



REPUBLIC OF KENYA

# A ROAD NETWORK DEVELOPMENT MASTER PLAN STUDY

## FINAL REPORT

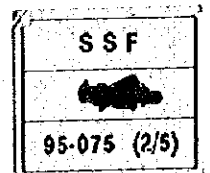
### VOLUME I

MAY 1995

JAPAN INTERNATIONAL  
COOPERATION AGENCY

MINISTRY OF PUBLIC  
WORKS AND HOUSING

PACIFIC CONSULTANTS INTERNATIONAL (PCI)  
CONSTRUCTION PROJECT CONSULTANTS (CPC)





2809<sup>9</sup>

JICA LIBRARY



1121107161

国際協力事業団

28099



**REPUBLIC OF KENYA**

**A ROAD NETWORK DEVELOPMENT  
MASTER PLAN STUDY**

**FINAL REPORT**

**VOLUME I**

**MAY 1995**

**JAPAN INTERNATIONAL  
COOPERATION AGENCY**

**MINISTRY OF PUBLIC  
WORKS AND HOUSING**

**PACIFIC CONSULTANTS INTERNATIONAL (PCI)  
CONSTRUCTION PROJECT CONSULTANTS (CPC)**

**The following foreign exchange rate is applied in the study:  
US\$1.00=60.15Ksh (as of November 1994)**

## Preface

In response to a request from the Government of the Republic of Kenya, the Government of Japan decided to conduct "A Road Network Development Master Plan Study" in the Republic of Kenya and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Kenya a study team headed by Mr. KIYOSHI YASUKAWA, and composed of members of Pacific Consultants International, and Construction Project Consultants Inc., three times between January 1994 and January 1995.

The team held discussions with the officials concerned of the Government of Kenya and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Kenya for their close cooperation extended to the team.

May 1995



Kinio Fujita

President

Japan International Cooperation  
Agency





May 1995

Mr. Kimio Fujita

President  
Japan International Cooperation Agency  
Tokyo, Japan

### Letter of Transmittal

Dear Sir:

We are pleased to formally submit herewith the final report of "A Road Network Master Plan Study in the Republic of Kenya".

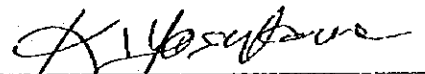
This report compiles the results of the study which was undertaken in the Republic of Kenya, from January 1994 to January 1995 by the Study Team, organized jointly by Pacific Consultants International and Construction Project Consultants.

We owed a lot to many people for the accomplishment of this report. First, we would like to express our deep appreciation and sincere gratitude to all those who extended their kind assistance and cooperation to the Study Team, in particular, officials concerned of Ministry of Public Works and Housing, the Republic of Kenya, and Kenyan Counterpart Team.

We also acknowledge the officials of your agency, the JICA Advisory Committee and the Embassy of Japan in the Republic of Kenya.

We wish the report would be able to contribute really to Kenya's people and socio-economic development in the future.

Very truly yours,



---

Kiyoshi Yasukawa

Team leader  
The study Team for  
A Road Network Master Plan Study  
in the Republic of Kenya



## TABLE OF CONTENTS

<b>Chapter 1 : Outline of The Study</b>	1-1
<b>Chapter 2 : Natural and Physical Features in Kenya</b>	
2.1 Physical Conditions	2-1
2.2 Natural Disasters	2-10
<b>Chapter 3 : Past Economic Development Pattern And Constraints</b>	
3.1 Existing Policy Framework and Constraints	3-1
3.2 Growth Performance and Economic Structure	3-4
3.2.1 Population and Labor Force	3-4
3.2.2 Economic Structure in Kenya	3-9
3.2.3 Regional Structure	3-14
3.2.4 Urbanization Patterns and Urban Rural Balance	3-23
3.2.5 City Ordering System for Analyzing urbanization	3-30
3.2.6 Environmental Constraints	3-40
3.3 Future Performance Prospects	3-47
3.3.1 Structural Adjustment Measures	3-47
3.3.2 National Development Framework	3-62
3.3.3 Regional Development Framework	3-68
<b>Chapter 4 : Transport Sector Conditions and Development Needs</b>	
4.1 Prevailing Condition of Different Transport Modes	4-1
4.1.1 General Considerations	4-1
4.1.2 Land Transport	4-3
4.1.3 Maritime Transport	4-17
4.1.4 Pipeline Transport	4-20
4.1.5 Air Transport	4-21
4.1.6 Inland Waterway Transport	4-24
4.1.7 Tourism Traffic	4-25
4.2 Supplemental Surveys	4-30
4.2.1 Traffic Survey	4-30

4.2.2	Road Inventory Survey	4-34
4.2.3	Axle load Survey	4-37
4.3	Evaluation of the Present Road Network	4-39
4.3.1	Assessment of the Existing Road Network	4-39
4.3.2	Present Traffic Characteristics and Network Pattern	4-48
4.3.3	Intra-Regional Aspects	4-76
4.3.4	Environmental Aspect	4-78
<b>Chapter 5 : Road Transport Modeling and Demand Forecast</b>		
5.1	Planning Horizon	5-1
5.2	Study Area and Zoning System	5-1
5.3	Methodology and Modeling Procedure	5-3
5.3.1	Overview	5-3
5.3.2	Road Network Development Procedure	5-5
5.3.3	Trip Matrix Development Procedure	5-11
5.4	Sufficiency Analysis of Base Year	5-15
5.5	Forecast of Future Demand	5-18
5.5.1	Trip Generation and Attraction Model	5-18
5.5.2	Trip Distribution Model	5-22
5.5.3	Future Zonal Trip Activity	5-23
5.5.4	1994 Road System Against 2013 Demand	5-25
<b>Chapter 6 : Major Conclusions</b>		
6.1	Road Network Development Policy	6-1
6.1.1	Strategic Options and Alternatives	6-1
6.1.2	Road Network Planning Policy	6-3
6.1.3	Functional Classification	6-14
6.2	Recommended Future Road Network	6-20
6.2.1	New and Upgrading Requirements	6-20
6.2.2	Implication of Future Road Network	6-34

6.2.3	Environmental Conditions in Road Planning	6-36
6.3	Maintenance Requirements	6-54
6.3.1	Present Situation of Road Maintenance	6-54
6.3.2	Current Problems and Issues	6-65
6.3.3	Policy and Institutional Reform	6-68
6.3.4	Plan for Road Maintenance	6-69
6.4	Road Network Development Project	6-78
6.4.1	Project Long List	6-78
6.4.2	Environmental Consideration in the Further Study	6-80
6.4.3	Estimated Investment Requirements	6-86
6.4.4	Economic Evaluation	6-110
6.4.5	Implementation Policy and Programme	6-116
6.4.6	Estimated Budgetary Implications	6-133
6.4.7	Institutional and Organizational Aspects	6-147
6.4.8	Major Assumptions and Risk Analysis	6-153

**Appendix 1 Materials for Road Construction**

**Appendix 2 Regional Development Framework by District**

**Appendix 3 Supplemental Survey**

**Appendix 4 Project List**

**Summary**

**Volume II : ANNEX**

- ANNEX I: Traffic Simulation Results
- ANNEX II: Technical Assessment Of The Existing Road Network
- ANNEX III Project & Maintenance Implementation Schedule



## Table and Figure Lists

Table No.	Title	Page
Table 2.1.1	Chronology of Flood Events	2-17
Table 3.2.1	Population Growth in Kenya	3-4
Table 3.2.2	District Population in 1979 and 1989	3-5
Table 3.2.3	Land Area and Population in Density by Province in 1989	3-7
Table 3.2.4	Labor Force and Wage Employment in Kenya, 1989 and 1990	3-8
Table 3.2.5	Modern Wage Employment by Industrial Sectors	3-8
Table 3.2.6	Structural Composition of Gross Domestic Product	3-10
Table 3.2.7	Sectoral Growth of Domestic Product	3-11
Table 3.2.8	Gross Domestic Product by Major Sectors and GDP Per Capita in 1988 and 1992	3-13
Table 3.2.9	Regional Comparative Advantage by Major Crop Group, 1989	3-17
Table 3.2.10	Agricultural Potential Areas by District	3-19
Table 3.2.11	Wage Employment of Manufacturing Industry by Major Town	3-22
Table 3.2.12	Population Density by District in 1989	3-24
Table 3.2.13	Ranking of Towns by Population Size and Region	3-27
Table 3.2.14	Indices of Cluster Tree	3-33
Table 3.2.15	Population of Each Territory	3-38
Table 3.2.16	Forest Resources and Deforestation	3-42
Table 3.2.17	The Number of Threatened Species	3-43
Table 3.2.18	Environmental Constraints in Kenya	3-45
Table 3.3.1	Projections of Road Development by Surface Type	3-52
Table 3.3.2	Projected Number of Tourist an Earning, 1993-1996	3-56
Table 3.3.3	Estimated Number of Visitors to the Tourism Regions	3-59
Table 3.3.4	Projected Future Population and Urbanization Framework	3-63
Table 3.3.5	Projected Future Gross Domestic Product	3-63
Table 3.3.6	Growth Rates of Future Gross Domestic Product	3-65
Table 3.3.7	Projected Future GDP Per Capita Growth Rate	3-66
Table 3.3.8	Projected Future Labor Force and Wage Employment	3-67
Table 3.3.9	Estimated Future Population by Province	3-70
Table 3.3.10	Estimated Future Urban Population by Province	3-74
Table 3.3.11	Estimated Future Rural Population by Province	3-75
Table 3.3.12	Estimated Future Wage Employment by Province	3-77
Table 4.1.1	Railway-Kilometerage of Track 1991/92	4-3
Table 4.1.2	Rolling Stock in 1990	4-5
Table 4.1.3	Passenger Traffic Handled	4-6
Table 4.1.4	Freight Tonnage Handled	4-6
Table 4.1.5	Road Length of all Classified Roads by Surface Type in 1992	4-10
Table 4.1.6	Total Length of International Trunk Roads(class A)	4-11
Table 4.1.7	Total Length of National Trunk Roads(class B)	4-12
Table 4.1.8	Total Length of Primary Roads(class C) by Surface Conditions	4-13
Table 4.1.9	Total Length of Primary Roads(class C) in Agricultural Potential Area	4-13
Table 4.1.10	Vehicle Km by Type and by Road Class in 1989	4-15

Table No.	Title	Page
Table 4.1.11	Vehicle with Current Licences	4-16
Table 4.1.12	Share of Passengers Transported on Land Transport	4-16
Table 4.1.13	Share of Freight Transport on Land	4-17
Table 4.1.14	Passenger Handled at Mombasa Harbor	4-18
Table 4.1.15	Fright Handled at Mombasa Harbor	4-19
Table 4.1.16	Vessels Entering Kenya Ports, 1983-1990	4-20
Table 4.1.17	Container Traffic Handled 1975-1991(theses)	4-20
Table 4.1.18	Pipeline throughout of White Petroleum Products	4-21
Table 4.1.19	Commercial Traffic at Jomo Kenyatta and Moi Int'l Airports	4-23
Table 4.1.20	Inland Waterways Capacity-Vessel in Service 1991/92	4-24
Table 4.1.21	Passengers and Freight Handled	4-25
Table 4.1.22	Visitor Arrivals and Departures by Purpose of Visit	4-26
Table 4.1.23	Number of Days Stayed by Purpose of Visit	4-28
Table 4.1.24	Number of Visitors to National Parks and Game Reserves	4-28
Table 4.1.25	Hotel Nightly Bed Occupied by Zone	4-29
Table 4.2.1	OD Traffic Survey Stations	4-31
Table 4.2.2	Weekly Variance	4-33
Table 4.2.3	Monthly Variance	4-33
Table 4.3.1	Summary of Load Analysis	4-42
Table 4.3.2	Average Vehicle Equivalence Factors	4-41
Table 4.3.3	Average Vehicle Equivalence Factors by Survey	4-44
Table 4.3.4	Average Vehicle Composition in 1994	4-51
Table 4.3.5	Heavy Vehicle Ratio by Survey Points in 1994	4-51
Table 4.3.6	Volume of Vehicle Generation/Attraction by Type	4-53
Table 4.3.7	Comparison of Traffic Demand by Vehicle Type	4-52
Table 4.3.8	Year 1994 Trip Length Distribution	4-61
Table 4.3.9	Generation and Attraction of Freight Tonnage Handled by Commodity	4-64
Table 4.3.10	Complaints Regarding Road Projects	4-78
Table 5.3.1	Definition of Terrain Type	5-8
Table 5.3.2	Assumed Maximum Capacity in PCU/hour by Road Width and Terrain	5-9
Table 5.3.3	Assumed Maximum Capacity in PCU by Road Width and Terrain	5-9
Table 5.3.4(1/2)	1994 Road Characteristics Summary	5-11
Table 5.3.4(2/2)	1994 Road Characteristics Summary	5-11
Table 5.3.5	Comparison of 1994 Observed and Modeled Demand	5-14
Table 5.4.1	1994 Loaded Network Parameters by Road Type	5-15
Table 5.4.2	Loading of 1994 OCU Trips onto 1994 Network Top Ten	5-16
Table 5.5.1	Changes in Vehicle Ownership	5-20
Table 5.5.2	Interchange Modification of Tanker Matrices	5-22
Table 5.5.3	Comparison of Traffic Demand by Vehicle Type	5-23
Table 5.5.4	Year 2013 Loaded Network Parameters by Road Type	5-25
Table 6.1.1	Classification of Cities	6-8
Table 6.2.1	Time Band and Covered Population	6-34
Table 6.2.2	Covered Population to Mombasa by Time Band	6-36
Table 6.2.3	Lists of Gazetted Forests(1-6)	6-46



Table No.	Title	Page
Table 6.2.4	Lists of National Parks and Reserves	6-53
Table 6.3.1(1)	Road Length of the Road Network Development Programme	6-61
Table 6.3.1(2)	Road Length of the Road Network Development Programme	6-62
Table 6.3.1(3)	Road Length of the Road Network Development Programme	6-63
Table 6.3.1(4)	Road Length of the Road Network Development Programme	6-64
Table 6.3.2	Recurrent Budget	6-60
Table 6.3.3	Expenditures and Budget	6-67
Table 6.3.4(1)	Road Maintenance Programme	6-70
Table 6.3.4(2)	Road Maintenance Programme	6-71
Table 6.3.4(3)	Road Maintenance Programme	6-72
Table 6.3.4(4)	Road Maintenance Programme	6-73
Table 6.4.1	Relationship of Impacts of the Projects	6-81
Table 6.4.2	Classification of Road Maintenance and Improvement Works for Paved Roads	6-87
Table 6.4.3	Classification of Road Maintenance and Improvement Works for Unpaved Roads	6-88
Table 6.4.4	Itemization of Construction and Maintenance Strategies	6-89
Table 6.4.5	Status of Road Projects under Contract	6-92
Table 6.4.6	Cost Level of Road Projects under Contract with MOPW&H	6-93
Table 6.4.7	Estimated Average Cost in "Summary of Roads Development Programme"	6-95
Table 6.4.8	Cost Level of Road Works Planned in "Roads Development Programme"	6-96
Table 6.4.9	Summary of Costs used in the Analysis of Road Projects	6-98
Table 6.4.10	Summary of Base Rates and Derivation of 1994 Costs	6-99
Table 6.4.11	Inflation Trends	6-100
Table 6.4.12	Estimated Unit Cost for Road Works	6-102
Table 6.4.13	General Scenario for Economic Evaluation	6-111
Table 6.4.14	Evaluation Scenario of Rehabilitation/Reconstruction	6-112
Table 6.4.15	Existing traffic Level	6-113
Table 6.4.16	Surface Conditions	6-114
Table 6.4.17	Maintenance Options by Surface Type	6-115
Table 6.4.18	Cross Section Type	6-119
Table 6.4.19	Maintenance Options	6-121
Table 6.4.20	Implementation Plan of Major Projects	6-127
Table 6.4.21(1)	Total Budget Appropriations and Gross Expenditure Estimations	6-134
Table 6.4.21(2)	Total Budget Appropriations and Gross Expenditure Estimations	6-135
Table 6.4.22(1)	Total Budget Expenditure for Roads	6-137
Table 6.4.22(2)	Total Budget Expenditure for Roads	6-138
Table 6.4.23	Cumulative and Average Annual Gross Expenditures	6-139
Table 6.2.24	Cumulative and Average Annual US Dollar Gross Expenditures	6-140
Table 6.4.25	Expenditure Structure and Pattern of the Recurrent Budget for Roads	6-141
Table 6.4.26	Road Sections Supported by Donor	6-143
Table 6.4.27	Estimated Future Budget	6-145
Table 6.4.28	Five Year Periods Budget	6-145
Table 6.4.29	Budget and Investment Requirements	6-146
Table 6.4.30	Personnel Development	6-150
Table 6.4.31	Distribution of Total Staff over Administrative Layers	6-150

Figure No.	Title	Page
Figure 1.1	Road Network Covered by the Master Plan Study	1-1
Figure 1.2	Work Schedule	1-4
Figure 2.1.1	Physiographic Regions	2-2
Figure 2.1.2	Relief Map	2-3
Figure 2.1.3	Geological Map of Kenya	2-7
Figure 2.1.4	Drainage Area Boundaries	2-8
Figure 2.1.5	Mean Annual Rainfall	2-11
Figure 2.1.6	Distribution of Landslide Factors in Kenya	2-13
Figure 2.1.7	Seismic Zoning Map	2-15
Figure 2.1.8	Flood Areas in the Country	2-19
Figure 3.2.1	Population Growth by District(1979-1989)	3-6
Figure 3.2.2	Identification of District Basis Regions	3-16
Figure 3.2.3	High Population Agricultural Area	3-21
Figure 3.2.4	Existing Industrial Corridor	3-22
Figure 3.2.5	Population Density by District in 1989	3-25
Figure 3.2.6	Distribution Pattern of Towns by Population Size in 1989	3-26
Figure 3.2.7	Visualized Cluster Tree among Cities and Towns	3-34
Figure 3.2.8	Cluster Tree	3-35
Figure 3.2.9	Hierarchy of Territory	3-36
Figure 3.2.10	Spacial Location of Territory	3-37
Figure 3.2.11	Distribution of Forest Areas	3-41
Figure 3.2.12	Environment Constraints in Kenya	3-46
Figure 3.3.1	Tourism Regions and Areas	3-59
Figure 3.3.2	Spacial Development Concept	3-61
Figure 3.3.3	Regional Development Concept	3-69
Figure 4.1.1	Current Transport Facilities	4-2
Figure 4.1.2	Railway Network in Kenya	4-4
Figure 4.1.3	Six Principal Commodities, 1986-1992	4-7
Figure 4.1.4	Annual Freight Net Tonnage between Stations in 1991/1992	4-8
Figure 4.1.5	Road Network System in Kenya	4-9
Figure 4.1.6	Population Density above 100 Persons/sq km District in 1989	4-14
Figure 4.1.7	Agricultural Potential Areas by Rainfall Factors	4-14
Figure 4.1.8	Pipeline Route	4-22
Figure 4.1.9	Tourism Area of National Parks and Reserves	4-27
Figure 4.2.1	Overall Procedure of Database Development	4-32
Figure 4.3.1	24 Hours Traffic Volume in 1989	4-49
Figure 4.3.2	24 Hours Cross-Sectional Traffic Volume of Principal Roads in 1994	4-50
Figure 4.3.3(1)	Vehicle of Flow by Type of Vehicle	4-57
Figure 4.3.3(2)	Vehicle of Flow by Type of Vehicle	4-58
Figure 4.3.3(3)	Vehicle of Flow by Type of Vehicle	4-59
Figure 4.3.3(4)	Vehicle of Flow by Type of Vehicle	4-60
Figure 4.3.4	Comparison of OD Pattern in 1983 and 1994	4-62
Figure 4.3.5	Year 1994 Trip Distribution by Type of Vehicle	4-63
Figure 4.3.6	Freight Tonnage OD Handled by Commodity	4-69
Figure 4.3.7	Territorial Formation in 1993 and 1994	4-71
Figure 4.3.8	Present Major Road Network Pattern	4-73

Figure No.	Title	Page
Figure 5.2.1	Traffic Zone System	5-2
Figure 5.3.1	Overview of Simulation	5-4
Figure 5.3.2	Screenline Location	5-13
Figure 5.4.1	Year 1994 Loading Results	5-17
Figure 5.5.1	Year 2013 PCU Desire Line	5-24
Figure 5.5.2	Loaded Year 2013 Traffic Demand onto 1994 Base Year Network	5-26
Figure 6.1.1	Relationship of Socio-Economic Issues and Coordination	6-4
Figure 6.1.2	Hierarchy of Cities	6-8
Figure 6.1.3	Location of Centers	6-9
Figure 6.1.4	Conceptual Drawing of Cluster Road Network	6-10
Figure 6.1.5	City Pair Load Factor on Each Link	6-17
Figure 6.1.6	Criteria Chart	6-16
Figure 6.1.7	Definitive Road Classification	6-19
Figure 6.2.1	Missing Links	6-23
Figure 6.2.2	Bypass Analysis Chart	6-24
Figure 6.2.3	Major Problems on Tourism Access	6-30
Figure 6.2.4	Significance Future Road Network Plan	6-31
Figure 6.2.5	Integrated Future Road Network Plan	6-32
Figure 6.2.6	Necessity of Strategic Approach	6-33
Figure 6.2.7	Necessity of Establishment of Road Network	6-33
Figure 6.2.8	Accumulated Population	6-35
Figure 6.2.9	Covered Population to Mombasa	6-36
Figure 6.2.10	Areas of Gazetted Forests	6-45
Figure 6.2.11	Areas of National Parks and Reserves	6-52
Figure 6.2.12	Causes of Major Environmental Constraints and Measures	6-44
Figure 6.4.1	Phased Construction and Maintenance Strategy by Road Category	6-90
Figure 6.4.2	Cross Section Type I-Dual Carriage Way	6-118
Figure 6.4.3	Cross Section Type II-VIII-Single Carriage Way	6-118
Figure 6.4.4	Geometric Improvement Diagram	6-120
Figure 6.4.5	Road Maintenance Diagram	6-121
Figure 6.4.6(1)	Major Projects	6-131
Figure 6.4.6(2)	Major Projects	6-132
Figure 6.4.6(3)	Major Projects	6-132
Figure 6.4.7	Composition and Growth of Budget	6-146
Figure 6.4.8	Existing Organizational Structure of MOPW&H	6-148
Figure 6.4.9	Existing Organizational Structure of the Road Department in MOPW&H	6-149



## Abbreviation

<b>AADT</b>	<b>Annual Average Daily Traffic Volume</b>
<b>A/C</b>	<b>Asphalt Concrete</b>
<b>S/D</b>	<b>Surface Dressing</b>
<b>ADT</b>	<b>Average Daily Traffic Volume</b>
<b>ESA</b>	<b>Equivalent Standard Axle</b>
<b>GOK</b>	<b>Government of Kenya</b>
<b>HDM</b>	<b>Highway Design and Maintenance Standard Model</b>
<b>JICA</b>	<b>Japan International Cooperation Agency</b>
<b>MOPWH/MOPW&amp;H</b>	<b>Ministry of Public Works and Housing</b>
<b>MRP</b>	<b>Minor Roads Programme</b>
<b>PTA</b>	<b>Preferential Trade Area</b>
<b>RARP</b>	<b>Rural Access Roads Programme</b>
<b>RUCM</b>	<b>Road User Cost Model</b>
<b>SPR</b>	<b>Special Purpose Road</b>
<b>S.L.</b>	<b>Super Link</b>

## **Chapter 1 Outline of the Study**

## Chapter 1 Outline of the Study

### (1) Background of the study

The principal traffic and transport modes in the Republic of Kenya are road, railway, harbor, airport and pipeline transport. However, road transport accounts presently for 69% of total freight and 96% of total passenger transport, making it therefore the prime mode among all transport modes. The international trunk roads (class A in the Kenyan classification system)<sup>\*)</sup> form the trunk lines for the commodity transport to the Sub-Saharan inland countries Uganda, Rwanda, Burundi and eastern Zaire.

