	330	140	1,220	1,330	16,630	

Key: C. S. = Cupressus lusitanica
P. P. = Pinus patula
Ex = Exotic
Fu = Fuel

OT = Other
P. R. = Pinus radiata
Tr = Timber

Chapter 3

Basic Concept of Regional Industrial Development in the Nyeri District

The policy of proceeding with the Industrial Estate Development Program (I.E.D.P.) and the Rural Industrial Development Program (R.I.D.P.) as discussed in Chapter 1 in the Nyeri District has already been established. The Nyeri Industrial Estate, which forms the subject of this study, is a part of these two programs. A detailed exposition of the industrial estate development plan will be given in the next chapter; in the present chapter, we shall outline and evaluate of the manner in which K.I.E., Ltd., the agency which is to implement the project, envisages the overall concept of the I.E.D.P. and the R.I.D.P., the contents and the course of development of the plans.

3-1 Structural Elements and Overall Scheme of I.E.D.P. and R.I.D.P.

I.E.D.P. and R.I.D.P. comprise the following works:

- (i) Construction of the industrial estate
- (ii) Construction of R.I.D.C.s
- (iii) Construction of Industrial Promotion Area (I.P.A.)
- (iv) Financing, technical and management guidance, and technical training to facilitate establishment and growth of businesses in the district.

The implementation and administration of the work in these four areas is to be carried out by K.I.E., Ltd., which has been given the responsibility of guiding the maturation and development of industrialization in the region, while ensuring liaison between the different areas of work and managing the limited resources available.

K.I.E., Ltd. is currently drawing on its past operational results and experience to establish a methodology for systematic development of the strategy for industrialization in the region, and to inter-relate the industrial estate with the activities of the R.I.D.C. is, which in the past have been carried out experimentally with the grant assistance of Sweden. K.I.E., Ltd.'s approach is based on the following principles:

- (i) Establishing a comprehensive strategy for I.E.D.P. and R.I.D.P. at the province level.
- (ii) According to the system of arrangements under this strategy, the industrial estate will form the nucleus, and its extension services will be performed by R.I.D.C. and I.P.A., with the regional manager overseeing the administration of the whole.

In the case of the Mombasa district this approach has already been put into practice. That is, the concept of placing an industrial estate in the Mombasa Special Municipality, placing R.I.D.C.'s at four points, namely, Kwale, Kilifi, Malindi, and Voi, and fostering the growth of small industry in the three districts surrounding the nucleus of Mombasa City has been laid down in the "Mombasa Set-up" plan and is now being put into effect. In the case of the Nyeri district, the framework envisaged for the overall system is a further development of this concept.

The standpoint of K.I.E., Ltd. as it carries out the above system of general strategy has begun to show signs of change. In the past, K.I.E., Ltd. was one of the twelve public corpora-

tions affiliated with I.C.D.C., as shown in Fig. 3-2. It is now beginning to aim at increasing its independence, both organizationally and in terms of the flow of development funds, by becoming separate from the assistance and control of I.C.D.C., together with establishing an internal mechanism for coordination of the industrial estate and R.I.D.C. and I.P.A. operations under a regional manager, in order to implement in each region the overall system of the R.I.D.P. discussed above with liaison between the various structural elements. The recommendations of the World Bank on the Republic of Kenya's policies to promote small- and medium-scale industry included the suggestion that K.I.E., Ltd. be placed on a self-supporting basis. The organizational position of K.I.E., Ltd. along such lines would probably be as shown in Fig. 3-3.

Further, based on the conditions of the Nyeri region it would be rational to give the regional office some measure of autonomy in decision-making and develop a mechanism for the coordinated management of the various projects in the region covered by the programs, as shown in the organizational set-up illustrated in Fig. 3-4.

3-2 Purpose and Functions of the Industrial Estate and R.I.D.C.

The purpose of developing small-scale industry in rural regions has already been discussed in Chapter I. To summarize here, the following general points can be noted:

- (i) Replacing import or internal shipment of industrial products.
- (ii) Increase of added value by processing of local resources, and expansion of exports and internal supply.
- (iii) Increase of employment by introduction of labor-intensive industry.
- (iv) Promotion of Kenyanization.
- (v) Modernization, rationalization, and increase of competitiveness of existing industry.
- (vi) Redressing disparity between regions.
- (vii) Supply of industrial products for low-income stratum.
- (viii) Raising the level of the industrial structure by means of interrelationships between industries.
- (ix) Growth of G.D.P. by promotion of industrial investment.