However, in spite of the importance of roads, still only some 45 % of the Kenyan trunk line road system (classes A; B; C)<sup>\*)</sup> is paved. In addition, the deterioration of and damage to the trunk road network has increased over the past, due to the rapid rise in the number of motorcars in recent years as well as the increase in the number of overloaded vehicles. Furthermore, road development is somewhat lacking behind. As a result of these circumstances, the status of the road network has become a general obstacle to overall economic expansion and regional development. Since the development of regional roads has also not found the necessary attention; they have become a hindrance to regional development that takes full advantage of local and regional development potentials.

It is obvious that the road network of the Republic of Kenya performs an important function for economic growth as well as regional and local development. The countries and organizations providing "Official Development Assistance" are aware of the need for assisting in the development of Kenya's road network and infrastructure. Hence, a number of projects have been and are being implemented in this area. Taking this situation into consideration, a long-term road development master plan is required in order to advance road development in the Republic of Kenya in a planned, coordinated and efficient manner.

---

The classification system comprises six main categories. These are : class A: international trunk roads; class B : national trunk roads; class C : primary roads; class D : secondary roads; class E : minor roads and special purpose roads (SPR).

(2) Objective of the Study

The objective of the Study is to formulate a master plan for the development of the road network in Kenya. The master plan's target year is 2013.

(3) Scale of the Study

The Study area covers the total territory of the Republic of Kenya. The Study road network covers the international trunk roads (class A), national trunk roads (class B) and the primary roads (class C). Secondary roads (class D); minor roads (class E) and special purpose roads (SPR) are outside the scope of the Study. Figure 1.1 shows the road network covered by this master plan Study..

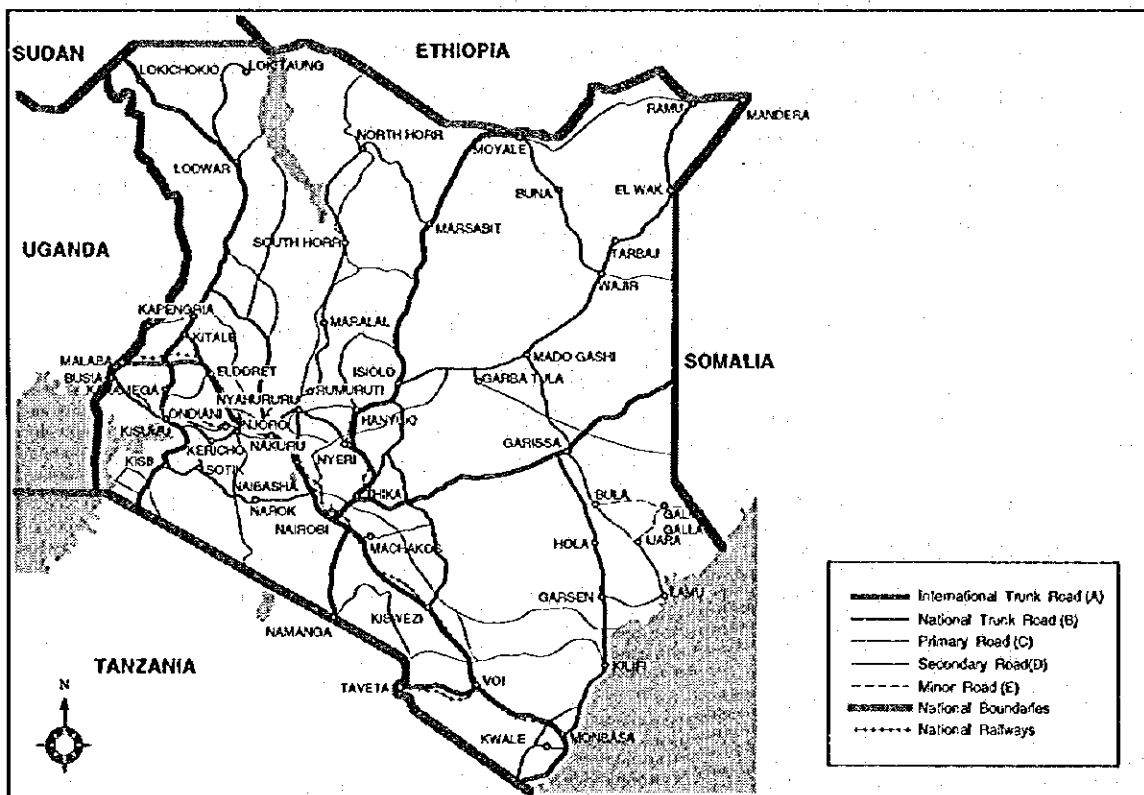


Figure 1.1 Road Network Covered By The Master Plan Study



**(4) Implementation of the Study**

Implementation of the of the master plan Study has been divided into two main phases as shown graphically in Figure 1.2.

- a During the first implementation phase, the following major work items have been addressed :
- The collection and analyses of information and data
  - A review of the prevailing socio-economic condition and the formulation of a future socio-economic framework
  - A road condition primary survey, which was employed as a tool for the assessment of the present road network
  - A traffic survey, on basis of which the future traffic demand was forecasted
  - An initial environmental survey
  - The formulation of basic policies for road network development
  - The design of the future road network, and
  - The preparation of a list of development projects.
- b During the second phase of master plan formulation, the following major work items have been covered :
- The formulation of a road maintenance plan
  - The implementation of an initial environmental survey.
  - The assessment of the road network development projects
  - The formulation of an appropriate investment program
  - Recommendations on organizational and institutional aspects, and
  - A second initial environmental survey.

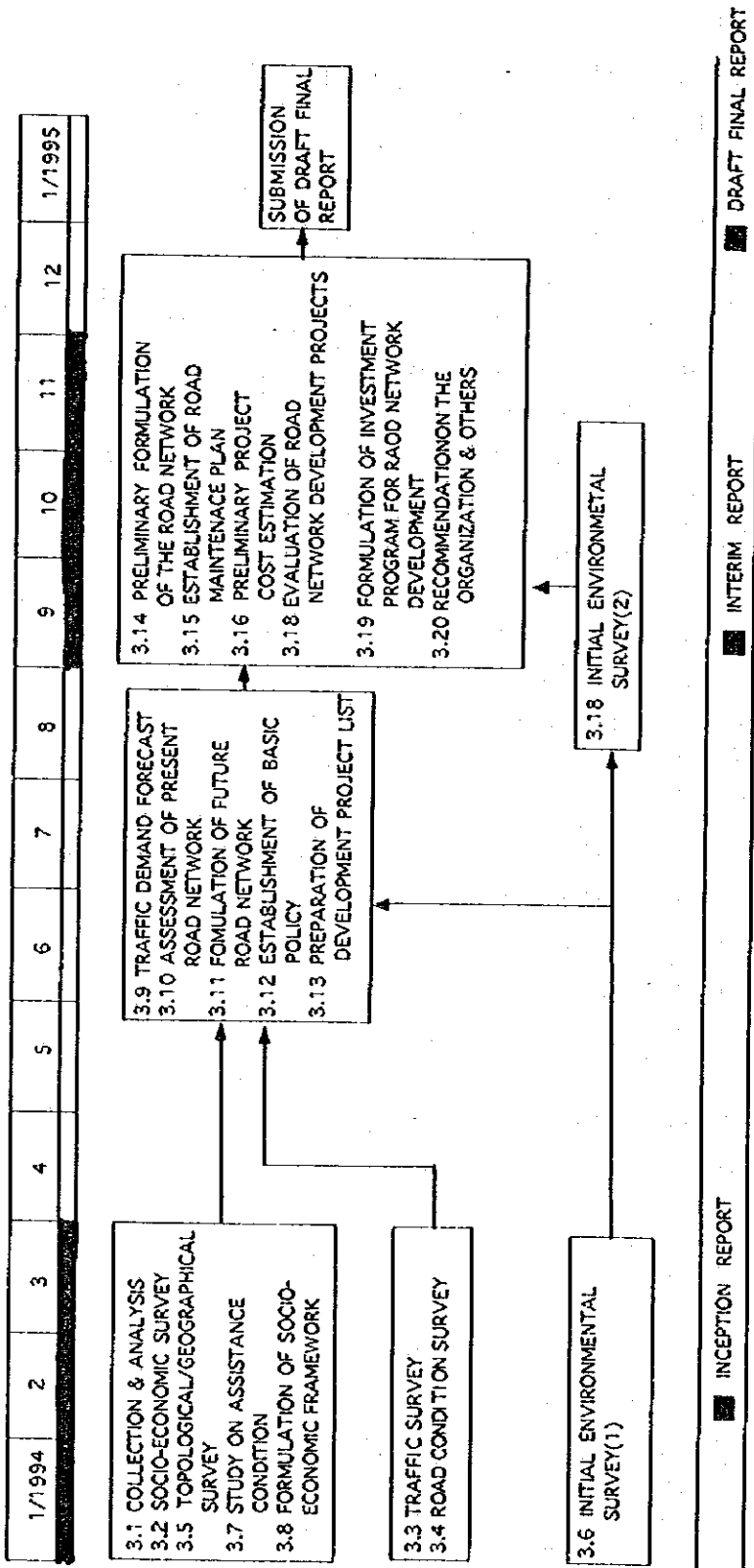
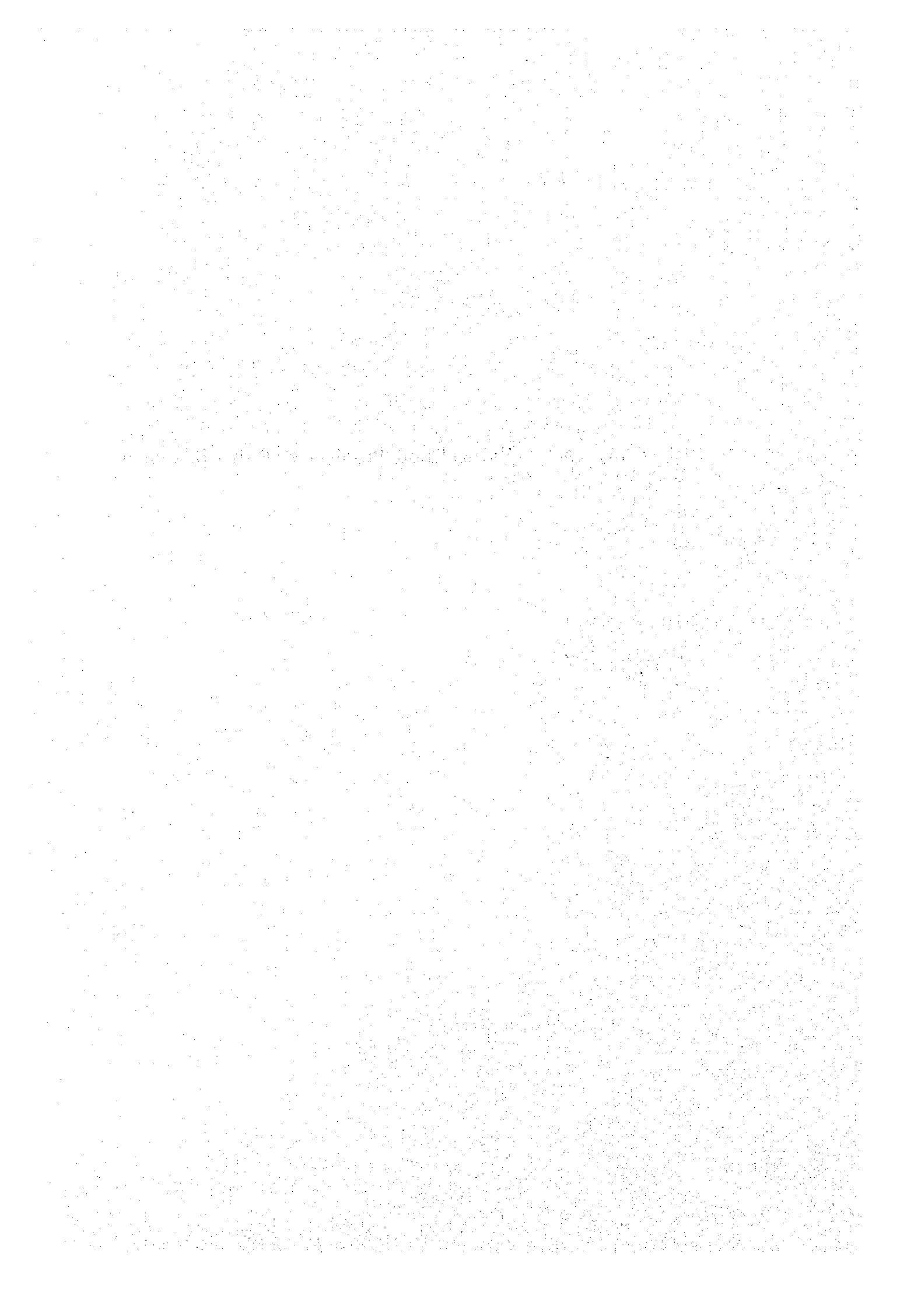


Figure 1.2 Work Schedule

█ Work in Kenya  
 ▭ Work in Japan

## **Chapter 2 Natural and Physical Features in Kenya**



## Chapter 2      Natural and Physical Features in Kenya

### 2.1 Physical Conditions

#### (1) Physical Geography

The Republic of Kenya is located approximately between latitudes 4°21'N and 4°28'S and between longitudes 32°E and 42°E. The country is bisected almost horizontally by the equator and vertically by the 38° longitude. Uganda is located to the west of her border, the Sudan and Ethiopia to the north, Tanzania to the south and Somalia and the Indian Ocean to the east. Kenya covers a total area of about 580,367 km<sup>2</sup>, out of which 11,230 km<sup>2</sup> are covered by water.

Kenya has a great diversity of landscapes ranging from glaciated mountain peaks under permanent snow cover, to a flight of plateau to the Coastal Plain. The country consists of eight physiographic regions : the coastal plain, the Duruma-Wajir low Belt, the low Foreland Plateau, the Kenya Highlands, the Kenya Rift Valley, the Nyanza Lowlands, the Nyanza Plateau and the Northern Plainlands (Fig. 2.1.1 refers ).

Figure 2.1.2 summarizes the physical features in form of a relief map.

#### 1) The Coastal Plain

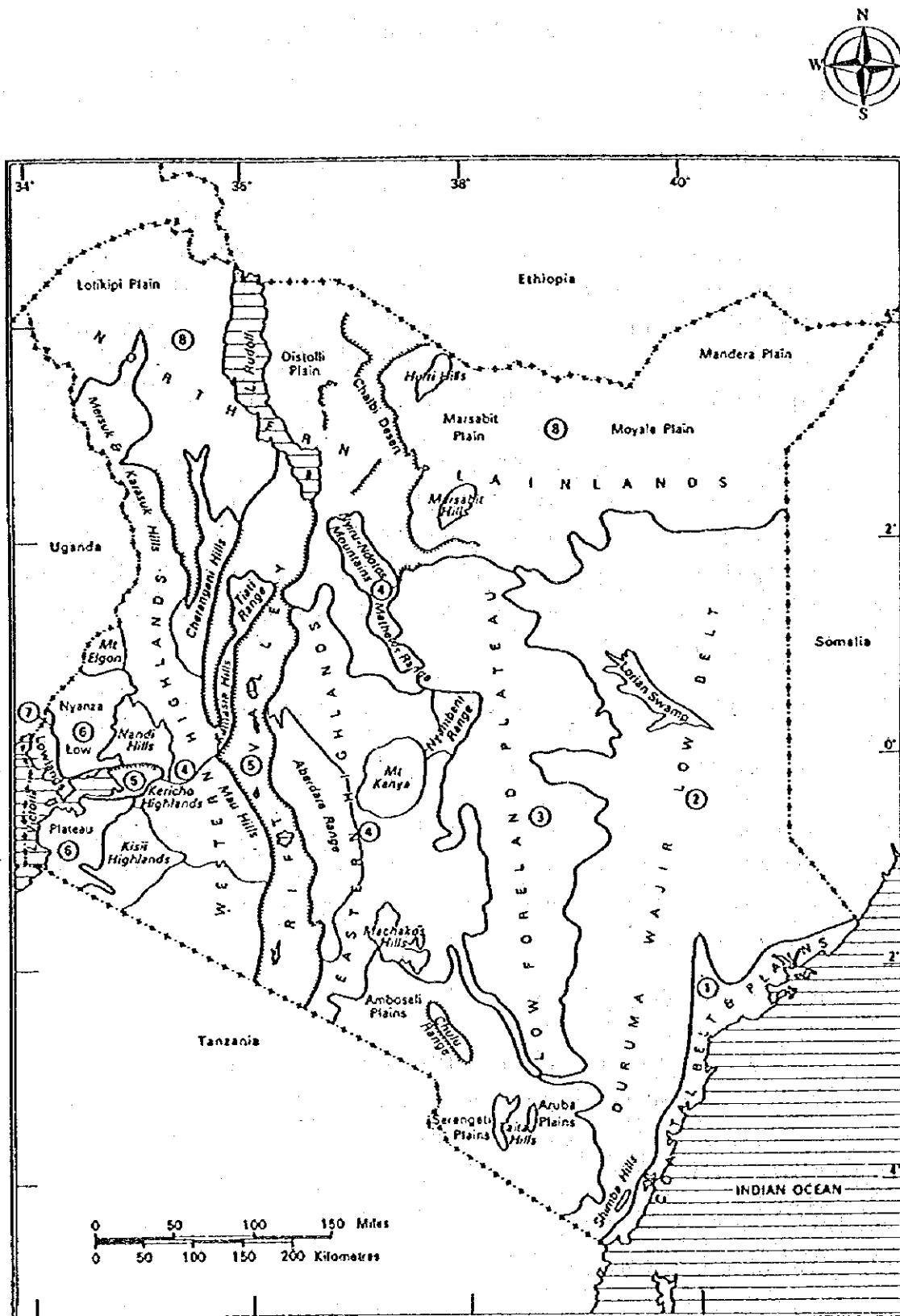
The Kenya coast is a low and narrow plain with an altitude of 0 m to 300 m above sea level and ranging from 16 to 75 kilometers in width. The plain is at its widest at the river deltas, such as at those of the Athi and Tana rivers, particularly at the Tana river delta.

#### 2) The Duruma - Wajir Low Belt

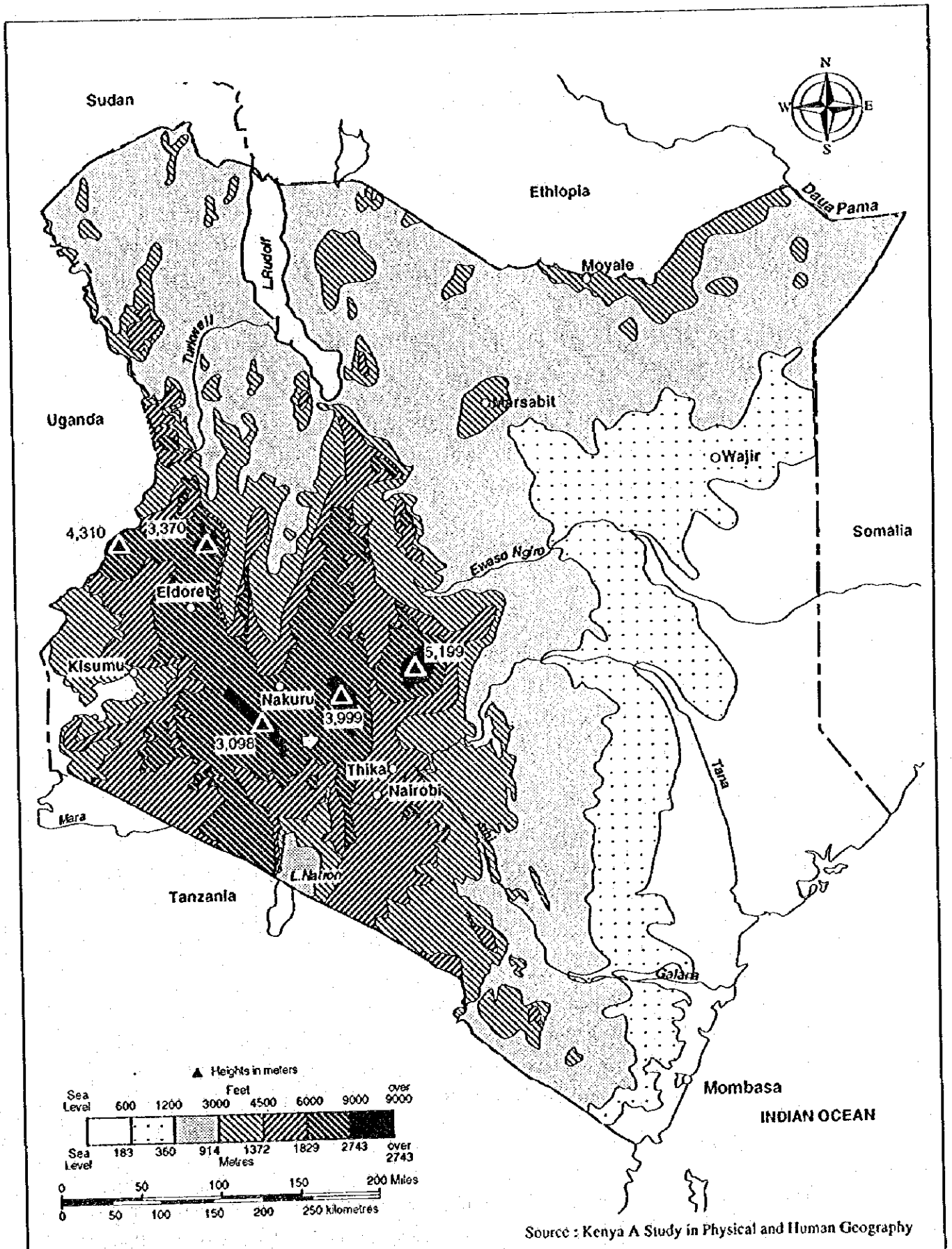
The belt is an extensive region characterized by an obvious uniformity in that it is dry, monotonously flat and very uninspiring. It is separated from the coastal belt by a rather ill preserved series of hills named Coastal Ranges. These ranges form a part of this region and rise very gently from an altitude of 150 m to about 300 m above sea level.

#### 3) The Low Foreland Plateau

The plateau's altitude varies between 300 m to 915 m above sea level. Much of it is flat, desolate and dry land. Except for the volcanic plains of Amboseli, the region forms one extensive erosion surface originating from the late Tertiary age,



Source : Kenya A Study in Physical and Human Geography



### Road Network Development Master Plan in Kenya

Figure 2.1.2 Relief Map

with numerous small and abruptly rising inselbergs.

4) The Kenya Highlands

The Kenya Highlands are famous, particularly for their role in the historical development of the Kenyan nation. As defined in this Study, these highlands possess tremendous physical diversity, although the unity of the region is evident by virtue of its great altitude. No single contour can be used to delimit the lower part of the region, for other important details, such as breaks in the slope and general appearance, must also be considered.

The Great African Rift Valley bisects the region into western and eastern highlands. Two sharply contrasting landscapes occur. Firstly, there are the *old upland massifs*, which are erosional remnants of old plantation surfaces of pre-Miocene to late Jurassic age. Secondly, there are the relatively younger *Tertiary-recent* volcanic highlands and plateaus.

5) The Kenya Rift Valley

The main valley runs meridian allied through the Kenya Highlands and continues into Tanzania. In the Distolli Plain, the faults are not so impressive due to later volcanic eruptions and sand dunes. In other places displacements of 1,200 m to 1,800 m are typical.

As the faults occur in a series of parallel faults, the sides of the main valley are typically stepped. Lower down into the valley bottom, however, these benches or platforms mark former lake levels. At the floor of the valley are a number of younger volcanic plugs and cones.

6) The Nyanza Low Plateau

This is a low plateau with a gentle but obvious slope towards Lake Victoria, the latter indicating that structurally it is a part of the down-warped Lake Victoria Basin. Much of the plateau's length is dominated by an extensive erosion surface at an altitude ranging from 1,200 m to 1,500 m.

7) The Nyanza Lowlands

This is a relatively minor region. It comprises a low lying swampy area, very much prone to flooding, and embraces the Yala - Nzoia Lowlands between Port Victoria, Ukwala, Boro and Imbo.



8) The Northern Plainlands

This is the most extensive of the regions covering the whole of Northern Kenya. It is also the least known of the regions due to its remoteness. The area is dominated by extensive low lying interior plains ranging between 360 m and 900 m in height. In this respect it may be said that they form the natural continuation of the Low Foreland Plateau. The area is also of considerable aridity.

(2) Geology

The geological surface of Kenya can be sub-divided into seven major rock formations by using the major geological rock types and ranking the oldest to the youngest as follows :

- a Very ancient *metamorphic rocks*, which are between 2,000 to 3,500 million years old. Metamorphic rocks are those rocks which have become altered considerably from their original structure and composition by pressure and heat. These types are found mainly in western Kenya around the Lake Victoria region and also in northern Kenya, in the districts of Marsabit (eastern part); Wajir (northern part); and Mandera (western part).
- b "*Bukoban Sandstones*" , which are at least 650 million years old and which are found in western Kenya, south of Kisumu. Sandstones are a group of rocks of sedimentary origin, consisting of sand grains consolidated or mixed together with materials such as quartz and clay.
- c Highly layered and metamorphosed rocks of the *Mozambique Belt* , which are between 620 and 410 million years old. They are found mainly in the Rift Valley (Turkana and Narok Districts), the Eastern (Isiolo, Kitui and Machakos Districts) and the Coast Provinces (Taita District).
- d "*Karoo Sandstones*" are 400 to 300 million years old. They are found in the Coast Province in the districts of Taita, Kilifi, Kwale and Tana River.
- e *Young Sedimentary Rocks* formed around 200 to 20 million years ago. Sedimentary rocks are formed by the accumulation and consolidation of mineral and organic fragments that have been deposited by water, ice or wind. In Kenya, they have become level beds of sandstone and clay and are found all along the coastal strip and on the north-eastern tip of the country, in Mandera District.

- f *Recent Volcanic Rocks* , dating from 20 million years ago, are found in the volcanic land in the Rift Valley and its associated highlands.
- g *Recently formed sands, clay and raised coral reefs*. These can be found in the north west of Kenya, along the shores of Lake Turkana, and in the arid and semi-arid lowlands of eastern and north-eastern Kenya, mainly in the districts of Marsabit, Wajir, Garissa, Tana River and Lamu.

Figure 2.1.3 shows the geology of Kenya.

### (3) Drainage

Drainage in Kenya is determined primarily by the Rift Valley, which roughly bisects the highlands zone from north to south. Within the rift, drainage takes place into a chain of lakes, which have no surface outlet. West of the rift, rivers drain into Lake Victoria. To the east, rivers follow a southeasterly course into the Indian Ocean.

Topography and rainfall streams have created many semi-closed, poorly drained or overflow areas retaining substantial amounts of water, which originate on upslope areas.

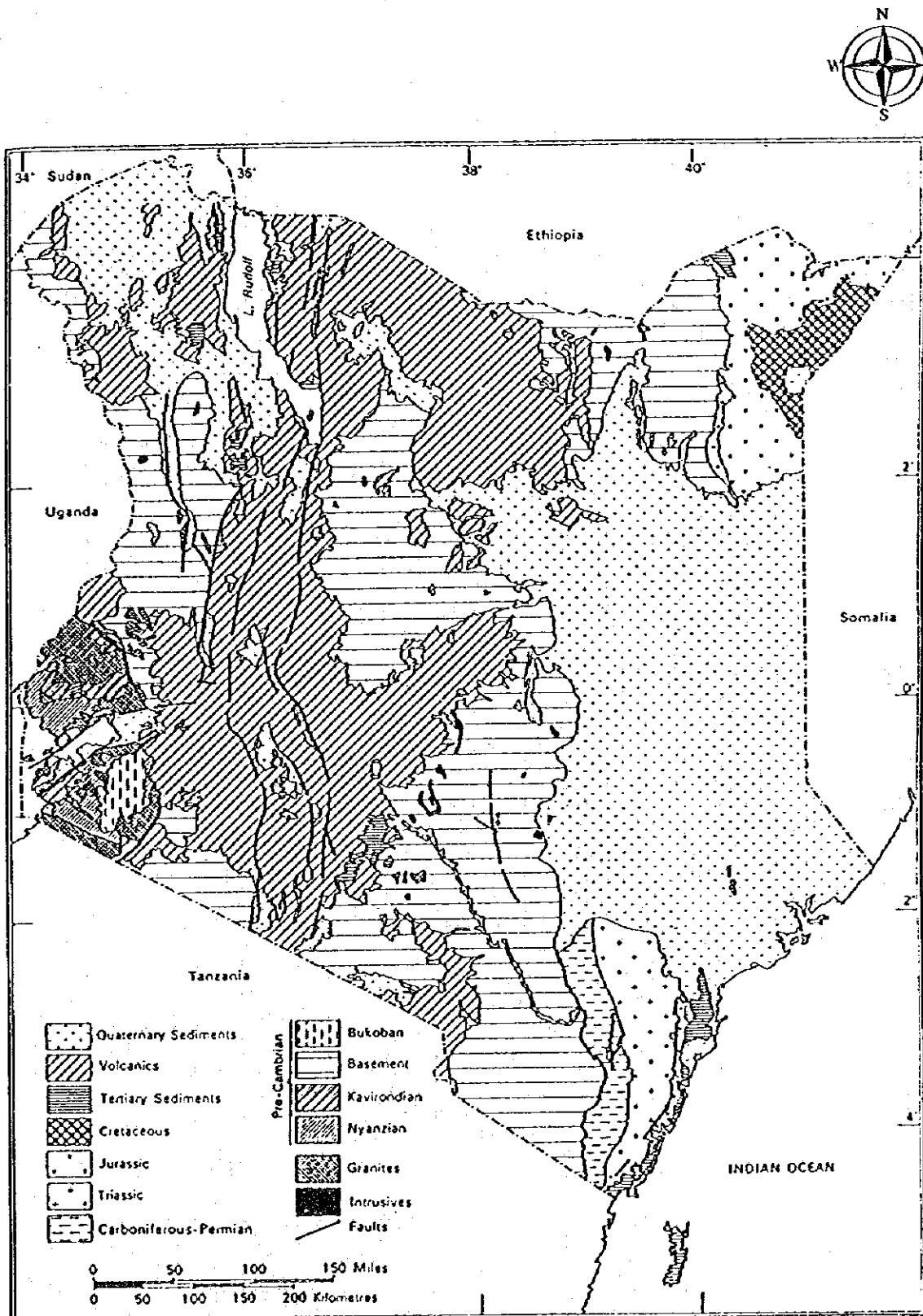
#### 1) Catchments

Kenya is divided into five major drainage areas as depicted in Figure 2.1.4.

- a Lake Victoria ( drainage area 1 )
- b Rift Valley ( drainage area 2 )
- c Athi River ( drainage area 3 )
- d Tana River ( drainage area 4 )
- e Ewaso Nyiro River ( drainage area 5 ).

Areas 3 and 5 receive their names from their principal rivers, although substantial portions of their territory do not drain into those channels.

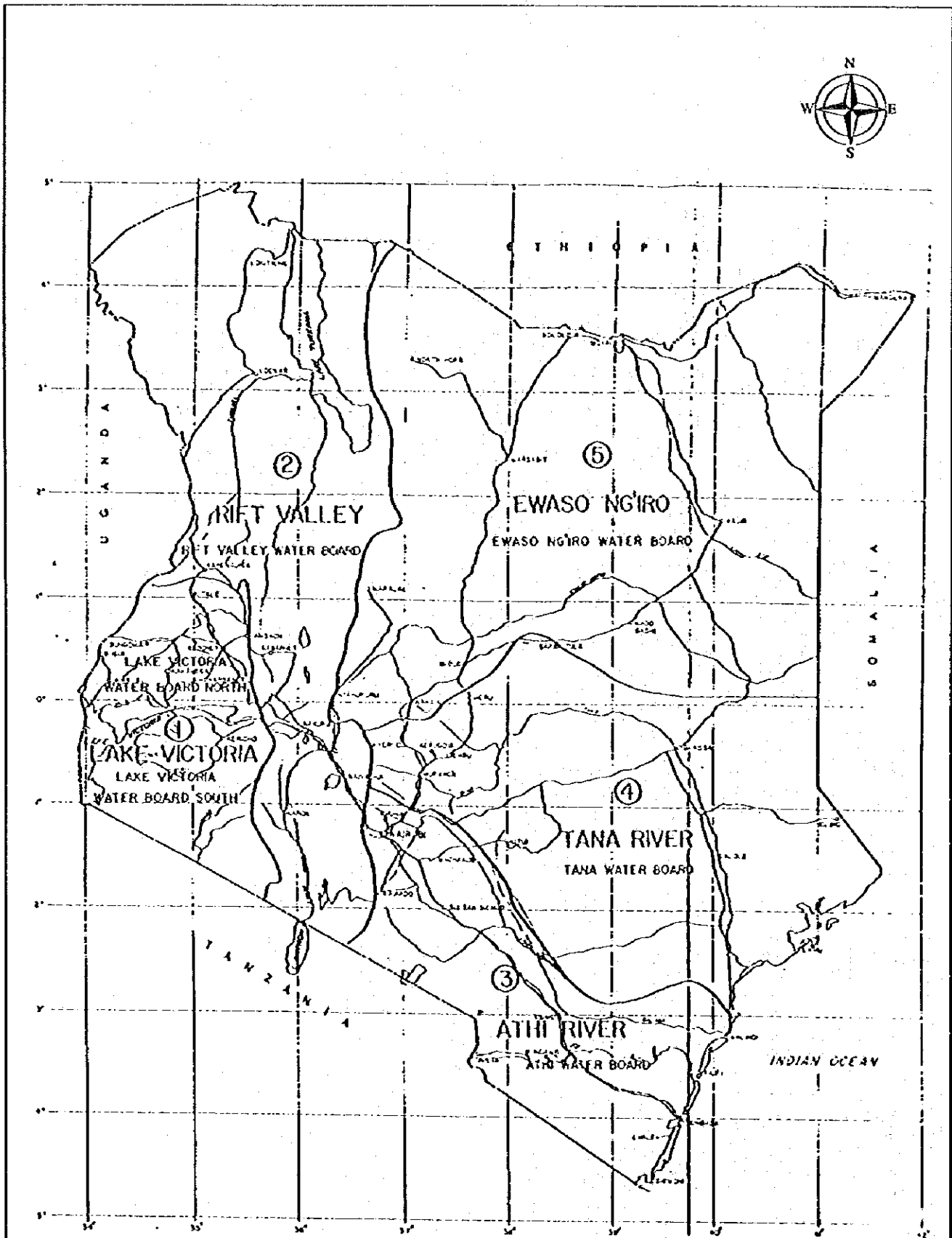
The Lake Victoria Area comprises the entire catchment, which drains into Lake Victoria and Lake Kioga via numerous rivers. Most of these streams flow into the Kenyan shore of Lake Victoria. However, Malakisi, Malaba and six other rivers form a riparian boundary with Uganda or flow across to Uganda. The Mara River feeds renowned wildlife refuges in Kenya and downstream in Tanzania before it reaches Lake Victoria.



Source : Kenya A Study in Physical and Human Geography

**Road Network Development  
Master Plan in Kenya**

**Figure 2.1.3  
Geological Map of Kenya**



Source: Kenya A Study in Physical and Human Geography

The Rift Valley Area has a closed drainage system, which spills into Lake Turkana in the North, Lake Natron in the south and a number of smaller lakes in between.

The Athi River Area comprises most of the country's southeast. Drainage flows down the southern slopes of the Aberdare Range and the eastern flank of the Rift Valley and flows into the Indian Ocean. Several lesser streams rise in the coastal belt or in the plateau foreland and flow directly into the ocean or into closed basins.

The Tana River Area drains the eastern slopes of the Aberdare Range, the southern slopes of Mt. Kenya and the Nyambeni Range and flows into the Indian Ocean.

The Ewaso Nyiro Area waters originate on the northern slopes of the Aberdare Range, on Mt. Kenya as well as on lesser mountain masses or uplands in the north and northeast. They flow into the Lorian Swamp and other similar regions, which mark the normal downstream; flowing continuously during wet or very wet years across into Somalia. Except for the Ewaso Nyiro River itself, streams of this area probably flow only in direct response to immediately antecedent rainfall.

## 2) Lakes

Lakes in Kenya are classified according to their origin into four main categories, namely tectonic, volcanic, glacial, and coastal or flood plain lakes. Tectonic lakes include Lake Victoria and the Rift Valley lakes, such as Lake Turkana, Baringo, Bogoria, Nakuru, Elmentaita, Naivasha, Magadi and Amboseli.

Volcanic lakes are usually crater lakes, such as Lake Paradise in Marsabit. Glacial lakes are mainly found near Mt. Kenya. Both, volcanic and glacial lakes are of very small dimensions.

Coastal lakes are those which occupy marshy ground both, along the coast and near Lake Victoria, such as the Yala Swamp.

Flood plain lakes, seasonal marshes and similar poorly drained freshwater areas form a substantial underutilized land resource.

**(4) Rainfall**

Kenya has a mean annual rainfall of about 500 millimeter, which varies from under 250 millimeter in the arid areas in the north and the east to over 2,000 millimeter on the high mountain ranges. The annual rainfall follows generally the seasonal pattern. However, there are no absolutely dry seasons and rain may fall at any time in all areas of Kenya. The seasonal variations are most distinct east of the Rift Valley and in the dry low lands of the north and east (with two distinct rainy seasons from March through May and from October through December). In the area west of the Rift Valley the seasonal distribution of rainfall is the weakest, with a long and almost continuous rainy season. Most of the rain falls from April to August. September and October are drier months with high rainfall again in November.

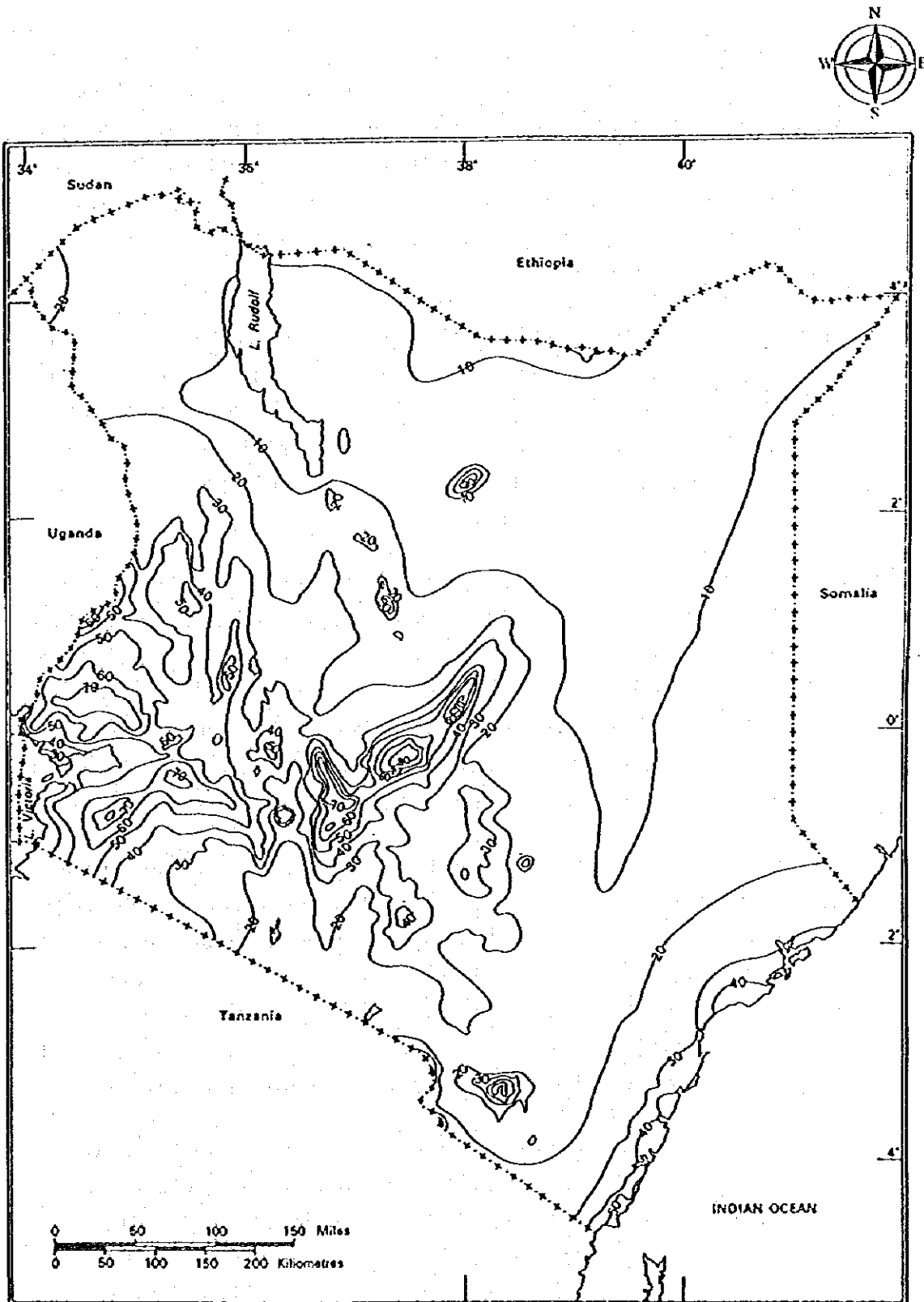
The isotype of mean annual rainfall are shown in Figure 2.1.5.