In order to achieve these goals, the following functions are looked for in K.I.E., Ltd's operations:

- (a) Raising the motivation of Kenyans to invest in small-scale industry.
- (b) Training of industrialists and able personnel.
- (c) Introduction, improvement and dissemination of industrial production technology.
- (d) Providing funds for commercial development.
- (e) Providing infrastructure to support business activities.

These functions may be collated into three types: (1) provision of the physical groundwork; (2) technical guidance and assistance; and (3) provision of funds. In the following sections, we shall study the functions of the industrial estate, R.I.D.C., and I.P.A.

3-3 Functions of the Industrial Estate

First on the list is the function of providing the physical groundwork. This consists of providing the various facilities which support industrial production activities, such as preparation

Fig. 3-1 Mombasa Set-up

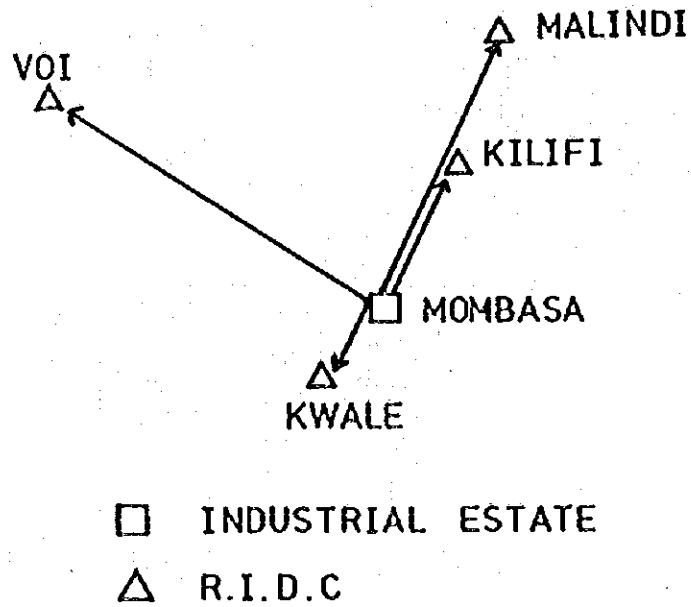


Fig. 3-2 Position of K.I.E. Ltd. Up to Today

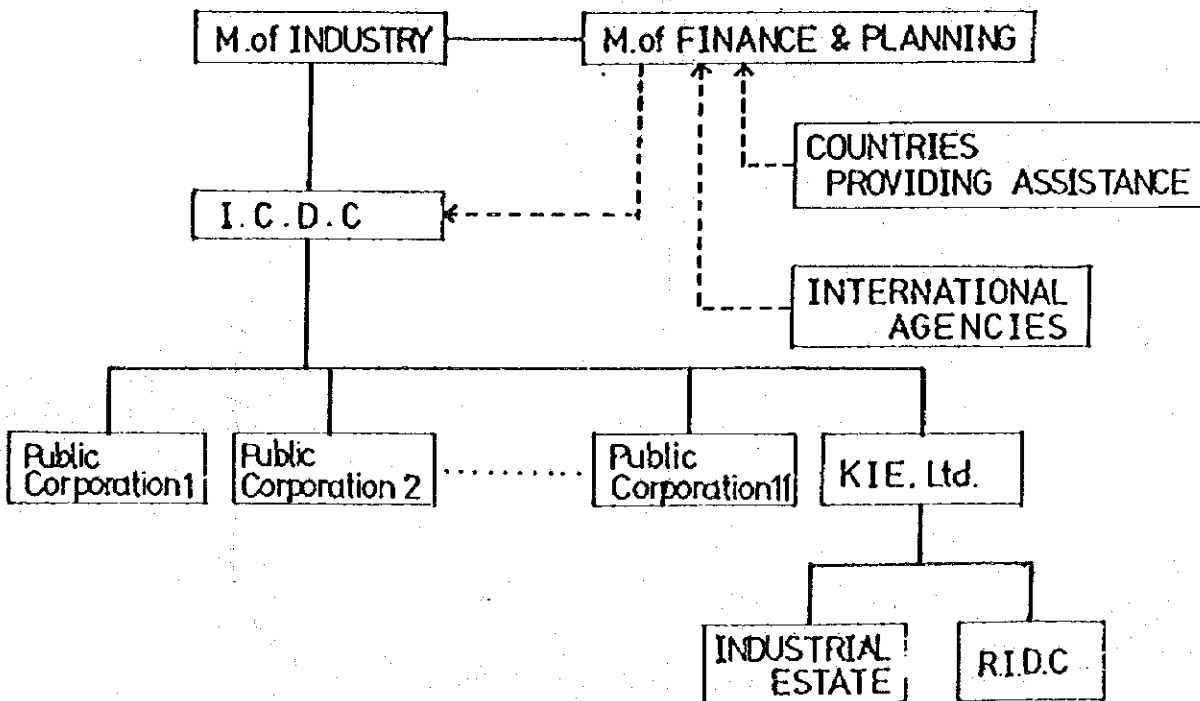


Fig. 3-3 Future Position of K.I.E. Ltd.

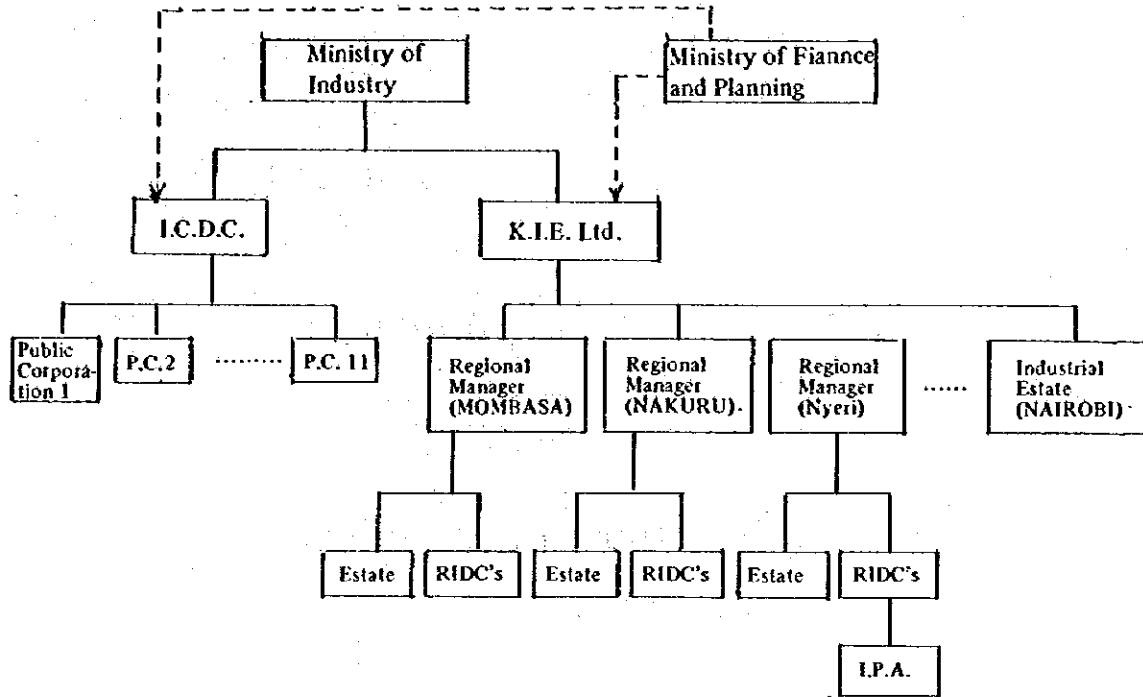
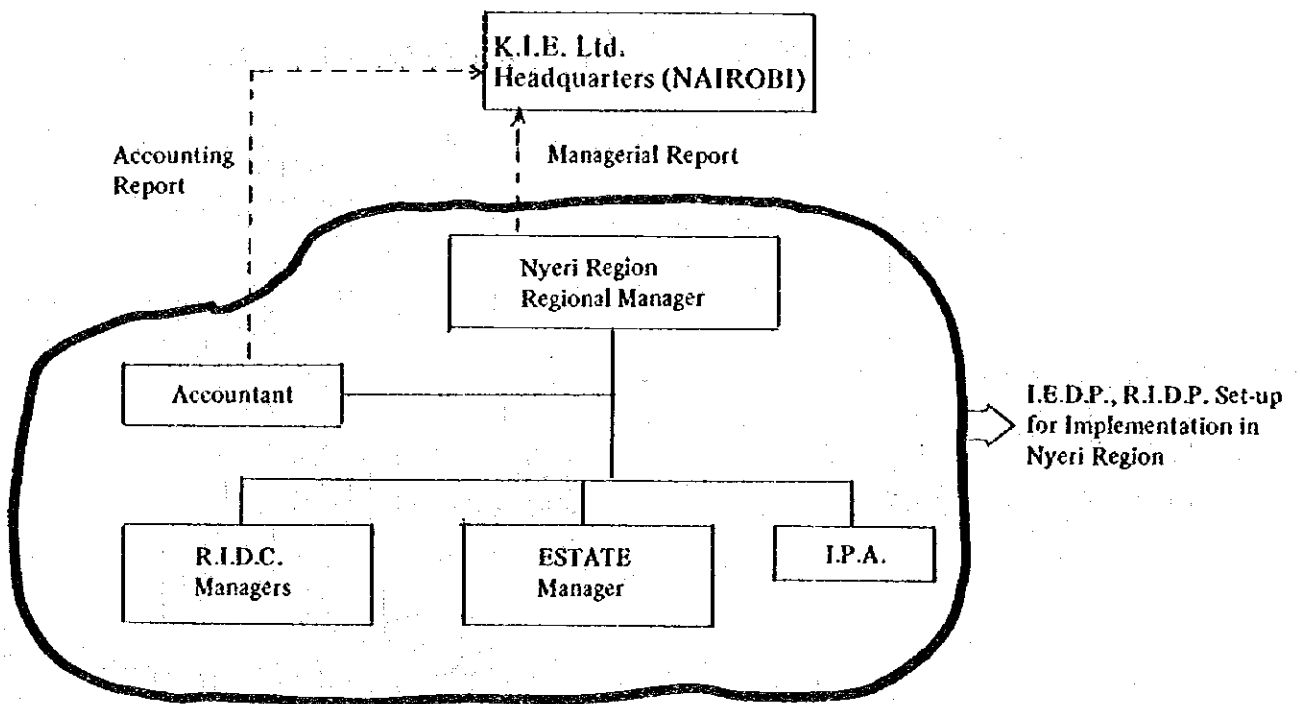