**2.2 Natural Disasters**

**(1) Landslides**

The landslide problem in Kenya has been researched little and there is a lack of information on both, the distribution of landslide phenomena and their economic and social significance. The landslide risk in Kenya is assessed according to geology, rainfall and slope gradient. The areas identified as being most at risk are those affected by major tectonic activity associated with the formation of the Rift Valley, with deeply weathered volcanic soils and a high to moderate mean annual rainfall. Prolonged or intense rainfall or a combination of the two are among the most important factors that trigger landslides.

The slope gradient is obviously a critical factor controlling the distribution of landslides, as failure will only occur on slopes exceeding the critical angle. Mass movements are generally confined to slopes of between 30° to 60°. Observations in the Aberdare foothills indicate a high frequency of valley side slopes of 20°, suggesting that this is close to the stable angle for the deeply weathered Tertiary volcanics, which form the substrate. It is assumed for the purpose of this study that slopes of 20° and over are potentially unstable. Their distribution is shown in Figure 2.1.6. The map identifies the areas with macro-scale slopes, that is generally with a relief of 300 m or exceeding more than 20°. It excludes, however, other areas, which may have short steep valley side slopes, but in which the regional gradient is more subdued.



Source : Kenya A Study in Physical and Human Geography

Figure 2.1.5  
Mean Annual Rainfall

A comparison of Figure 2.1.6 with the geological map of Kenya in Figure 2.1.3 shows that areas of steep slopes are located mainly along the flanks of the Rift Valley, especially to the west of the Elgeyo - Cherangani - Kapenguria area and to the east in the Aberdares range. Steep slopes are also associated with inselberg type hills of the Precambrian rocks in the Mathews and Ndoto ranges to the north of Mount Kenya, the Machakos and Kitui Hills to the south of Mount Kenya and the Taita Hills near the southern border.

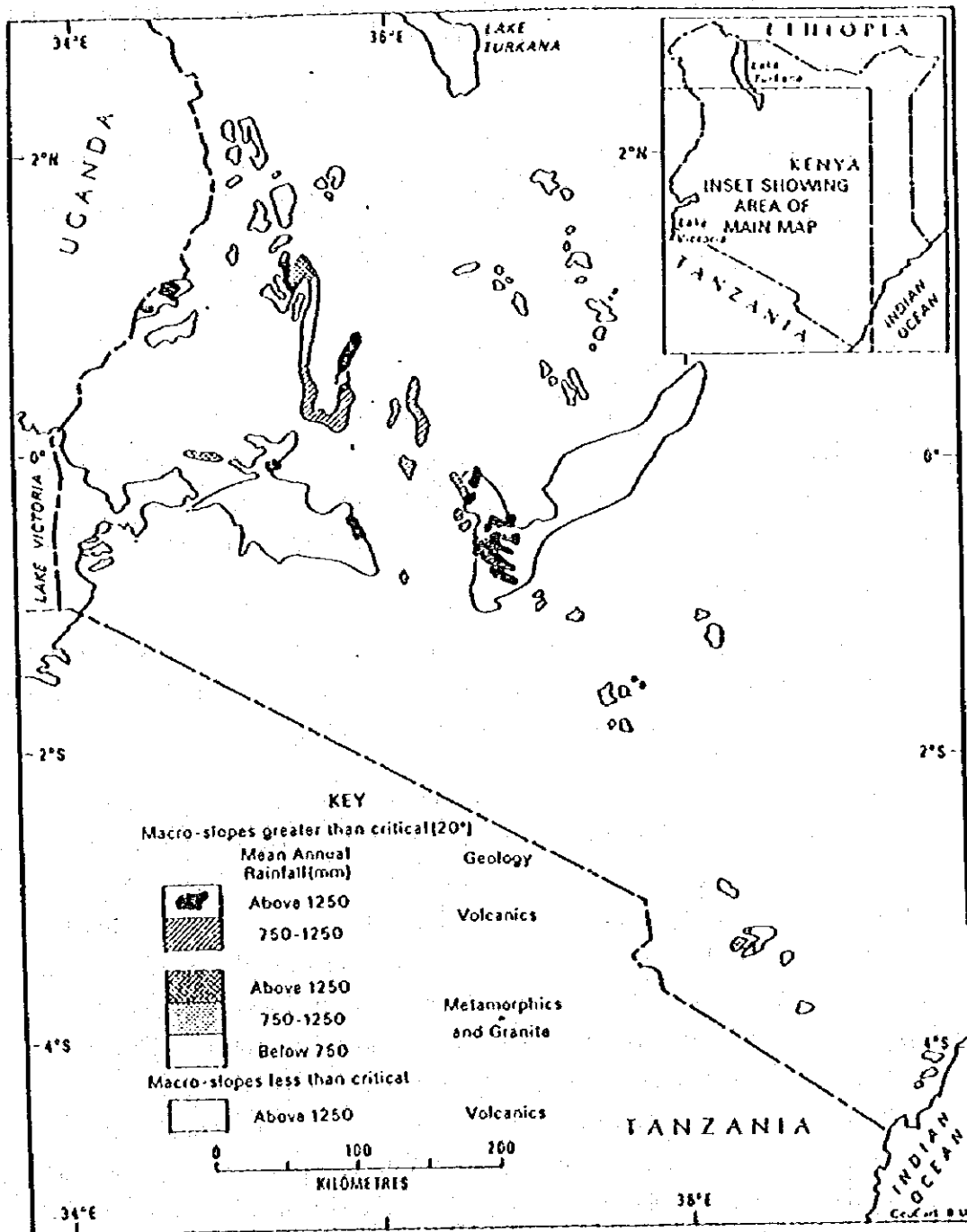
The areas predicted as having the highest landslide potential are those with a combination of steep slopes, high rainfall and deeply weathered volcanic rocks. Figure 2.1.6 shows that this combination occurs in the Aberdares and the Tugen Hills. Areas such as Mount Kenya satisfy two of the criteria, but lack the steep regional slope gradients. Local stream dissection and oversteepening along road cuttings will promote landslide activity here.

High rainfall and steep slopes coincide with basement rocks in the Cherangani and Taita Hills. As the mean annual rainfall diminishes, so does the potential for land sliding. However, the strong variability of annual rainfall at a station and the high intensity of storm rainfall means that in the sub-humid areas wetter periods occur with sufficient frequency to make land sliding a significant hazard. Hence the Elgeyo escarpment, with excessively steep faulty sharp slopes but with only a moderate rainfall will still have a significant landslide potential.

In the semi-arid areas in the Mathews and Ndoto ranges, debris avalanches rather than landslides may be expected as a result of infrequent but intense or prolonged rainfall events. Coarse debris produced by mechanical weathering would collect in steep ravines and gullies during the drier periods to be set in motion during high rainfall events. Numerous debris avalanches have been observed on steep hillsides within the Rift Valley floor near Lake Baringo (mean annual rainfall 650 mm), following exceptionally heavy rainfall in the first half of the year.

Two other landslides worthy of mentioning are the ones that occurred in Mukurwe-ini in Nyeri on 22nd September 1986 and the one that struck Gacharage Village of Muranga District in May, 1991.





**Figure 2.1.6**  
Distribution of Landslide Factors in Kenya  
No occurrence of these factor combinations are found outside the area shown on the map

The latter landslide was studied in detail by Messieurs T.C. Davies and I.O. Nyambok of the University of Nairobi. Their study concluded that the principal determining factors of the landslide were a high, mechanically unstable slope (28°) of deeply weathered volcanic soil and a high absorption capacity of the surface soil layer. The slide was triggered by rapid saturation of the soil following heavy downpour.

A number of other roads may be at risk to landslides, in particular at the Marigat-Kabarnet road up the Tugen escarpment and the Thuchi - Nkubu road around the east side of Mount Kenya, where a combination of high rainfall and deeply weathered volcanic soils may render the steep road cuttings unstable.

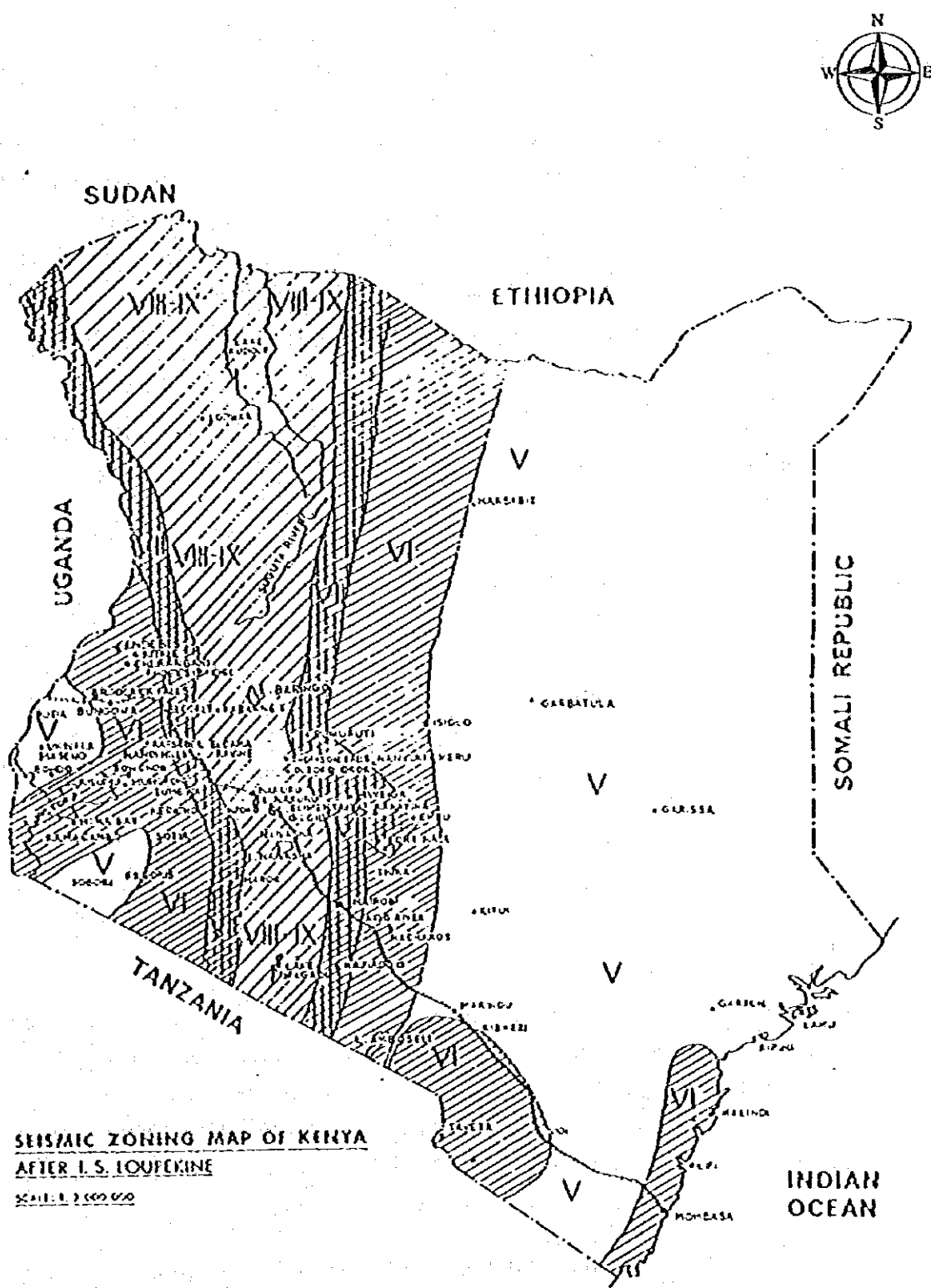
## (2) Earthquakes

Owing to the sparseness and irregular distribution in the recording population, knowledge of the earthquake history of Kenya is incomplete and uneven. In July, 1971, I.S. Loupekine of the Seismology Unit, Geology Department, University of Nairobi, prepared a catalogue of earthquakes felt in Kenya over the period 1982 to 1969.

It is unnecessary for the purpose of this Study to produce a complete chronological list of all the earthquakes that occurred in Kenya. What is most useful is to study the seismic zoning map reproduced in Figure 2.1.7.

The maximum expectable intensity appears to be VIII on the modified Mercalli scale, reaching locally in the Rift Valley an intensity of IX. It is thought that no area of Kenya has a maximum expectable intensity of less than V. Since this intensity is the threshold of damage, no part of Kenya is thus immune from damaging earthquakes. The map has been constructed on the basis of, firstly, actual past observations of intensity. Secondly, it employs geological factors, based on assigning the maximum intensity for a homogeneous unit characterized by the same regional geological structure. Such type of geological extrapolation is justified as it evens out distorted historical statistics, which are due to unevenness of the reporting population. The major Rift faults have been considered as fundamental criteria for the purpose of geological projection. Intensity V is taken as the threshold of damage and it has to be noted that this is the lowest intensity value assigned to Kenya.

The present work suggests the existence of a belt of stronger seismicity, extending from the Lakipia escarpment in a south-eastern direction. The Catalogue contains



**SEISMIC ZONING MAP OF KENYA**  
 AFTER I.S. LOUFKINE  
 SCALE: 1:2,000,000

Figure 2.1.7  
 Seismic Zoning Map

several instances of seismic wave propagation along this direction, especially for the earthquake of 6 January 1928, when seismic waves caused relatively strong effects in the Nyeri - Fort Hall - Embu area and also as far as Sokoke, near Kilifi and Mombasa. The existence of NW-SE faults along this belt is significant together with the position of Mt. Kenya as its center. The existence of a NW-SE trend of seismicity has been deduced in the Chyulu Range - Taita Hills area, where a NW-SE alignment is to be found in the volcanic range, conelets and faults. A similar alignment of craters and conelets is to be found on mount Kilimanjaro.

No attempt has been made to indicate seismic risk, but a frequency indication can be obtained from the following figures of total numbers of earthquakes for the period 1982 to 1969 (13 years).

Maximum intensity	Number of earthquakes
IX	1
VIII	0
VII	3
VI	28
V	128
IV	382
III - II	25
Total: 567	

### (3) Floods

Flood records are sparsely documented in Kenya. Table 2.1.1 shows a chronology of flood events. According to the table, the 1961 flood was probably the biggest in the last 30 years. The flood, often called Uhuru Rains, caused serious damage throughout the country. Other noteworthy events were floods in 1963/64, 1968, 1977/78, 1982, 1985, 1988 and 1990. These floods mainly hit the Lake Victoria Basin and the coastal area (Athi, Lumi, Tana river basins).

The Grundy Report on the 1961 flood is the only record reporting the actual condition and damage caused by a flood. The report is hence very helpful to show the general features of flood and damage in Kenya.

An extract from the report mentions that during the later part of 1961, floods of unusual intensity and duration were experienced in most areas of the country. The

Table 2.1.1 Chronology of Flood Events

Year	Lake Victoria Basin					Rift Valley Basin				Athi River Basin			Tana River	Ewaso Ngiro North River	Remarks
	Nzoia River	Yala River	Nyando River	Sondu River	Kuja River	Mara River	Turkwel River	Keno River	Ewaso Ngiro South River	Athi River	Lumi River	Nairobi River			
1961	●	●	●	●	●	.	.	.	.	○	○	○	○	○	Uhuru Rains
1962	.	.	.	○	.	.	.	.	.	.	○	.	.	.	
1963	○	○	○	○	○	.	.	.	.	.	.	.	○	.	
1964	○	○	○	○	○	.	.	.	.	.	.	.	○	.	
1965	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
1966	.	.	.	.	.	.	.	.	.	.	.	.	○	.	
1967	.	.	.	.	.	.	.	.	.	.	○	.	○	.	
1968	○	○	○	○	○	.	.	.	.	.	○	.	○	○	
1969	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
1970	○	.	○	.	.	.	.	.	.	.	○	.	.	.	
1971	.	○	.	.	.	.	.	.	.	.	○	.	○	.	
1972	○	.	○	.	.	.	.	.	.	.	.	.	.	.	
1973	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
1974	.	.	○	.	○	.	.	.	.	.	.	.	.	.	
1975	○	.	.	.	.	.	.	.	.	.	.	.	.	.	
1976	.	.	.	.	.	.	.	.	.	.	○	.	.	.	
1977	○	○	○	○	○	.	.	.	.	○	.	○	○	.	
1978	○	○	○	.	○	.	.	.	.	○	○	.	○	.	
1979	.	○	○	.	.	.	.	.	.	.	.	.	○	.	
1980	.	.	.	.	.	.	.	.	.	.	○	.	.	.	
1981	○	○	.	○	.	.	.	.	.	.	○	.	.	.	
1982	○	○	○	○	○	.	.	.	.	.	○	.	.	○	
1983	○	○	.	.	.	.	.	.	.	.	.	.	.	.	
1984	.	.	.	.	.	.	.	.	.	.	.	.	○	.	
1985	.	○	○	.	○	.	.	.	.	.	○	.	.	.	
1986	.	.	.	.	.	.	.	.	.	○	.	○	.	.	
1987	.	.	.	○	.	.	.	.	.	.	○	○	.	.	
1988	○	○	○	○	○	.	○	.	.	.	.	○	○	○	
1989	.	.	.	.	.	.	.	.	.	.	○	.	○	○	
1990	.	○	○	○	○	.	.	.	.	.	.	.	○	.	

## Notes:

- : Most serious flood between 1961 and 1990
- : Serious floods
- : Floods causing a certain damage

channels of many rivers were inadequate to contain the flood waters, which spread over their valleys and inundated large areas of low-lying land. Many bridges were destroyed or submerged for periods of days, and numerous road and railway embankments were breached or washed away. Damages caused by the 1961 flood were as follows :

- a The flood inundated the Kano Plain, Yala Swamp and other low-laying areas around Lake Victoria. The inundation area was approximated 250 km<sup>2</sup>, excluding permanently swampy areas. Serious damage took place along the Nzoia, Yala and Nyando rivers. The inundation was reportedly aggravated by the rising water level at Lake Victoria, which was reported at about 1.3 m higher since then.
- b The flood also hit the Lower Tana regions. About 500 km<sup>2</sup> of land near Garissa was inundated by flood waters. At Garsen, the plains were submerged under as much as 2 m of water and inundation was observed to be up to a width of 13 km.
- c The bridge spanning the Athi River north of Malindi was carried downstream by the flood. This bridge has been re-constructed at a higher level to prevent submersion in floodwaters.

Flood prone areas in the country are depicted in Figure 2.1.8 and are discussed hereunder :

- a Most serious damage took place on the Kano Plain, as reported in many previous reports, mainly due to flooding from the Nyando River. The flooding causes severe damages almost every year not only to farmlands and grazings, but also to human settlements on the plain.
- b The next severe area may be Yala Swamp, which was affected by the combination of floods from the Nzoia and Yala rivers. The damage potential is foreseen to increase as progress of the expansion for Yala Swamp farming.
- c The areas around river deltas such as those of the Sondu, Kuja and Lumi rivers are also damaged by floods almost every year. Although the areas are smaller than the above, the degree of damage is considerably greater.

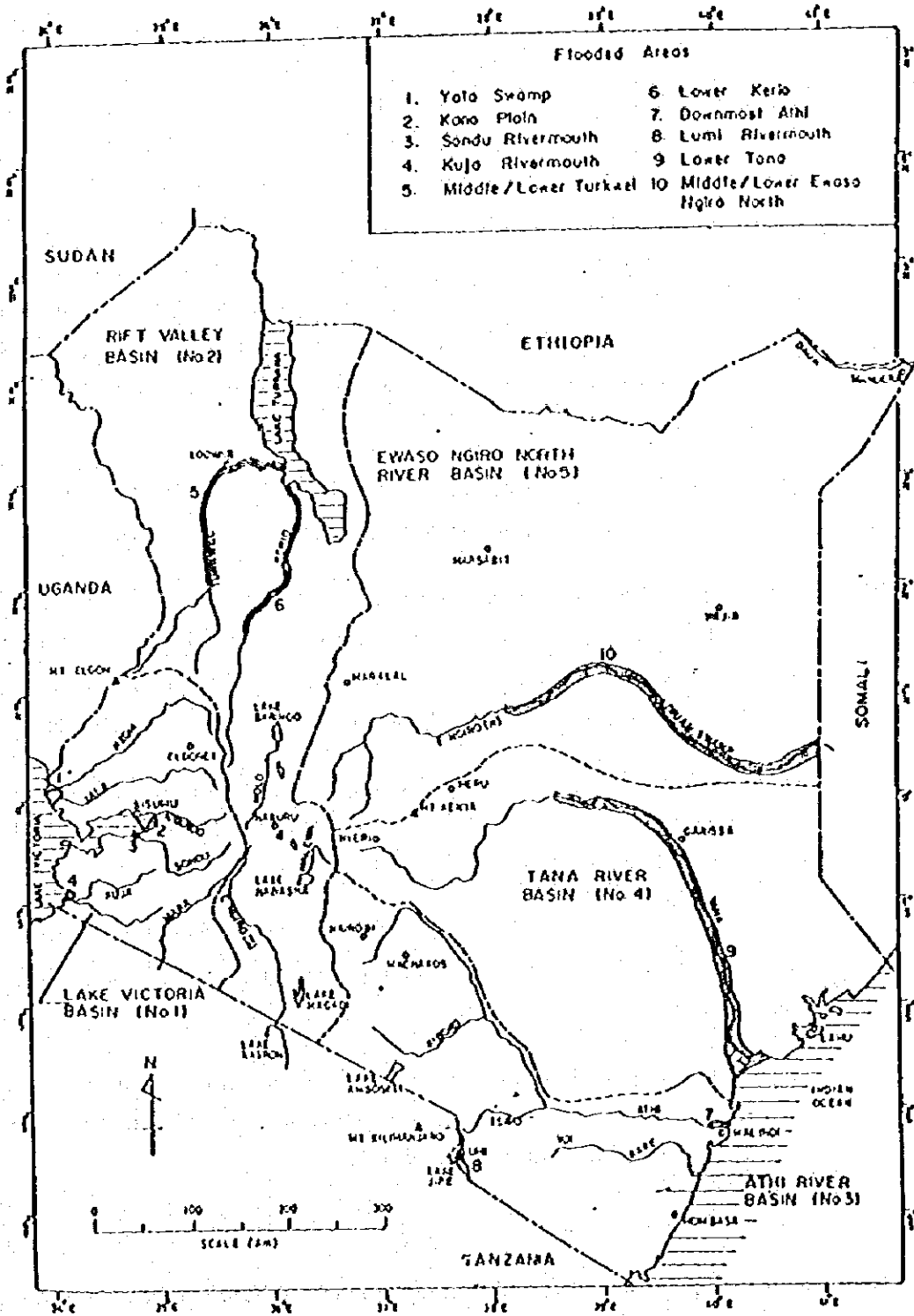


Figure 2.1.8  
Flood Areas in the Country

- d Intensive rain often hit the Nairobi and Mombasa urban areas, causing not only flooding along shores of small rivers but also traffic interruption, even at main roads.
- e There are large flood areas along the Lower Tana : as long as 650 km from the delta of the river up to the Kora hills with an approximate width of 5 km on average. However, human settlements and farmlands are mostly situated on natural levees, which are generally some meters higher than the flood plain. Human activity has not yet fully developed in the plain so far. On the other hand, the Tana River is notorious for its heavy meandering, with bank erosion at concave portions and local deposition at convex portions, sometimes leaving oxbow lakes in the flood plain. Thus, damage recorded is mainly attributed to bank erosion, particularly near villages and at intake structures and bridges.
- f The Middle/Lower Turkwel and downmost Athi have flood areas along the river banks, where minor farming and grazing are practiced.
- g Small flood areas with low damage exist in the lower reaches of Malakisi, Sio, Awach Tende, Lambwe, Malewa, Molo and Daua rivers, and parts of Muranga, Nyandarua and Embu districts. Submergence, sometimes destruction of bridges, is a characteristic of the damage in this category.
- h Flooding in the Middle/Lower Ewaso Ngiro North and the Lower Kerio occurs in considerably large areas. Nevertheless, the damages are usually of a minor extent, due to less human activity there.
- i Riverine areas and valley bottoms and the upper reaches of many rivers elsewhere suffer from flooding in limited areas. But no significant damage has been reported.
- j Almost no flood problems exist along small streams in mountain areas and lagas in the ASAL area. The only damage caused is traffic interruption, due to drifts in the lagas during heavy rainfalls.

#### (4) Soil Erosion

The dangers of soil erosion increased in Kenya in the 1960s, when the approach to soil conservation changed from enforcement to advisory, which led to a temporary breakdown of soil conservation activities. In response to this situation,



Kenya stepped up her efforts to conserve the soil in the 1970s, with emphasis on advice and training of farmers, extension workers and funding of soil conservation programs.

Although success has been achieved in certain areas, the dangers of soil erosion are still eminent. Soil erosion is still widespread in both, the high and low potential areas. This is mainly due to the high erosive effect of rainfall, the topography of the land, the type of vegetative effect of rainfall, the type of vegetative cover and the land usage. Soil erosion is most severe in arid and semi-arid areas (85% of Kenya), moderate in high and medium potential regions and lowest in forests and improved grazing areas. Considerable soil loss (as much as 20 tones/ha/year) has been reported in certain high potential areas suitable for arable agriculture, such as the Muranga District. Estimates show that in high potential areas in which erosion takes place, about 2.5 cm of top soil can be removed in about 15 years; a rate which exceeds the rate at which soil can be formed by natural processes. In the high and medium potentials areas of Bungoma District, Nyanza and Central Provinces, gully erosion is eminent.

Soillessness due to running water and wind, which is above the permissible amounts of 10 tones/ha/year, is noticeable in marginal and semi-arid areas. This is due mainly to overstocking and overgrazing by livestock and wildlife. Such soil loss has been reported in parts of Machakos, Kwale, Kilifi, Embu, Kitui, Kajiado, Nakuru, Meru, Samburu, West Pokot, Taita Taveta, Narok, Laikipia, Baringo, Elgeyo Marakwet and Marsabit. In West Pokot, Kajiado, Nakuru, Taita, Kitui and Embu soil losses exceed a rate of 32 tones/ha/year. By 1983 about 200,000 tones of top soil were already lost to the Indian Ocean from Kitui District and the surrounding areas. It has been predicted that, in the absence of conservation measures and depending on the future rate of soil erosion, about 50 % of the Amboseli grazing lands will be stripped of their soil cover within 50 to 125 years.

Special soil conservation programs, which have achieved reasonable success, are underway in over 36 districts in the high and low potential areas. In the range lands, however, the control of stocking rates of both, livestock and wildlife, has been a disturbing factor. With the setting up of the Permanent Presidential Commission for Soil Conservation and Afforestation, considerable progress has been achieved, and it is hoped that soil conservation work will be sustained.

## **Chapter 3 Past Economic Development Pattern and Constraints**

## Chapter 3 Past Economic Development Patterns and Constraints

### 3.1 Existing Policy Framework and Constraints

#### (1) Past Trend

The past trend of economic performance and growth in Kenya can be divided into several periods as follows:

##### a 1964-1971

In this period after her independence, the Republic of Kenya has achieved a rather high economic growth rate averaging 6.5% per year.

##### b 1972-1975

The first oil crisis occurred in 1972 and this event caused a slow down in economic growth, with the growth rate decreasing to below 4% for much of the early 1970s.

##### c 1976-1977

This period is characterized by an unexpected "coffee boom", which contributed to an average GDP growth rate of 8.2%.

##### d 1979

The second oil crisis took place in 1979. It brought about an inflationary push and, with the increasing cost of imported inputs and raw materials, economic growth slowed down again.

##### e 1980-1985

An average 6% GDP growth rate was recorded in the early 1980s. However, the growth rate fell below 1% in 1984. This decrease was largely attributed to a severe drought in that year, which resulted in a negative 3.9% growth of the agricultural sector.

##### f 1985-1986

Favorable weather conditions coupled with the Government's budgetary discipline and improved management principles enabled Kenya to achieve about 5% GDP growth in this period. The year 1986 was characterized by a recovery, when

agriculture and manufacturing grew at around 5%. In addition to the positive effects caused by good weather, the improvement in growth performance since then could be attributed to the introduction of some structural adjustment measures.

g 1990-1993

The GDP growth rate has continued to stay below 4% since 1990. It fell drastically in 1992 to a mere 0.4%. This slow down in real GDP growth could be attributed to a number of factors. Among the major have been the actual decline in real output and value added in agriculture, caused mainly by below average rainfall, and the sluggish growth in aggregate private domestic demand. Other factors have been reduced imports of intermediate goods caused by the foreign exchange shortages and the suspension of donor aid. However, the suspension of donor assistance has been lifted and symptoms of a recovery in the real GDP growth rate can be observed in the recent year.

(2) Current Economic Policy

As has been observed in general terms above, Kenya's economic performance has been affected by natural disasters, such as draught, and by external conditions, such as the oil crisis. This indicates that the structural composition of Kenya's economy has been and continues to be rather weak and unbalanced. Moreover, high population growth has kept absolute per capita GDP as well as per capita GDP growth low.

The Government's Sessional Paper No 1 of 1986, titled "Economic Management for Renewed Growth", contains Kenya's development strategy up to the year 2000. The strategy's major objectives are the recovery of macro economic stability and a sustainable annual average real GDP growth performance of some 5% up to the year 2000. The 7<sup>th</sup> National Development Plan, covering the period 1994 to 1996, is currently in force. Major elements of the existing policy framework and major constraints are elaborated on as follows :

a Principal Strategy in the Sessional Paper of 1986

The Sessional's Paper principal policy objectives can be itemized as follows :

- Establishing a market determined exchange rate
- Reducing fiscal deficits and rationalizing public investment.

- Liberalizing trade policy; liberalizing agricultural prices and marketing and deregulating internal prices
- Improving financial sector policy
- Improving the efficiency of public enterprises
- Establishing a true labor market
- Improving the coverage and quality of social services
- Improving the economic balance between the rural and urban sectors
- Creating employment opportunities and income.

**b Key Issues on National Development**

The current national development policy, as reflected, *inter alia*, in the development plan in force, can be summarized as follows :

- Adjusting to a process of increasing urbanization
- Minimizing economic gaps between urban and rural areas
- Accelerating employment generation
- Increasing foreign exchange earnings
- Developing a transport network capable to meet traffic demand, and
- Improving environmental preservation.

**c Constraints for Development**

There are presently many constraints to accelerated and at the same time sustainable development. However, it is strongly pointed out in the Sessional Paper that the crucial focus of development efforts will have to be directed towards achieving a future sustainable real per capita GDP growth. The high population growth rate has been and continues to be a strong constraint to attain such growth. Conversely speaking, it can be said that a rather high GDP growth rate has to be accomplished in order to achieve accelerated per capita GDP growth. It is expected in this context that the manufacturing sector in particular and the industry sector in general will become leading sectors in the future growth process. Notwithstanding the role of these sectors, the agricultural sector will also

have to be developed in order to create employment, thereby reducing unemployment.

Measures will also have to be taken to address the rapid urbanization process which will accompany the future economic development. Increased migration to large cities such as Nairobi and Mombasa will undoubtedly occur. Shortages in the provision of basic social services and other infrastructure would worsen the situation in these cities considerably. Reducing the income gap between rural and urban areas is, therefore, an important point in maintaining a sustainable economic growth path.

The realization of a suitable and adequate transportation system as one of the basic infrastructure is likewise a key issue for attaining the planned economic growth mentioned above.

## 3.2 Growth Performance and Economic Structure

### 3.2.1 Population and Labor Force

#### (1) Population

The final results of the 1989 Population Census were published in March 1994. The total population in 1989 was surveyed at a level of 22,067,000 people and the annual average growth rate over the period 1979 to 1989 was established at 3.71 %. Average population growth in Kenya since independence in 1963 has been at a rate of over 3.4 % p.a. ( table 3.2.1 refers ).

Table 3.2.1 Population Growth in Kenya

Census Population (x 1,000)				Growth Rate (% p.a.)		
1962	1969	1979	1989	1962/1969	1969/1979	1979/1989
8,636	10,942	15,327	22,067	3.44	3.43	3.71

Source: Statistical Abstract, Central Bureau of Statistics  
Kenya Population Census 1989 (Vol. 1), Central Bureau of Statistics

The age structure reveals a pyramid shape with a dependency ratio of 1.118. The dependency ratio is a figure to measure the dependence of the population aged less than 15 and more than 65 years old against the total labor force. Kenya's dependency ratio is assessed the highest in the world according to the Country

Report of the World Bank. The World Bank stresses that controlling population increase is one of the vital factors for attaining sustainable growth and development in Kenya.

Provinces that show a growth rate higher than the national average are Nairobi (5.11 % p.a.) and the Rift Valley (4.69 % p.a.). Natural population growth in rural areas is generally higher than that in urban areas. However, general population growth in urban areas, that is natural population growth combined with in-migration, is higher than in rural areas. Hence, the higher population growth in Nairobi indicates a strong pressure resulting from in-migration into Nairobi, while that in the Rift Valley indicates a greater increase in natural population growth compared to the national average.

Districts that exceed the national average population growth are Nyandarua (4.3 % p.a.) in the Central Province, Isiolo (5.3 % p.a.) and Kitui (3.8 % p.a.) in the Eastern Province and Kakamega (4.0 % p.a.) in the Western Province. Population growth in the Coastal and Nyanza Provinces are with 3.44 % p.a. and 3.16 % p.a. below the national average. The population in the Northeastern Province shows a relative stable size with a population growth of 0.22 % over the 10 years census period. Twelve out of thirteen districts in the Rift Valley Province exhibit higher than national average rates of population growth. Only the population in Bomet and Turkana districts in the Rift Valley Province grew with 2.5 % p.a. and 2.8 % p.a., respectively, at below the national average. Among the districts other than Bomet and Turkana in Rift Valley Province, Narok shows with 6.8 % p.a. the highest and Samburu with 3.8 % the lowest population growth rate. The Rift Valley Province is thus characterized as an area of high population growth. The absolute size of the district population in the census years 1979 and 1989 is compared in Table 3.2.2 and the respective population growth rates are presented graphically in Figure 3.2.1.

Table 3.2.2 District Population in 1979 and 1989

District No.	District Name	1979	1989	Growth Rate (% p.a.)
1	Nairobi	430,568	478,518	3.30
2	Nyamira	342,733	352,118	2.70
3	Lamu	41,235	54,811	3.31
4	Mombasa	310,038	471,658	3.30
5	Tana River	117,537	211,801	3.78
6	COASTAL	49,701	151,471	3.89
7	COASTAL	1,347,734	1,663,363	3.44
8	Garissa	118,853	126,454	0.61
9	Mandera	106,457	127,385	1.82
10	Wajir	718,747	120,358	0.31
11	NORTHERN	371,717	367,187	0.22
12	Embu	281,313	340,854	2.87
13	Isiolo	11,643	72,115	5.27
14	Meru	460,930	471,312	1.81
15	Machakos	568,127	793,517	3.45
16	Makindu	458,854	419,141	3.35
17	Mgarani	85,511	133,650	3.31
18	Meru	831,928	895,179	3.53
19	WESTERN	1,141,131	1,621,649	3.90
20	EASTERN	2,110,851	2,876,333	3.17
21	Kitui	448,182	610,901	3.31
22	Kisumu	231,508	402,897	3.39
23	Nyandarua	618,172	643,027	3.13
24	Nyeri	419,361	595,481	4.50
25	Nyandarua	282,826	477,918	3.53
26	CENTRAL	3,348,832	3,507,365	3.18
27	Siaya	817,773	1,363,673	3.11
28	Wunduchi	205,143	358,165	5.73
29	Uasin Gishu	150,024	222,780	4.01
30	Rift Valley	188,810	368,178	3.41
31	Rehoboth	328,835	528,460	3.58
32	Bomet	310,531	398,864	2.52
33	Laikipia	138,176	225,312	5.23
34	Nakuru	275,336	373,779	5.21
35	Karuri	506,635	618,918	4.05
36	Narok	211,438	402,850	6.84
37	Samburu	72,338	112,019	3.78
38	Trans Nzoia	260,557	405,126	4.50
39	Turkana	143,861	185,114	2.75
40	Uasin Gishu	284,291	452,185	4.89
41	West Pokot	158,545	237,003	3.82
42	RIFT VALLEY	3,240,431	4,128,474	4.69
43	Rish	568,568	783,872	3.16
44	Kisumu	500,213	385,156	2.53
45	Kisumu	482,354	643,381	3.35
46	Siaya	471,519	658,027	3.37
47	Siaya	471,680	614,449	3.70
48	Uasin Gishu	348,568	487,939	3.17
49	WESTERN	3,841,436	3,859,114	3.14
50	Bungoma	205,136	358,889	3.81
51	Busia	297,450	415,334	2.57
52	Kakamega	650,418	1,014,119	4.02
53	Wajir	351,421	481,318	3.12
54	WESTERN	1,851,887	3,418,397	3.83
55	WESTERN	19,327,834	22,067,600	3.71

Source: Kenya Population Census, 1989 - Volume I, Central Bureau of Statistics

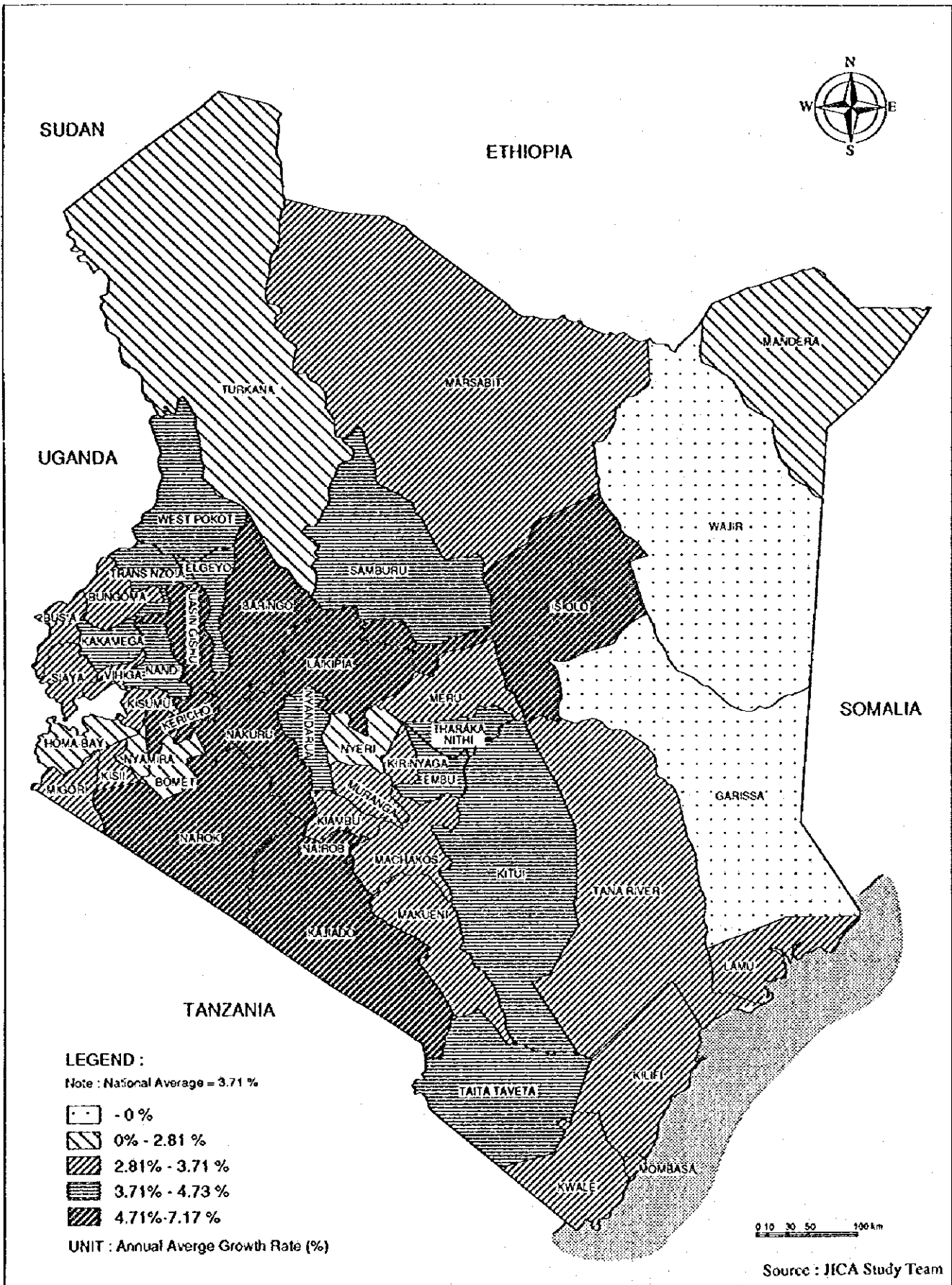


Figure 3.2.1  
Population Growth by District (1979-1989)



The entire territory of Kenya comprises 582,646 km<sup>2</sup>, out of which 11,230 km<sup>2</sup> is covered by water, accounting for about 1.9 % of the total territory. Agricultural land of high potential covers some 67,850 km<sup>2</sup>, that is about 11.9 % of the country's total net land area (total area minus water body). Such high potential agricultural land can mostly be found in the Central Highlands. It lies typically some 1,500 meter above sea level in the Central Province and in the neighboring area of Lake Victoria, that is part of the Nyanza and Western Provinces. Most of Kenya's land is either semi-arid or arid land.

The average population density in 1989 was 38 persons per sq. kilometer. Provinces that have a population density over the national average are the Central, Nyanza, Western and Nairobi Provinces. This implies that 49 % of the total population inhabits in 6 % of the country's total land area. The land area and the population density by Province are summarized in Table 3.2.3.

Table 3.2.3 Land Area and Population Density by Province in 1989

Province	Land Area*		High Potential Agricultural Land		1989 Population		Density
	(Sq. km)	(%)	(Sq. km)	(%)	(x 1,000)	(%)	Persons/km <sup>2</sup>
Cost	83,040	(14.5)	3,730	(5.5)	1,829.2	(8.5)	22
North Eastern	126,902	(22.2)	-	-	371.4	(1.7)	3
Eastern	155,760	(27.3)	5,030	(7.4)	3,768.7	(17.6)	24
Central	13,173	(2.3)	9,090	(13.4)	3,116.7	(14.5)	237
Nairobi	684	(0.1)	-	-	1,324.6	(6.2)	1,937
Rift Valley	171,108	(29.9)	30,250	(44.7)	4,981.6	(23.2)	29
Nyanza	12,526	(2.2)	12,180	(18.0)	3,507.2	(16.4)	280
Western	8,223	(1.4)	7,410	(10.9)	2,544.3	(11.9)	309
Total	571,416	(100.0 %)	67,690	(100.0 %)	21,443.7	(100.0 %)	38

Note: \*Excluding water area. Unit : as indicated. Figures may not add up due to rounding.

Source: Statistical Abstract 1991, Central Bureau of Statistics  
Kenya Population Census 1989 - Volume I, Central Bureau of Statistics

## (2) Labor Force

Kenya's size of the labor force in 1989 and 1990 has been estimated by the Ministry of Planning and National Development at 9,252,000 persons and 9,624,000 persons, respectively. The share of the labor force in the total population in Kenya is about 42 % and of that total some 15 % are employed in the modern wage employment sector in the monetary economy as shown in Table 3.2.4. The balance of the remaining 85 % of the labor force is engaged in subsistence agriculture, the informal sector and the non-monetary economy.