Fig. 3-4 Set-up for Implementation of I.E.D.P. and R.I.D.P. in Nyeri Region



of sites, construction of standard factory buildings, laying-on of utilities such as electricity and water supply, facilities for drainage and liquid waste treatment, communications facilities, and residential service facilities for employees, and further of providing these services to the enterprises concerned at a reasonable price.

Next, there is the important function of picking out to receive these services, industrial production projects which are capable of securing adequate profitability, and carrying out surveys, research, and promotion to train industrialists to implement this system. In other words, this means cultivating the enterprises which will occupy the industrial estate. This function is of the utmost importance in the Republic of Kenya, which is in the early stages of industrialization.

Thirdly, there are several functions concerning technical instruction and assistance, i.e., the offering of consulting or advisory services.

The services and software to be offered to the enterprises which enter the industrial estate include the following: recommendation and introduction of profitable projects and of machinery and equipment; guidance and advice concerning product and market development and management; technical guidance, etc. To take the example of the Nairobi industrial estate, there K.I.E., Ltd.'s economists and engineers are engaged intently in advising the tenant enterprises. In the case of Nyeri the background to industry suggests an even greater importance for this type of function.

Fourth, it is standard practice in Kenyan industrial estates to establish therein a Technical Service Center (T.S.C.), which provides such services as maintenance of the machinery and equipment of companies in the estate, production of parts, etc. In rural districts where there is little consolidation of such services, this is an important function of the industrial estate. The T.S.C. is equipped mainly with metal-working machinery. The active use of the T.S.C. in combination with technical training and product development serves toward fostering small industry.

The next function is that of financing for the tenant enterprises. K.I.E., Ltd. provides financing for their machinery purchase costs. To enable enterprises to commence activities with small capital is to promote the placement of enterprises in the industrial estate.

Finally, integrated management and support of and liaison between the functions of R.I.D.C.'s and I.P.A., as discussed in the following sections, can be cited as one of the functions of the industrial estate as the nucleus of the regional industrial development program.

3-4 Functions of R.I.D.C.

Rural Industrial Development Centers (R.I.D.C.) are highly significant to the rural industrial development program. The industries which occupy the estate, although small in scale, are corporate business entities with excellent competitiveness and employment capacity. R.I.D.C. activities, however, are directed at manual industry of the cottage type.