Table 3.2.4 Labor Force and Wage Employment in Kenya, 1989 and 1990

Year	(x 1,000 persons)		
	Population	Labor Force	Wage Employment
1989	22,067	9,252	1,355
1990	22,753	9,624	1,413

Source: Estimates by Ministry of Planning and National Development

Note: The number of population in 1989 in this table is adjusted by MOPND, based on that of census

The Government of Kenya had initially planned that increasing demand originating from the modern wage employment sector would absorb the increasing labor force. However, modern sector employment creation was achieved only at a very slow pace. Hence, the Government is presently fostering employment creation in the informal sectors ( jua kali ), in particular in urban areas.

The overall distribution of modern wage employment over sectors shows that about 20 % are employed in the primary, some 20 % in the secondary and about 60 % in the tertiary sector, as shown in Table 3.2.5. The public sector accounts for nearly half, that is about 48 % of total modern wage employment. The high proportion of the public sector is largely due to the "Africanization" policy since national independence, which had encouraged the nationalization of privately owned companies. The accelerated creation of employment in the public sector has, however, contributed to an increasing financial deficit of the Government.

Table 3.2.5 Modern Wage Employment by Major Sectors

(Unit : as indicated)

Industrial Sector	Public & Private Total		Public Sector	
	Persons	(%)	Persons	(%)
1. Agriculture & Forestry	269,724	19.0	47,423	7.0
2. Mining & Quarrying	8,640	0.6	679	0.1
<b>Primary Sector</b>	<b>278,364</b>	<b>19.6</b>	<b>48,102</b>	<b>7.1</b>
3. Manufacturing	187,683	13.2	41,544	6.1
4. Electricity & Water	22,438	1.6	21,924	3.2
5. Construction	71,395	5.0	34,476	5.1
<b>Secondary Sector</b>	<b>281,516</b>	<b>19.8</b>	<b>97,944</b>	<b>14.4</b>
6. Wholesale & Retail Trade	113,972	8.0	9,349	1.4
7. Transport & Communications	79,194	5.6	48,235	7.1
8. Finance, Insurance, etc.	65,249	4.6	17,928	2.6
9. Community, Social & Personal Services	600,253	42.3	457,776	67.4
<b>Tertiary Sector</b>	<b>858,668</b>	<b>60.5</b>	<b>533,288</b>	<b>78.5</b>
<b>Total</b>	<b>1,418,548</b>	<b>100.0</b>	<b>679,334</b>	<b>100.0</b>

Source: Statistical Abstract 1991, Central Bureau of Statistics

Given the need to reduce the budget deficit, the Government has been urged recently to privatize public corporations and rationalize the Government sectors.

### 3.2.2 Economic Structure in Kenya

#### (1) Non-monetary Economy

The Kenyan economy is divided into the monetary and the non-monetary economy, comprising activities such as hunting animals, collecting plants and nomadic life. The Government has made continuous efforts to settle the people, which are engaged in the non-monetary economy. However, it is unlikely that the share of the non-monetary in Kenya's total economy will decrease sharply. The non-monetary economy's share in real Gross Domestic Product (GDP) in 1985 was 6 % and this share has remained almost unchanged at around 5.5 % of GDP in 1992.

#### (2) Gross Domestic Product (GDP)

The composition of GDP in 1992 measured in constant 1982 prices shows that 27.4 % of GDP originates from the primary, 18.0 % from the secondary and 54.6 % from the tertiary sector ( Table 3.2.6 refers ). Over the last 7 years period 1985 to 1992, the share of the primary sector declined from 30.5 % to 27.4 %, and that of the secondary sector increased slightly from 17.2 % to 18.0 %. The share of the tertiary sector increased from 52.3 % to some 54.6 %.

Agriculture, Government Services, Manufacturing, Trade/Restaurant/Hotels and Finance/Real Estate/Business Services are the largest five of GDP subsectors, accounting with 75.1 % for about three-fourths of GDP in 1992. The share of the agricultural subsector accounted for some 26.0 % of GDP in 1992. Taking into account the share of food processing of agricultural products, a subsector of manufacturing, agriculture related industries play an important role in the composition of GDP.

Real annual GDP growth ( constant 1982 prices ) over the period 1985 to 1992 averaged 3.1 % as shown in Table 3.2.7. The real annual average growth rate of the above-mentioned five sectors, namely, Agriculture, Government Service, Manufacturing, Trade/Restaurant/Hotels and Finance/ Real Estate/Business Services, was recorded at 0.5 %, 4.0 %, 4.0 %, 2.4 % and 3.1 %, respectively.

Table 3.2.6 Structural Composition of Gross Domestic Product :1985-1992  
(At 1982 Constant Prices)

(Unit: %)

	1985	1986	1987	1988	1989	1990	1991	1992
A. Non-Monetary Economy	6.1	5.8	5.7	5.6	5.6	5.4	5.4	5.5
B. Monetary Economy								
(1) Enterprises and Non-Profit Institutions:								
• Agriculture	29.4	29.3	29.0	28.8	28.5	28.2	27.3	26.0
• Forestry	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1
• Fishing	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
• Mining & Quarrying	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
• Manufacturing	12.8	12.8	12.9	13.0	13.1	13.3	13.5	13.6
• Building & Construction	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.1
• Electricity & Water	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.0
• Trade, Restaurants, Hotels	10.7	11.1	11.2	11.3	11.3	11.0	10.9	11.0
• Transport, Communications	6.2	6.2	6.1	6.1	6.0	5.9	6.0	6.1
• Finance, Insurance, Real Estate, etc.	7.4	7.5	7.5	7.6	7.7	7.9	8.2	8.7
• Ownership of Dwellings	5.7	5.6	5.6	5.5	5.5	5.4	5.5	5.5
• Other Services	3.0	3.0	3.0	3.1	3.2	3.2	3.3	3.3
Less: Imputed Bank Service Charges	-3.1	-3.0	-3.1	-3.2	-3.2	-3.2	-3.2	-3.3
Total	77.6	77.9	77.9	77.8	77.7	77.6	77.3	76.8
(2) Private Households (Domestic Services)	1.2	1.3	1.3	1.4	1.5	1.7	1.8	2.0
(3) Producers of Government Services	15.0	15.1	15.1	15.2	15.3	15.3	15.5	15.8
Total Monetary Economy	93.9	94.2	94.3	94.4	94.5	94.6	94.6	94.5
Total Monetary and Non-Monetary Economy	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Economic Survey 1990 and 1993, Central Bureau of Statistics

A privatization program for non strategic public corporations (parastatals) is now under way and rationalization of government services is part of the on-going structural adjustment measures. Economic recovery in Kenya depends largely upon the vitalization of the private sector, particularly on agriculture and its related agro-industries.

**Table 3.2.7 Sectoral Growth of Gross Domestic Product  
(At 1982 Constant Prices)**

(Unit : % p.a.)

	1984/85	1985/86	1987/88	1988/89	1989/90	1990/91	1991/92	1988/92*
<b>A. Non-Monetary Economy</b>	9.0	-0.4	2.8	4.0	2.8	2.1	1.2	2.6
<b>B. Monetary Economy</b>								
<b>(1) Enterprises and Non-Profit Institutions:</b>								
• Agriculture	3.7	4.9	4.4	3.9	3.4	-1.1	-4.2	0.5
• Forestry	5.9	9.8	8.4	11.4	5.0	8.4	4.2	7.2
• Fishing	17.1	1.7	12.3	4.6	4.4	-2.2	-4.2	1.0
• Mining & Quarrying	9.4	3.6	11.3	4.6	5.9	6.4	-8.0	1.9
• Manufacturing	4.5	5.8	6.0	5.9	5.2	3.8	-1.2	4.0
• Building & Construction	3.4	3.7	4.3	5.4	5.3	2.3	-2.7	2.6
• Electricity & Water	8.5	7.5	8.5	8.4	10.5	5.2	-1.9	5.5
• Trade, Restaurants, Hotels	6.8	9.8	5.8	4.4	2.3	1.3	1.5	2.4
• Transport, Communications	2.1	4.3	4.1	3.0	3.6	2.5	1.7	3.1
• Finance, Insurance, Real Estate, etc.	9.9	6.8	6.1	7.5	6.4	6.1	6.9	6.8
• Ownership of Dwellings	3.1	3.3	3.2	4.0	4.0	2.6	1.6	3.1
• Other Services	5.2	5.0	7.1	6.8	6.3	3.8	2.4	4.9
<b>Total (Excluding Imputed Bank Service Charges)</b>	4.8	5.8	5.0	4.8	4.2	1.8	-0.2	4.0
<b>(2) Private Households (Domestic Services)</b>	6.9	10.6	13.5	12.8	13.1	11.0	8.9	11.4
<b>(3) Producers of Government Services</b>	5.1	6.3	5.8	5.5	4.4	3.6	-2.4	4.0
<b>Total Monetary Economy</b>	4.9	6.0	5.3	5.1	4.4	2.3	0.4	3.1
<b>Total Monetary and Non-Monetary Economy</b>	5.1	5.6	5.1	5.0	4.3	2.3	0.4	3.1

Source: Economic Survey 1990 and 1993, Central Bureau of Statistics

Kenya's economy began to stagnate in 1988. Annual real GDP growth at 1982 constant prices averaged about 5 % over the period 1985 to 1988, but decreased drastically to about 0.4 % in 1991/1992. The consumer price index was relatively stable, but has grown by an annual average of 19 % p.a. over the period 1988 to 1992. This means that the consumer index in 1992 was about twofold of that in 1988. Not only the development of Kenya's macro economy but also that of the household economy has slowed down since 1988, and this trend has lasted up to 1994.

(3) GDP Per Capita

GDP per capita over the period 1988 to 1992 declined by minus 1.95 % in absolute terms (Table 3.2.8 refers). The highest individual annual GDP per capita growth rate during the same period was recorded in 1988/89 at only 1.5 % and the rate declined subsequently to a negative growth of -2.9 % in 1991/1992. Provided that GDP per capita grew at a real annual average rate of 1.5 %, it will take about 50 years to double Kenya's GDP per capita. Kenya's GDP grew at real 5.0 % when the 1.5 % GDP per capita was achieved. This implies that the pressure of the growing population detains a rapid increase in GDP per capita. Population growth control will therefore be a vital policy to achieve a considerable improvement in the income level of the Kenyan people.

(4) Balance of Payments and International Trade

Kenya's balance of payments reflected a considerable deficit twice in the consecutive 5-year periods of 1978 to 1983 and 1987 to 1992. The former deficit was highly attributable to both, an increase in oil prices caused by the world wide oil crisis and also a fall of world coffee prices. The latter deficit was brought about by another fall in world coffee prices in 1987 by 37 % and by 27 % again in 1989. The price fall in 1989 followed after a short rise of world coffee prices in 1986.

The total value of international trade in 1992 was K£ 2,955 million, out of which 33 % were exports and 67 % imports. Total trading value increased about 12 % from the previous year but the yearly balance of payments deficit increased also by about 11 %.

**Table 3.2.8 Gross Domestic Product by Major Sectors and GDP Per Capita in 1988 and 1992**

Industrial Sectors	1988		1992	
	1982 Const. Price K£ Million	%	1982 Const. Price K£ Million	%
<b>A. Non-Monetary Economy</b>	<b>214.75</b>	<b>5.6</b>	<b>237.43</b>	<b>5.5</b>
<b>B. Monetary Economy</b>				
<b>(1) Enterprises and Non-Profit Institutions:</b>				
• Agriculture	1,109.25	28.8	1,129.70	26.0
• Forestry	36.47	1.0	48.16	1.1
• Fishing	12.27	0.3	12.58	0.3
• Mining & Quarrying	10.15	0.3	11.01	0.3
• Manufacturing	502.80	13.0	588.61	13.6
• Building & Construction	121.68	3.2	134.54	3.1
• Electricity & Water	36.47	1.0	45.11	1.0
• Trade, Restaurants, Hotels	436.27	11.3	478.94	11.0
• Transport, Communications	234.02	6.1	263.60	6.1
• Finance, Insurance, etc.	291.27	7.6	377.94	8.7
• Ownership of Dwellings	212.20	5.5	238.98	5.5
• Other Services	119.72	3.1	144.50	3.3
Less: Imputed Bank Service Charges	-121.81	-3.2	-142.03	-3.3
<b>Total of (1)</b>	<b>3,000.76</b>	<b>77.8</b>	<b>3,331.64</b>	<b>76.8</b>
<b>(2) Private Households (Domestic Services)</b>	<b>55.30</b>	<b>1.4</b>	<b>85.26</b>	<b>2.0</b>
<b>(3) Producers of Government Services</b>	<b>586.16</b>	<b>15.2</b>	<b>685.43</b>	<b>15.8</b>
<b>Total Monetary Economy</b>	<b>3,642.22</b>	<b>94.4</b>	<b>4,102.33</b>	<b>91.5</b>
<b>Total Monetary &amp; Non-Monetary Economy</b>	<b>3,856.97</b>	<b>100.0</b>	<b>4,339.76</b>	<b>100.0</b>
<b>Gross Domestic Product Per Capita (K£)</b>	<b>172.27</b>		<b>168.91</b>	

Source: Economic Survey 1993, Central Bureau of Statistics

Kenya's major export commodities are tea, petroleum products, horticulture and coffee. These four commodities account for some 66 % of the total export value ( current price base ). Petroleum products account for about 14 % of the total export value, with mainly inland country destinations such as Uganda. Besides petroleum products, Kenya is a supplier country of primary products. The export value of "Food and Beverages" and "Industrial Supplies" accounts for 54 % and 22 % of the total export value, respectively.

The import value of crude petroleum and petroleum products accounts with 21 % for the highest share in total import value; followed with some 20 % by machinery and other capital equipment. The import value of iron & steel, artificial resins and industrial supplies accounts for 38 % of total import value.

Kenya's integrated price index, reflecting mainly primary sector products, increased by 100 points over the period 1988 to 1992,. The price index of all export commodities increased more rapidly by 143 points, but the price index of non-oil imports increased by 150 points. It is manifest that such global economic trends do not favor a country such as Kenya, which is exporting mainly primary sector products, possesses no oil and is not yet industrialized.

Major export destinations are the E.E.C., Africa, the Far-East and Australia. Their share in total exports is 40 %, 27 % and 14 %, respectively. Major countries of export destination are the United Kingdom (18.3 %), Uganda (7.0 %) and Germany (6.5 %). Economic relationships with European countries are historically strong. Trading circumstances are, therefore, easily influenced by their economic situation, which shows some stagnating signs since the late 1980s.

Major import originating regions are the E.E.C., the Far-East, Australia and the Middle East. Their shares in total import value are 34 %, 23 % and 22 %, respectively. Major individual countries of origin are Arab Emirates, the United Kingdom and Japan, the shares of which are 16.3 %, 11.4 % and 9.4 %, respectively. Kenya, as a non-oil country, depends largely upon the Middle East for petroleum energy resources. This is another vital element of Kenya's economy that it can be influenced directly by the fluctuation of world oil prices.

### 3.2.3 Regional Structure

#### (1) Identification of District Basis Regions



It is considered useful and appropriate for planning purposes to combine administrative districts into several planning regions, based on the climatic and geographical conditions discussed previously. Such planning regions are depicted in Figure. 3.2.2 and outlined below :

**a Hot Semi-Desert Region**

The region receives very little rain throughout the year and is affected by drought. The region includes districts such as Turkana, Samburu, Marsabit, Isiolo, Mandera, Wajir and Garissa.

**b Coastal Belt Region**

The region is characterized by a rainy season from April to July and is located along the coast. The center of this region, which consists of four districts, is Mombasa city. Lamu is somewhat separated by the Tana River and it forms, therefore, a sub-region. However, Lamu can be integrated into the same planning region, taking into account the succession of geographical and climatic conditions. Accordingly, the region comprises Kwale, Mombasa, Kilifi and Lamu Districts.

**c Central Highland Region**

This region has two rainy seasons and dry months less than half of the year and it covers most of the high potential agricultural land. The region is covered by the Athi and Tana Catchment Water Boards. Although Nyandarua District is part of the Rift Valley Catchment Water Board, it is a region with two rainy seasons. Nyandarua District was, therefore, included into the Central Highland Region. Hence, the region comprises the Nairobi, Kiambu, Muranga, Kirinyaga, Nyeri, Nyandarua, Meru, Tharaka Nithi, Embu and Machakos Districts.

**d Eastern Semi-Arid Region**

The region has two rainy seasons and seven to nine dry months. The land with lower than 1,000 meter of altitude receives little rainfall averaging about 400 mm per year. Part of the western Kajiado District is covered by the Rift Valley Catchment Water Board. However, since most of Kajiado District has similar of the region's characteristics, it is regarded appropriate to incorporate the district into this planning region.

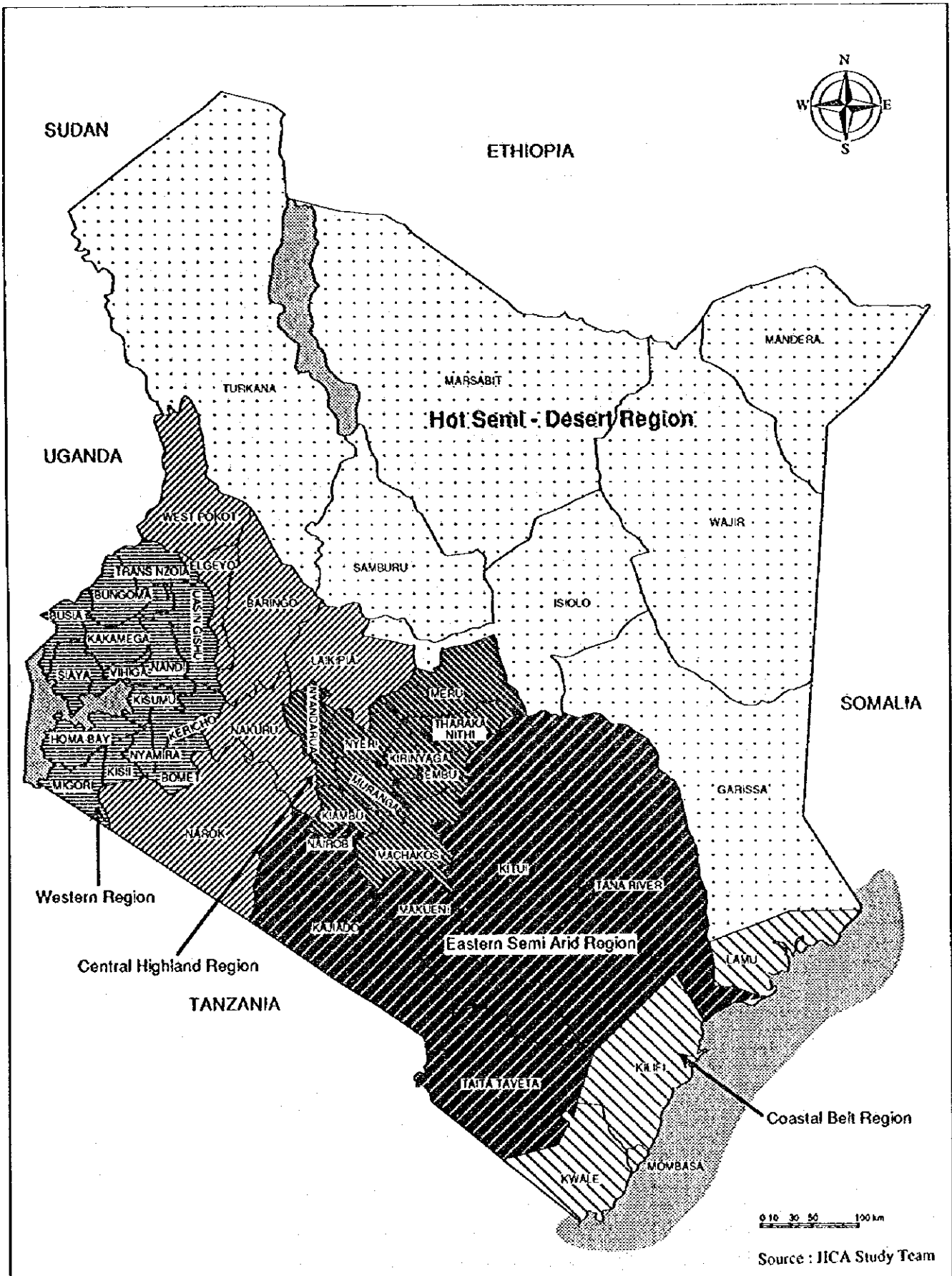


Figure 3.2.2  
Identification of District-Basis Regions

Accordingly, the region consists of Kitui, Makueni, Tana River, Taita Taveta and Kajiado Districts.

e Western Region

This planning region is identified as the western side of the Rift Valley. Part of Narok District belongs actually to this area. However, it was determined to include this district into the below mentioned Rift Valley Region, because of distinguished similarity of rainfall characteristics. The Western Region is characterized by non-definitive rainy seasons, though Trans Nzoia and Uasin Gishu are categorized as one rainy season Districts.

f Rift Valley Region

The Rift Valley Region is an area encompassed by the eastern and western ridges of the Rift Valley. Although the Laikipia District is part of the Northern Ewaso Ng'iro Catchment Water Board, it was incorporated into the Rift Valley Region, because of the similarity of rainy season. Districts included in this region have one rainy season lasting from March to September. The exception is Narok District, which has a rainy season lasting from December to May.