Dr. Livingstone of the University of Nairobi has pointed out the need for a development strategy which will distinguish between regional craft industry and small factories; and create

an organic relationship between them; in other words, a development strategy for an effective shift from craft industry to small factories. This is to say, it is the role of R.I.D.C. activities to provide guidance and assistance with the aim of creating and fostering craft industry. Viewed in this way, this function of the R.I.D.C.'s resembles that of the industrial estate, but the difference in their field of application leads to differences in the level and contents of the following functions that will be required in each case:

- (i) Finding and selecting projects to be handled: Projects must be found which can become established as craft industries and grow into small industries.
- (ii) Promotion: The creation and fostering of cottage-type manual industries must be planned.
- (iii) Consulting: Guidance and advice must be provided on marketing and management, and also referrals and technical advice on introduction of machinery and equipment, production and improvement of quality of new products, etc.
- (iv) Common Workshop Service: This is equipped with machinery and equipment suited to the economic environment of the district; it makes full use of them in providing practical training in their operation, together with providing such services as trial production, maintenance, and parts production for companies registered with the R.I.D.C., in a similar way the T.S.C. of an industrial estate.
- (v) Financing: Assistance is provided in financing the introduction of machinery and equipment in order to establish craft-type cottage industries or to improve their profitability.

3-5 Functions of Industrial Promotion Area (I.P.A.)

The R.I.D.C., which was begun with the grant of Denmark, has through a process of trial and error clearly determined its functions to be as stated above. As the next step from R.I.D.C. activities, it has given rise to the I.P.A., which was formed as an extension of the R.I.D.C. activities in Machakos, and is providing successful.

The I.P.A. provides an arena for the operations of independent enterprises which have reached a certain level once technical knowledge has been disseminated through the activities of R.I.D.C. That is, it is the organization of existing independent enterprises into a group. It therefore takes the form of preparation of sites, and construction of leasing-out of buildings by K.I.E., Ltd. as in the case of industrial estates. However, the level of infrastructure provided is not so high as that of the estates, the buildings are of low-cost construction in blocks, and are leased at an extremely low rate.

The function of the I.P.A. is thus the leasing of the buildings, but as this forms part of the activities of R.I.D.C. the latter are also continued for enterprises housed by the I.P.A. I.P.A.'s will probably become established in districts where existing independent enterprises and cottage-type manual industries are congregated, or where a number of projects have been generated by R.I.D.C. activities.

3-6 Location of Industrial Estate, R.I.D.C. and I.P.A.

The industrial estate is the central undertaking of the Nyeri region industrial development program. The findings on the environment for regional development reported in the preceding section lend further support to the conclusion that the existing plan to locate it in the Nyeri

Urban Area is appropriate. The record of activities by the existing R.I.D.C. (Nyeri), and the suitability of this location for finding and selection of tenant projects and for promotional purposes also lend weight to this conclusion.

As discussed in the paragraph on the functions of the industrial estate, the sphere of operations of K.I.E. includes activities to promote industrialization outside the estate, but this service does not extend to the entire Nyeri region. There is therefore a need to establish R.I.D.C.s as "satellite centers" for the promotion of industrialization in the rural town areas outside the range of the industrial estate's services and where the conditions for industrialization are inferior to those in the vicinity of Nyeri City.

When the distance range of industrial estate and R.I.D.C. services is estimated from the distribution of those registered to receive financing from the Nyeri R.I.D.C., it is found that 70 percent of them are operating within a radius of 30 km. The fact that, whereas the cottage industries covered by R.I.D.C. activities are scattered in Muranga, Kiambu, and Nyahururu, the financing activities do not extend throughout the Central Province can be interpreted as showing the limit to which satisfactory service can be provided by the R.I.D.C. to be a distance of about 30 km.

Table 3-1 Distribution of Registered Recipients of Financing, by Distance from R.I.D.C.