(3) Regional Characteristics of Agriculture

According to the publication "Regional Comparative Advantage by Major Crop

Table 3.2.9 Regional Comparative Advantage by Major Crop Group, 1989

(Unit: %)

Province	Value Share of Export Crops	Value Share of Industrial Crops	Value Share of Food Crops
Central	57.3	0.4	14.3
Coast	1.0	4.4	2.7
Eastern	20.9	7.9	17.0
Rift Valley	9.1	1.6	42.6
Nyanza	9.7	33.5	12.7
Western	2.0	52.2	10.7
Total	100.0	100.0	100.0

Source: Ministry of Agriculture

Export Crops: Coffee, tea pyrethrum, pineapples sisal, trench beans

Domestic Industrial Crops: Coffee, sugar, tobacco oil crops

Food Crops: Maize, wheat, rice, sorghum/millet, beans, Irish potatoes, cabbages

Groups, 1989", published by the Ministry of Agriculture, the Central Province accounted for 57.3 % of the total value of export crops, followed by the Eastern Province with a share of 20.9 % ( Table 3.2.9 refers ).

As regards industrial crops, the Western Province accounted for 52.2 % of their total value, followed by the Nyanza Province with a share of 33.5 %.

The production value of export food crops is dominated by the Rift Valley Province, which accounted for 42.6 % of the total value. This is because a large portion (44.6 %) of the high potential agricultural land is located in the Rift Valley Province. The Rift Valley Province is specialized in the production of food crops.

The report prepared by Bigsten and Ndungu (1992) indicates that the Central Province produced in 1976 70 % of export coffee and 20 % of export tea, while the Nyanza Province produced only 4 % and 7 % of the respective export crops. Major products of the Nyanza Province are pyrethrum, cotton and sugar, but revenues gained from them are comparatively lower to those from coffee and tea. The high share of export crops in the Central Province is due to historical circumstances. The production of cash crops in the colonial era was permitted only in the Central Highlands.

A central area of the high potential agricultural land is located in the five districts of the Central Province, namely Nyeri, Muranga, Kiambu, Nyandarua and Kirinyaga. Rainfall is abundant there for such high mountains as Mt. Kenya and the Aberdare Ranges, with an altitude of some 3,000 meters. Another area of high potential agricultural land is the western part of the mountains from the Cherangani Hills to the Mau Escarpment. They, too, form an upland with an altitude of more than 3,000 meter. This area consists of the Nyanza and Western Provinces and additional six districts of the Rift Valley Province.

Agricultural potential by district is presented in Table 3.2.10. Agricultural potential is defined as follows, based on the average annual rainfall :

- High potential : Annual rainfall of 857.5 mm or more  
(over 980 mm in Coastal Province)
- Medium potential : Annual rainfall of 735 mm - 857.5 mm  
(735 mm - 980 mm in Coastal Province, and 612.5 - 857.5 mm in Eastern Province)

Table 3.2.10 Agricultural Potential Areas by District

DISTRICT NAME	CATEGORIES OF AGRICULTURAL LAND (1,000 hectares)				Sub-total	All Other Land	Total District Name	PERCENTAGE DISTRIBUTION OF CATEGORIES OF AGRICULTURAL LAND					Total
	High Potential	Medium Potential	Low Potential	Sub-total				High Potential	Medium Potential	Low Potential	Subtotal	All Other Land	
Nairobi	16	0	38	54	14	68	Nairobi	0.24%	0.00%	0.09%	0.10%	0.29%	0.12%
Nyandarua	386	5	24	415	78	493	Kiambu	5.69%	0.16%	0.08%	0.77%	1.60%	0.84%
Kisumu	160	0	12	172	157	329	Nyeri	2.36%	0.00%	0.03%	0.32%	3.23%	0.56%
Kenya	98	10	0	108	35	143	Kirinyaga	1.44%	0.32%	0.00%	0.20%	0.72%	0.24%
Nyanza	265	0	5	270	83	353	Nyanza	3.91%	0.00%	0.01%	0.50%	1.71%	0.60%
CENTRAL	909	29	41	985	353	1,318	CENTRAL	13.40%	0.48%	0.10%	1.79%	7.25%	2.24%
Kisumu/Siaya	432	29	461	965	0	461	Kisumu	6.37%	0.92%	0.00%	0.65%	0.00%	0.70%
Homa Bay/Mogoo	566	5	0	571	0	571	Homa Bay/Mogoo	8.34%	0.16%	0.00%	1.06%	0.00%	0.97%
Kisumu/Siaya	220	0	0	220	0	220	Kisumu/Siaya	3.24%	0.00%	0.00%	0.41%	0.00%	0.37%
Kisumu/Siaya	1,218	34	0	1,252	27	1,252	Kisumu/Siaya	17.95%	0.00%	0.00%	2.32%	0.00%	2.13%
NYANZA	325	0	0	325	55	380	NYANZA	4.79%	0.00%	0.00%	0.60%	0.55%	0.60%
Kakamega/Vihiga	253	0	0	253	55	308	Kakamega/Vihiga	3.73%	0.00%	0.00%	0.30%	0.47%	0.52%
Bungoma	163	0	0	163	82	245	Bungoma	2.40%	0.00%	0.00%	0.30%	0.00%	0.28%
WESTERN	741	0	0	741	82	823	WESTERN	10.92%	0.00%	0.00%	1.37%	1.68%	1.40%
Mombasa	104	21	0	125	0	125	Mombasa	1.53%	0.00%	0.00%	0.04%	0.00%	0.04%
Kilifi	126	247	851	1,202	39	1,241	Kilifi	1.88%	7.82%	2.92%	2.23%	0.80%	2.11%
Kwale	7	319	321	647	4	654	Kwale	0.10%	5.13%	1.21%	1.48%	0.62%	1.41%
Tana River	73	58	3,393	3,524	345	3,869	Tana River	1.08%	1.84%	8.06%	1.20%	0.88%	1.11%
Taita Taveta	42	10	590	642	1,054	1,096	Taita Taveta	0.62%	0.32%	1.40%	1.19%	2.16%	2.89%
COAST	373	796	5,663	6,832	1,472	8,304	COAST	5.50%	25.21%	13.45%	12.67%	30.24%	14.13%
Lalupa	100	0	768	868	74	942	Lalupa	1.92%	0.00%	1.82%	1.67%	1.52%	1.65%
Narok	908	0	784	1,692	240	1,932	Narok	13.38%	0.00%	1.67%	2.99%	4.93%	3.15%
Kajiado	22	0	1,760	1,782	314	2,096	Kajiado	0.32%	0.00%	4.18%	3.30%	6.45%	3.57%
Turkana	12	0	5,937	5,949	0	5,949	Turkana	0.18%	0.00%	14.10%	11.03%	0.00%	10.12%
Samburu	140	0	1,612	1,752	329	2,081	Samburu	2.06%	0.00%	3.83%	3.25%	6.76%	3.54%
Nakuru	291	39	231	561	141	702	Nakuru	4.29%	1.24%	0.55%	1.04%	2.90%	1.19%
Kencho/Bomet	166	84	751	1,001	62	1,063	Kencho/Bomet	2.45%	2.66%	1.78%	1.85%	1.27%	1.81%
Uasin Gishu	380	0	0	380	109	489	Uasin Gishu	5.60%	0.00%	0.00%	0.70%	2.24%	0.64%
Trans-Nzoi	327	0	0	327	51	378	Trans-Nzoi	4.62%	0.00%	0.00%	0.61%	1.05%	0.47%
Ekegyo/Marakwet	204	0	0	204	40	244	Ekegyo/Marakwet	3.45%	0.00%	0.00%	0.43%	0.82%	0.60%
West Pokot	103	0	92	195	39	234	West Pokot	3.07%	0.00%	0.22%	0.36%	1.58%	0.46%
RIFT VALLEY	3,025	123	365	3,513	1,515	5,028	RIFT VALLEY	44.58%	3.90%	29.02%	31.97%	31.13%	31.90%
Embu	86	186	0	272	19	291	Embu	0.97%	5.69%	0.00%	0.47%	0.39%	0.46%
Machakos/Makueni	241	95	315	651	341	992	Machakos/Makueni	3.55%	3.01%	7.75%	1.21%	7.01%	1.69%
Meru/Tharaka Nithi	67	1,137	1,078	2,282	657	2,939	Meru/Tharaka Nithi	0.99%	36.02%	2.56%	4.25%	13.50%	4.36%
Kisumu	125	771	454	1,350	68	1,418	Kisumu	1.84%	24.42%	1.08%	2.50%	14.00%	5.00%
Marsabit	4	0	7,045	7,049	346	7,395	Marsabit	0.06%	0.00%	16.73%	13.07%	7.11%	12.58%
EASTERN	503	2,189	11,453	14,145	1,431	15,576	EASTERN	7.41%	61.34%	27.20%	26.23%	29.40%	26.50%
Garissa	0	0	4,393	4,393	0	4,393	Garissa	0.00%	0.00%	10.43%	8.15%	0.00%	7.47%
Wajir	0	0	5,650	5,650	0	5,650	Wajir	0.00%	0.00%	13.42%	10.48%	0.00%	9.61%
Mandera	0	0	2,647	2,647	0	2,647	Mandera	0.00%	0.00%	6.29%	4.91%	0.00%	4.50%
NORTH-EASTERN	0	0	12,690	12,690	0	12,690	NORTH-EASTERN	0.00%	0.00%	30.14%	29.54%	0.00%	21.59%
	6,785	3,157	22,103	55,919	4,867	59,786		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Low potential : Annual rainfall of 612.5 mm or less

According to the above data, high potential agricultural land accounts for only 12 % of Kenya's entire land area, and of these 12 % some 44.6 % is located in the Rift Valley Province. Figure 3.2.2 shows the high potential agricultural area resulting from an overlay of districts with a higher proportion of high potential agricultural land with an agricultural land use map ( 1983 ) produced by the Ministry of Environment and Natural Resources.

#### (4) Regional Distribution of Manufacturing Industry

The distribution of manufacturing industries in Kenya is estimated based on numbers of "Wage Employment by Industry and Major Towns, 1986 - 1990". Data cover twentyone major towns, which had a wage employment level of over 2,000 person in 1972. While the number of such towns must have increased since 1972, manufacturing wage employment in the major towns accounted for 75.5 % in 1986 and 72.5 % in 1990 of total manufacturing wage employment. Hence, such an estimation approach is justified.

Ranking of major towns by share in wage employment in the year 1990 shows Nairobi (35.4 %), Mombasa (13.3 %), Thika (5.8 %), Eldoret (4.8 %), Nakuru (3.3 %), Kisumu (2.7 %), Machakos (1.7 %), Kericho (1.5 %), Athi River (1.1 %), and Webuyu (0.8 %) (Table 3.2.11 refers). Six out of the above ten towns are located along the Mombasa - Nairobi - Uganda Corridor (Route A-104 and A-109). Kisumu and Kericho are located along Route B-1, which diverges from Route A-109. Thika is on the Route A-2, which crosses the Central Province in a north-south direction. Machakos is the only major town located off arterial A or B class roads. Machakos is on Route C-97 that diverges from Route A-109.

Figure 3.2.4 identifies the above described industrial corridor.

The relative regional share of wage manufacturing employment of Nairobi decreased by 3.3 points over the period 1986 to 1990, from 38.7 % to 35.4 %. Major towns in the Nyanza, Eastern, Coastal, and Rift Valley Provinces expanded their relative shares. The growth rate of wage manufacturing employment was with 14.4 % the highest in Machakos, followed by Kisumu, Kericho, Mombasa and Eldoret at such average annual rates as 5.3 %, 4.8 %, 3.9 %, and 3.9 %, respectively.

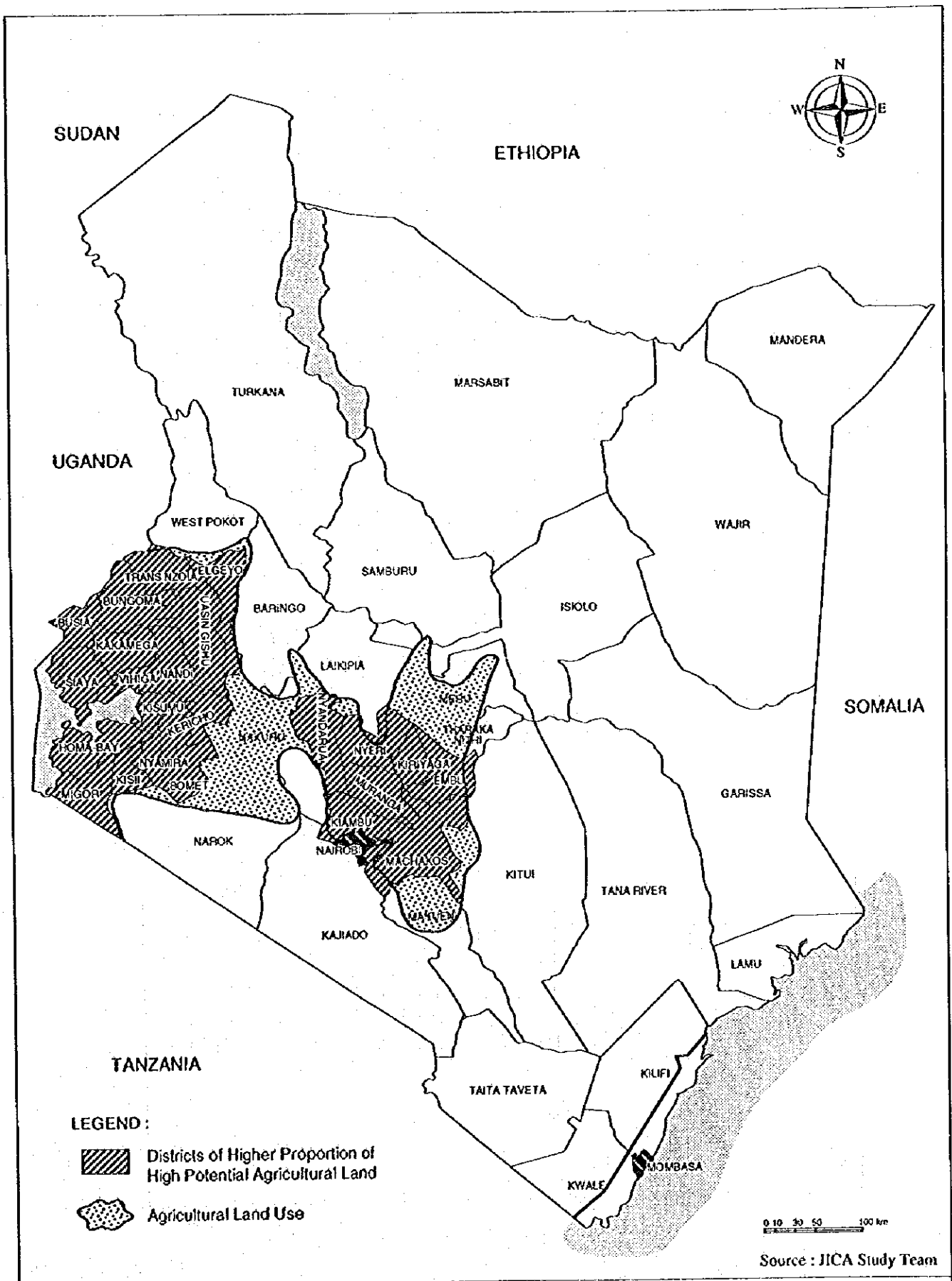
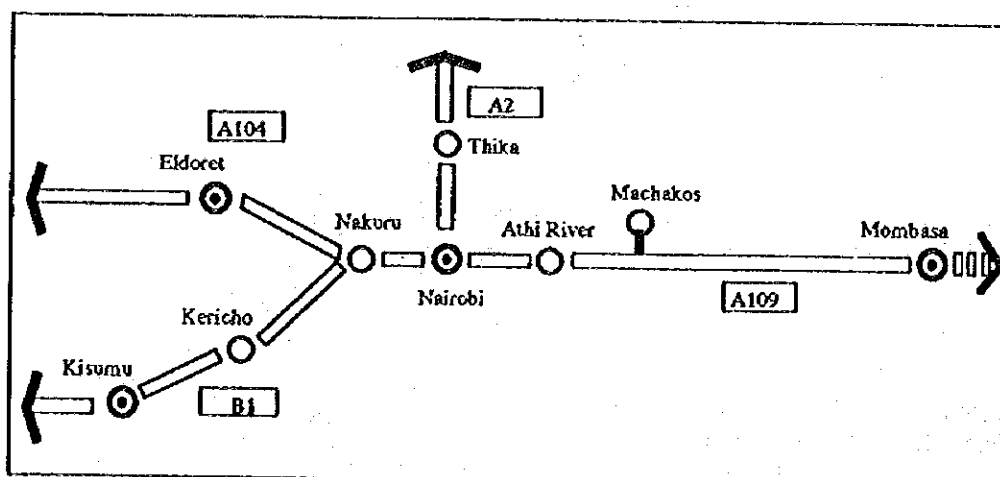


Figure 3.2.3  
High Potential Agricultural Area

Table 3.2.11 Wage Employment of Manufacturing Industry by Major Town

Major Towns	Year 1986		Year 1990		Growth Rate (% p.a.)
	Persons	(%)	Persons	(%)	
Nairobi	63,394	38.68%	66,373	35.36%	1.15%
Kiambu	9,573	5.84%	10,819	5.76%	3.11%
Murang'a	110	0.07%	46	0.02%	-19.58%
Nyandarua	494	0.30%	477	0.25%	-0.87%
Nyeri	560	0.34%	515	0.27%	-2.07%
CENTRAL	10,737	6.55%	11,857	6.32%	2.51%
Malindi	230	0.14%	280	0.15%	5.04%
Mombasa	21,369	13.04%	24,907	13.27%	3.90%
Taita	38	0.02%	47	0.03%	5.46%
COAST	21,637	13.20%	25,234	13.45%	3.92%
Embu	67	0.04%	61	0.03%	-2.32%
Machakos	4,373	2.67%	5,234	2.79%	4.60%
Meru	64	0.04%	144	0.08%	22.47%
EASTERN	4,504	2.75%	5,439	2.90%	4.83%
Kisii	187	0.11%	639	0.34%	35.96%
Kisumu	4,069	2.48%	4,996	2.66%	5.26%
NYANZA	4,256	2.60%	5,635	3.00%	7.27%
Kericho	2,399	1.46%	2,897	1.54%	4.83%
Laikipia	802	0.49%	927	0.49%	3.69%
Nakuru	6,329	3.86%	6,686	3.56%	1.38%
Trans Nzoia	326	0.20%	407	0.22%	5.70%
Uasin Gishu	7,679	4.69%	8,944	4.77%	3.89%
RIFT VALLEY	17,535	10.70%	19,861	10.58%	3.16%
Bungoma	1,469	0.90%	1,525	0.81%	0.94%
Kakamega	191	0.12%	217	0.12%	3.24%
WESTERN	1,660	1.01%	3,742	0.93%	1.21%
Major Town Total	123,723	75.49%	136,141	72.54%	2.42%
National Total	163,903	100.00%	187,683	100.00%	3.45%



Source : JICA Study Team

Figure. 3.2.4 Existing Industrial Corridor



### 3.2.4 Urbanization Pattern and Urban Rural Balance

#### (1) Population Distribution

High population density districts (leaving aside urban centers such as Nairobi and Mombasa), which show in 1989 a population density of between 100 to 500 persons per square kilometer, are found in major agricultural production areas. The highest population density is with 517 persons/sq.km in the Kisii District and the lowest is with 100 persons/sq.km in the Machakos District (Table 3.2.12).

The high population density area is typically divided into two distinct parts as depicted in Figure 3.2.5. One part covers the whole area of Central Province and Meru, Embu and the Machakos Districts of the Eastern Province. The other part extends from Nakuru in the Rift Valley Province towards the West. This part comprises the entire Nyanza and Western Provinces and further such districts in the Rift Valley Province, which are confined to the Lake Victoria Basin. Districts with a population density of less than 100 persons/sq.km have a proportion of either semi-arid or arid land, holding therefore a smaller supporting capacity for human settlements.

#### (2) Distribution Pattern of Urban Population

A town in Kenya is defined as a settlement with a population size of more than 2,000 people. In 1989 there was a total of 124 towns. About 76.7 % of the total urban population live in 45 towns with a individual population size of over 10,000 people (Figure 3.2.6 refers). There are 41 towns in the Western and 30 in the Central Region, 17 in the Rift Valley, 8 in the Central Belt and 24 in other regions.

Some 15 towns with a population size over 10,000 are located in the Central Region. Their population accounts for 50 % of Kenya's total urban population. The Western, Rift Valley, Coastal Belt and other Regions have 14 towns with 16.8 %, 6 towns with 6.6 %, 3 towns with 13.7 %, and 7 towns with 3 % of the total urban population, respectively.

There are 9 towns with a population size of over 20,000 people in the Central Region, 10 in the Western Region, 2 in the Rift Valley, 2 in the Coastal Belt and 1 in other Regions. It may be said that most of the towns have grown on basis of agricultural development. Table 3.2.13 shows the ranking of towns by population size and Region.