0 - 10 km	11	61 - 70 km	1
11 - 20 km	11	71 - 80 km	1
21 - 30 km	5	81 - 90 km	0
31 - 40 km	0	91 - 100 km	0
41 - 50 km	0	101 - 200 km	3
51 - 60 km	1	201 km and over	4

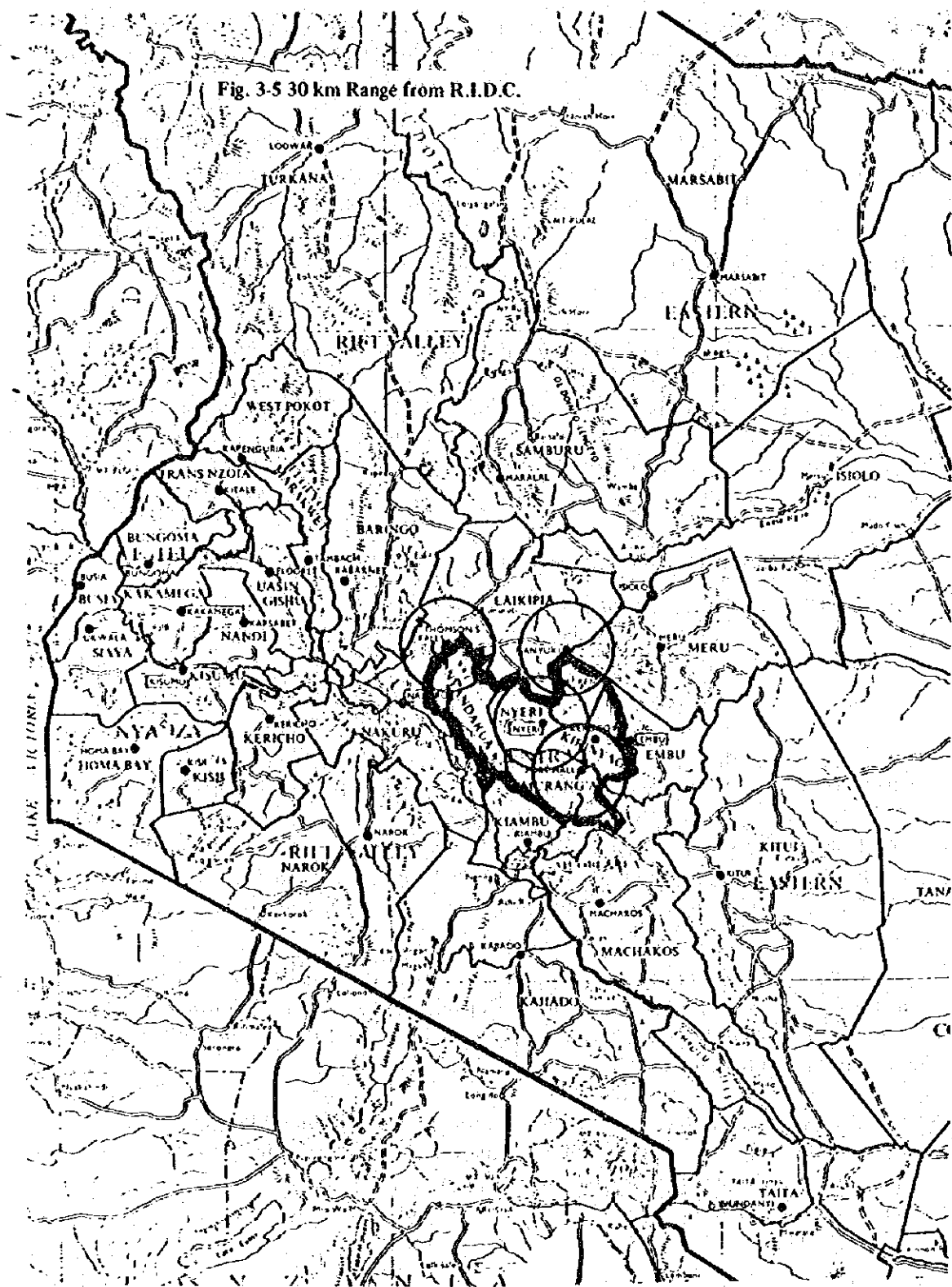
In view of these conditions, K.I.E., Ltd. is certainly correct in planning to establish new R.I.D.C.s in Nanyuki, Nyahururu, and Muranga in order to ensure that the R.I.D.C. services reach throughout the extended Nyeri district as defined earlier. As shown in Fig. 3-5, in combination with the existing Nyeri and Embu R.I.D.C.'s this will give almost complete coverage of the district, with the exception of the Meru and Laikipia districts. It is intended to establish another center in Meru in the future, which will complete the coverage of the whole district by R.I.D.C. services.

Next, it is planned to locate the I.P.A. in Karatina, where there is a congregation of sawmills formed into a cooperative association. Since the independent operators (mainly woodworkers and carpenter) desire to enlarge their premises, the establishment of a collective operation can be seen to be highly realistic.

To summarize the above, the Rural Industrial Development Program in the Nyeri district operates on a system which coordinates the various projects under a regional manager while maintaining overall liaison, under the following plan of disposition:

- | | |
|----------------------|------------------|
| 1. Industrial Estate | Nyeri Urban Area |
| 2. R.I.D.C. | Nanyuki |
| | Muranga |
| | Nyahururu |
| 3. I.P.A. | Karatina |

Fig. 3-5 30 km Range from R.I.D.C.



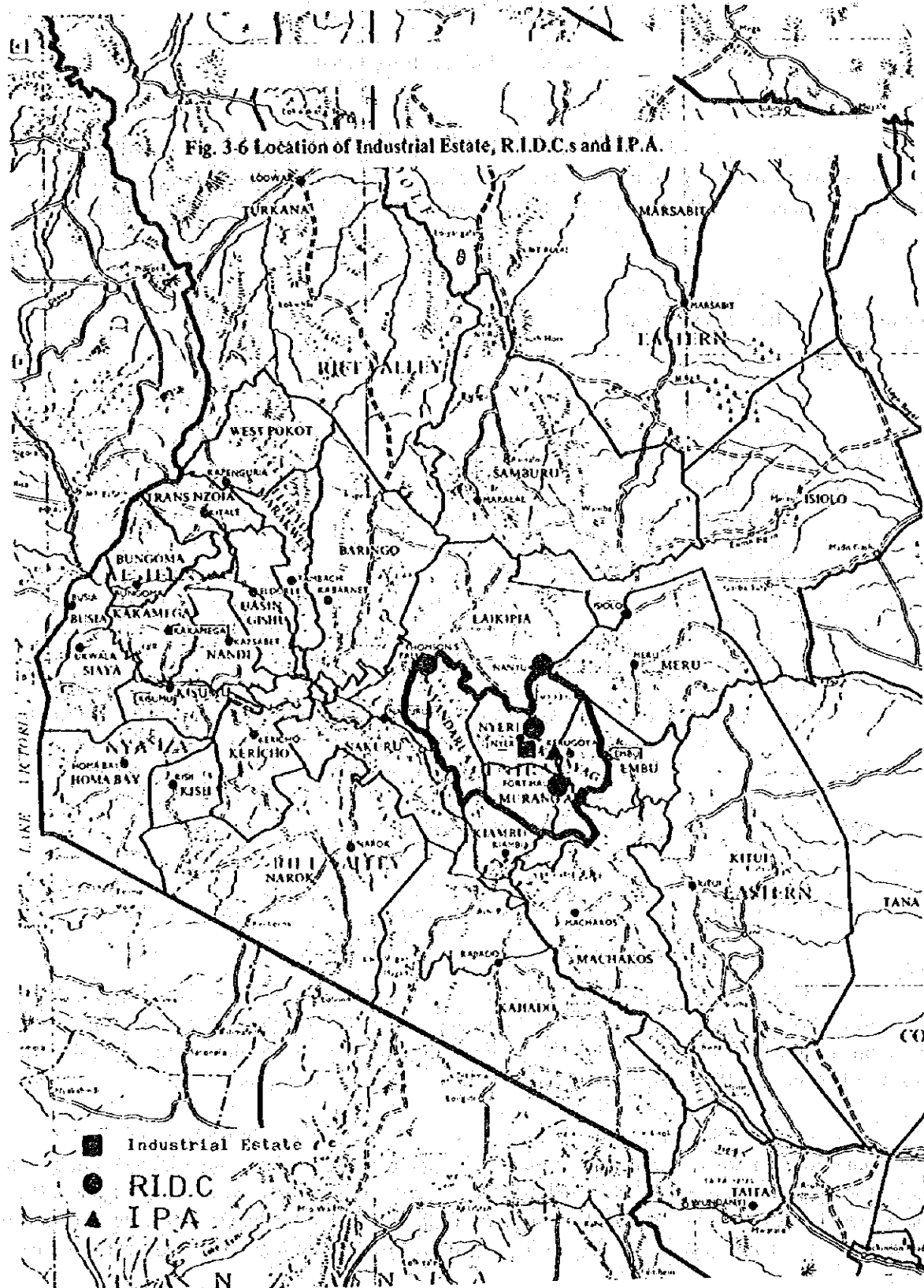


Fig. 3-6 Location of Industrial Estate, R.I.D.C.s and I.P.A.