Table 3.2.12 Population Density by District in 1989

District	Land Area (sq. km.)	Population in 1989	Density (per sq. km.)
Kilifi	13,006	610,546	47
Kwale	8,260	395,118	48
Lamu	6,818	58,571	9
Mombassa	282	471,858	1,673
Taita	16,965	213,801	13
Tana River	38,782	132,471	3
<b>Coastal</b>	<b>81,113</b>	<b>1,882,365</b>	<b>22</b>
Garissa	43,392	128,464	3
Mandera	25,871	127,385	5
Wajir	56,923	126,338	2
<b>North-East</b>	<b>126,186</b>	<b>382,187</b>	<b>3</b>
Embu	2,805	380,898	136
Isiolo	25,604	72,115	3
Ktui	29,803	671,574	23
Machakos	13,968	1,442,758	103
Marsabit	72,290	133,020	2
Meru	9,884	1,177,868	119
<b>Eastern</b>	<b>151,354</b>	<b>3,878,233</b>	<b>25</b>
Kiambu	2,587	940,994	364
Kirinyaga	1,485	402,987	271
Muranga	2,525	883,007	350
Nyandarua	3,373	355,461	105
Nyeri	3,266	624,946	191
<b>Central</b>	<b>13,236</b>	<b>3,207,395</b>	<b>242</b>
Nairobi	693	1,363,075	1,967
Baringo	10,954	358,106	33
Elgeyo Marakwet	3,049	222,780	73
Kajiado	21,756	266,178	12
Kericho	4,940	927,124	188
Laikipia	9,162	225,322	25
Nakuru	7,190	873,779	122
Nandi	2,784	446,218	160
Narok	18,002	409,850	23
Samburu	20,808	112,049	5
Trans Nzoia	2,467	405,126	164
Turkana	69,146	189,411	3
Uasin Gishu	3,218	458,482	142
West Pokot	8,937	232,003	26
<b>Rift Valley</b>	<b>182,413</b>	<b>5,126,428</b>	<b>28</b>
Kisii	2,198	1,170,108	532
Kisumu	2,077	683,391	329
Siaya	2,524	658,027	261
South Nyanza	5,708	1,097,588	192
Nyanza	12,507	3,609,114	289
Bungoma	3,072	698,889	228
Busia	1,652	413,334	250
Kakamega	3,561	1,506,069	423
Western	8,285	2,618,292	316
<b>KENYA TOTAL</b>	<b>581,787</b>	<b>22,067,089</b>	<b>38</b>

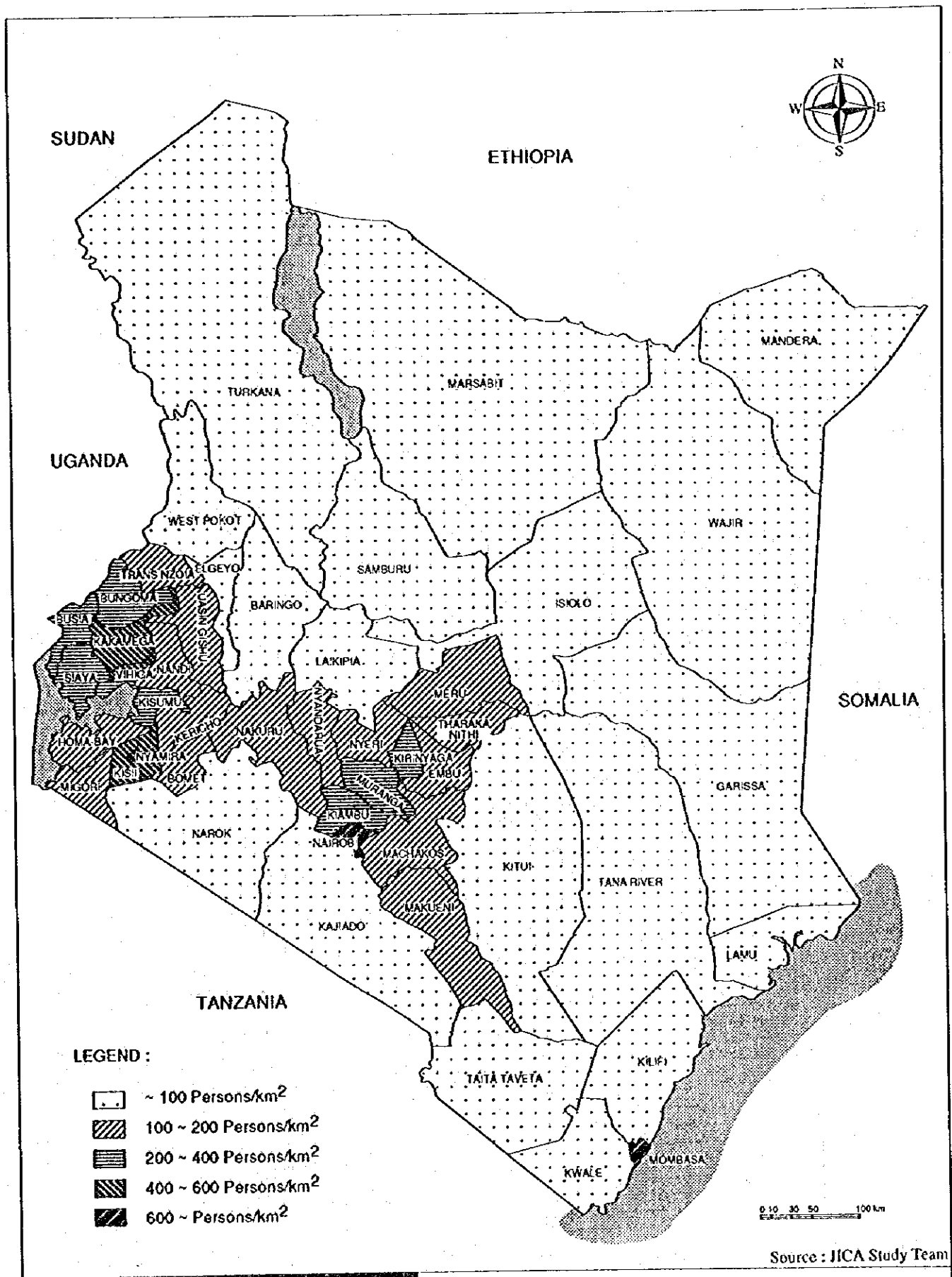
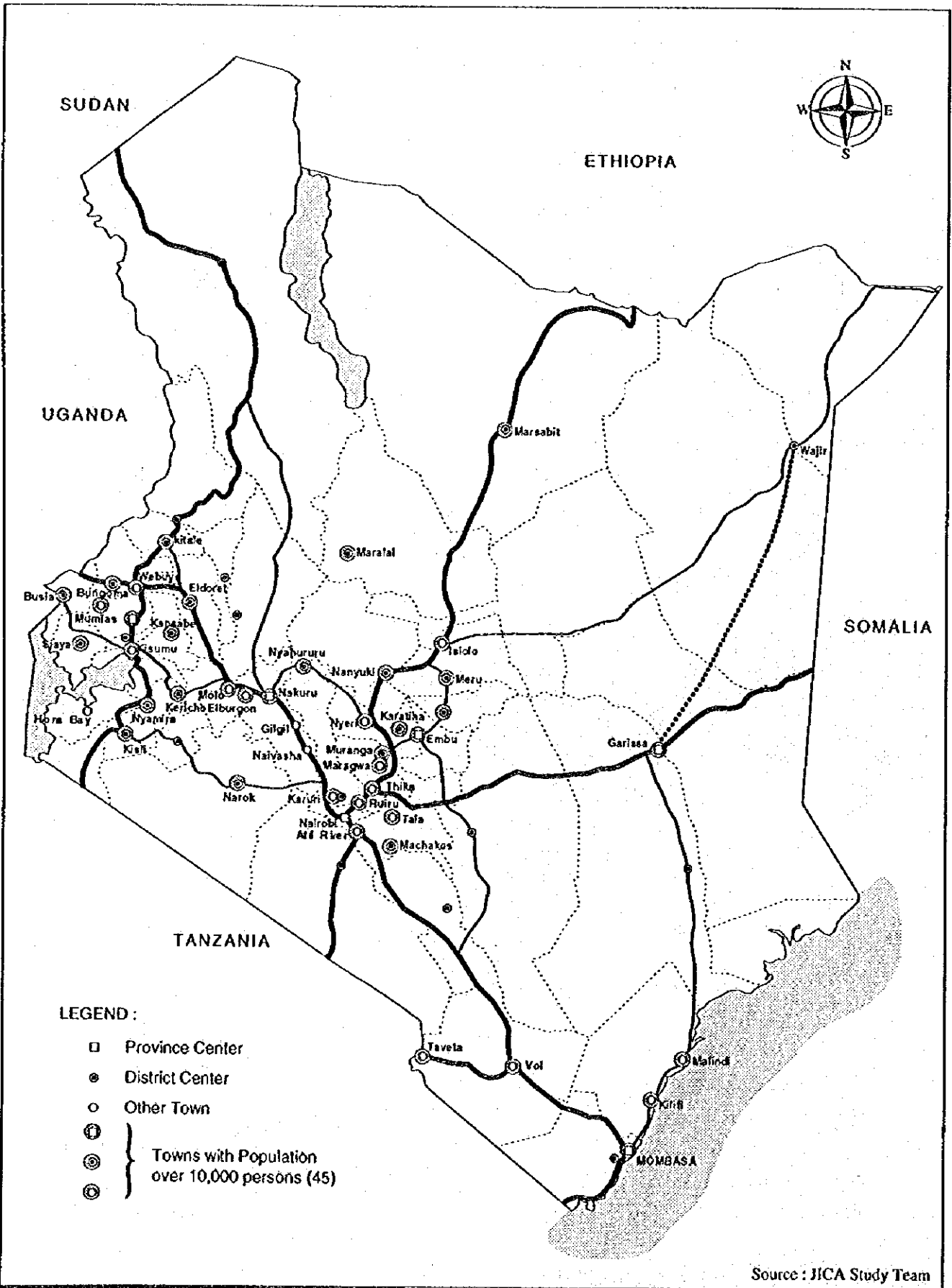


Figure 3.2.5  
Population Density by District in 1989



Source : JICA Study Team

**Road Network Development  
Master Plan in Kenya**

**Figure 3.2.6  
Distribution Pattern of Towns by Population Size  
In 1989**

Table 3.2.13 Ranking of Towns by Population Size and Region

Size of Population	Western Region		Rift Valley Region		Central Region		Coast Belt Region		Other Region		Total	
	Town Name	x 1,000 pop.	Town Name	x 1,000 pop.	Town Name	x 1,000 pop.	Town Name	x 1,000 pop.	Town Name	x 1,000 pop.	Town	x 1,000 pop.
20,000 and over	Kisumu Eldoret Kitale Kakamega Kisii Kericho Bungoma Webuye Mundao Homa Bay	185 105 53 47 44 40 29 26 24 21	Nakuru Naivasha	163 35	Nairobi Machakos Nyeri Meru Thika Maragwa Nanyuki Athi River Muranga	1,346 116 89 78 57 31 25 23 21	Mombassa Malindi	466 35	Garissa	27		
No. of Towns	10	(574)	2	(198)	9	(1,786)	2	(500)	1	(27)	24	(2,585)
10,000-20,000	Siaya Busia Kapsabet Nyamira	17 12 12 10	Gilgil Elburgon Narok Molo	14 12 11 10	Embu Karuri Nyahururu Kerugoya Tala Ruiru	18 15 14 13 13 12	Kilifi	12	Wajir Marakal Isfola Voi Marsabit Taveta	19 17 15 12 11 10		
No. of Towns	4/14	(51)	4/5	(47)	6/15	(85)	1/3	(12)	6/7	(84)	21/45	(279)
5,000-10,000	Ahero Muhoroni Migori Kilimnini Koru Sotik		Njoro Kabarnet Olkaria Rapengoria Eldama Ravine Maji Mazuri		Ngong Kitui Mwingi Kikuyu Karatina		Masambweni Maliakani		Lamu Ilola Mandera Mayole Ontgata-Rongai Kajiado Meru			
No. of Towns	6/20		6/12		5/20		2/5		7/14		26/71	
2,000-5,000	Itcu Vihiga Turbo Awendo Nyabikaye Kahaucha Oyugis Luanda Londiani Bongo Maseno Mof's Bridge Kendu Bay Chaptals Mwalie Yala Butere Kipkerion Keroka Burnt Forest Nambare		Kilgoris Magadi Mogollo Marigat Makutano		Nkubu Makuyu Othaya Kiambu Mara Githunguri Chuka Sagana Kibwezi Ruiru		Mamburui Lunga Lungu Watamu		Namanga Kargi Loitokitok Sololo Kwale Wamba Witu Garsen Baragot Bute Wundanyi Rumuruti Modogashi North Hor			
No. of Towns	21/41		5/17		10/30		3/8		14/24	(84)	53/124	-
												(3,736)

(3) Urbanization Levels in the Regions

One of the crucial issues in national development is how to cope with the urbanization pressure. Kenya's urban population is estimated in 1994 at about 5 million people, equivalent to about 20 % of the total population. It is projected by the Ministry of Planning and National Development that the urban population will reach a level of about 11 million, equivalent to 30 % of the total population in the year 2010. That would imply an average annual urbanization growth rate of 5.1%.

a Growth Center Policy

The Growth Center Policy is a concept to be combined with the Rural Trade and Production Center Policy. It is hoped that their harmonized development will lead to a balanced development between rural and urban areas.

b Regional Growth Center

The Seventh National Development Plan 1994 - 1996 designates six growth centers namely, Mombasa, Kisumu, Eldoret, Nakuru, Nyeri and Kakamega. Six planning regions have been identified above using such parameter as geography, climate, catchment water board, and distribution of urban population by size. Additionally, a city cluster system will be analyzed in following section 3.2.6.

The Northern and Eastern Regions lie in the arid and semi-arid land. These regions retain less development potential, unless high investment costs for reclaiming the land can be economically justified in future. Accordingly, the remaining four regions, that is the Western Region, the Central Region, the Coastal Belt Region and the Rift Valley Region will become economically important.

- Western Region

Kisumu in the Western Region is a most potential town with highly accumulated urban settlements and facilities. Kisumu is located in an advantageous environment, that is it has access to the water from the Lake Victoria and agricultural potentials exist not only in its neighborhood, but also in Uganda and Tanzania. Furthermore, Kisumu has a harbor and functions as a nodal point in the transport systems. Kisumu is thus an important town that can be designated as a regional center of the Western Region.

Eldoret is located at a highland through which international traffic to Uganda passes. A critical factor for Eldoret's further urban development is the availability of sufficient water supply to support a future population. If the water problem cannot be solved, then Eldoret's future development potential would be severely constrained. Eldoret will, therefore, function as a regional sub-center to support Kisumu.

Kakamega in the Western Region, which is located very close to Kisumu, represents a comparatively low development potential. Hence, it should continue to function in its present role as a district center, unless it is proven feasible to be developed as a growth center.

Homa-bay is another port located at a shore of the Lake Victoria. It supplements the port function of Kisumu and enhance the water-borne traffic to and from the opposite shores of Uganda and Tanzania. This town will be developed as a port town in a long-term view, as the regional as well as the international economic activities become highly stimulated.

#### - Central Region

A regional center of the Central Region should be Nairobi, the national capital of Kenya. But Nairobi faces shortages in water supply. It would therefore be preferable to establish in a planned manner satellite towns, such as Athi River, which develops an Export Processing Zone (EPZ).

Nyeri is the capital city of the Central Province. However, it is located at the water resource area of the Central Highlands. Rapid and large-scale urbanization would probably cause a serious impact on the natural environment of the water resource area. The urbanization process in the Central Region progresses not only in the surrounding area of Nairobi, but also in the north and northeastern areas of Nairobi, particularly along the route A-2 and B-6.

#### - Coastal Belt Region

Mombasa is the regional growth center of the Coastal Belt Region. Mombasa has large natural advantages and the only deep sea port among the East African countries. This implies a high potential for industrial investments. Mombasa has also been long developed as a coastal resort for

foreign tourists. It is imperative therefore to preserve the tourism resource along the coastal area and to induce the development of urban infrastructure into the hinterland area of Mombasa.

- **Rift Valley Region**

The Rift Valley Region in itself, can hardly form an independent economic region. Although Nakuru can be a growth center of the Region as designated in the National Plan, the city has a potential water supply problem. But adequate water supply is a prerequisite for fulfilling an expanding urban function. It seems more important for Nakuru's development to facilitate a nodal function in the transport networks that connect the eastern and western parts of Kenya.

Among the growth centers designated in the National Plan, Mombasa and Kisumu have high investment potentials, because these two centers are the gate way cities connected directly with the neighboring countries and international markets.

### **3.2.5 City Ordering System for Analyzing Urbanization**

(1) **Concept of City Ordering System**

1) **Background and application of this concept**

Taking into account the current problems and prospective development issues in Kenya, the following are key observations from both, a national development and road network development point of view.

a **Efficiency of National Development**

Kenya consists of a coastal area, highland area, semi arid area and other areas. Each area has its own characteristics, climatic, topographical and ethnic conditions.

Given this high level of diversification, some strategic measures are key factors in developing the country. A shortage of budgetary resources is another reason for the need of a strong strategy.



**b Countermeasures on Urbanization**

The current urbanization trend will accelerate in future. However, if urbanization emerges in every region and district simultaneously and uncontrolled, serious problems will arise with the supply of such necessary infrastructures as water supply, electric and transportation services. Such services will not be thoroughly provided in every city due to budgetary constraints and administrative procedures.

This indicates that intensive development efforts, which concentrate on key cities, are needed.

**c Hierarchy among Cities**

In view of the above, a city hierarchy is needed for :

- The selection of cities to function as regional centers
- For forming territory including surrounding cities and villages of each regional center
- For the enhancement of regional centers.

In other words, a clear and distinct city hierarchy system should be introduced in order to develop regions and districts.

**2) Idea of Ordering System**

In the city ordering system peripheral cities are subordinated to the regional centers in terms of administrative relationship and commodity movements including agricultural and commercial activities. Regional centers will have to provide high grade service facilities, such as financial markets, educational facilities and commercial activities.

The city ordering system is a therefore a method to represent this hierarchy system of cities in terms of relationships between a regional center and peripheral cities and villages from a point of view of the road network system.

**(2) Method**

The ordering of each link and network is calculated using the following steps.

1) Calculation of Indices

a Population of cities

The population size of major cities as surveyed in the 1989 population census is utilized in this analysis.

b Distance among cities

Distances among cities are calculated by space distance according to the X-Y coordinates of the cities.

c Calculation of Indices

Firstly, the following indices are calculated employing distances among cities and the number of population of each city as main parameter :

$$t(i,j)=T(i)*T(j)/D(i,j)$$

In a second step the following indices are calculated to form a cluster tree :

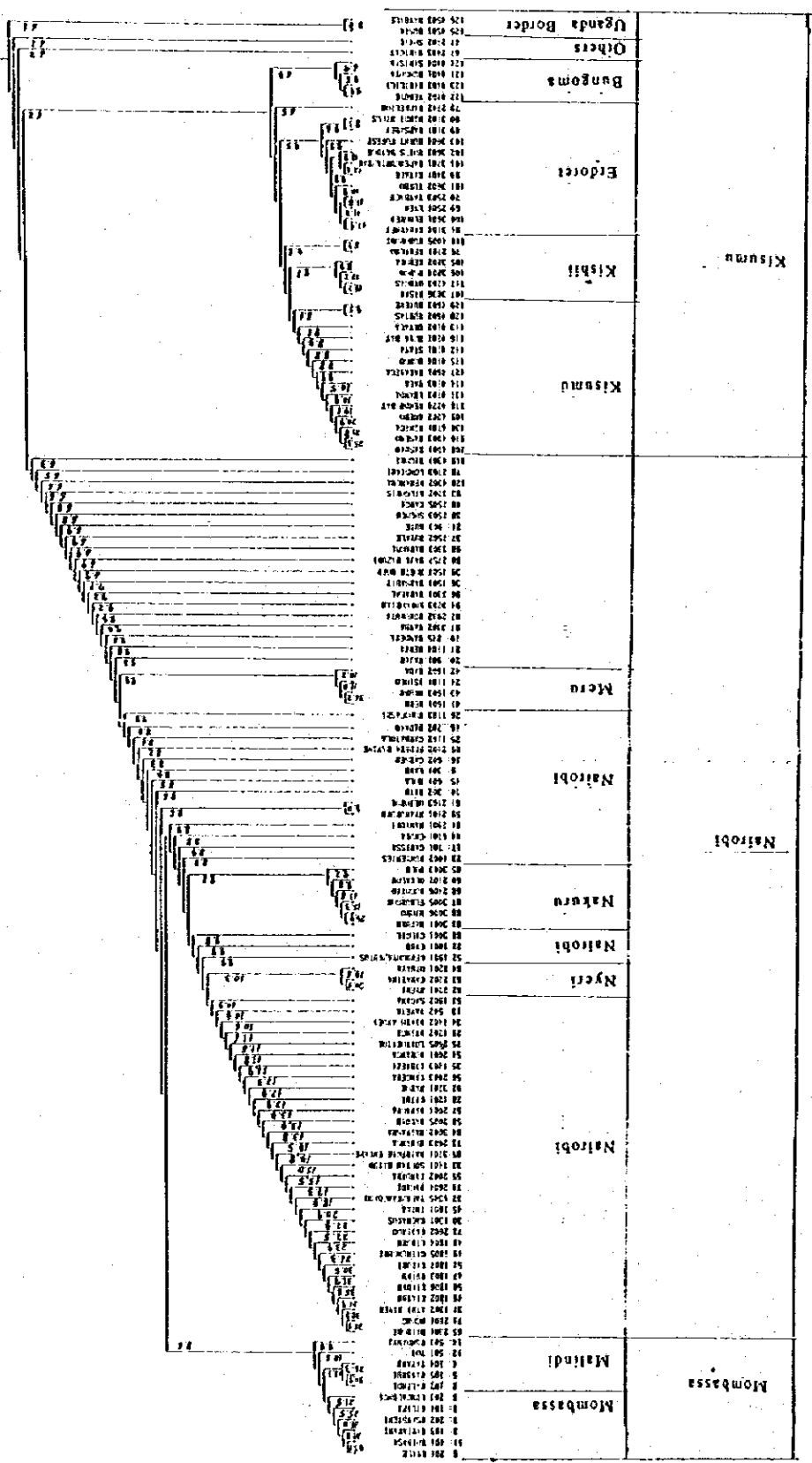
$$T(i,j)=t(i,j)/T(i).$$

When comparing  $t(i,j)/T(i)$  and  $t(i,j)/T(j)$ , the larger number is applied for  $T(i,j)$ .

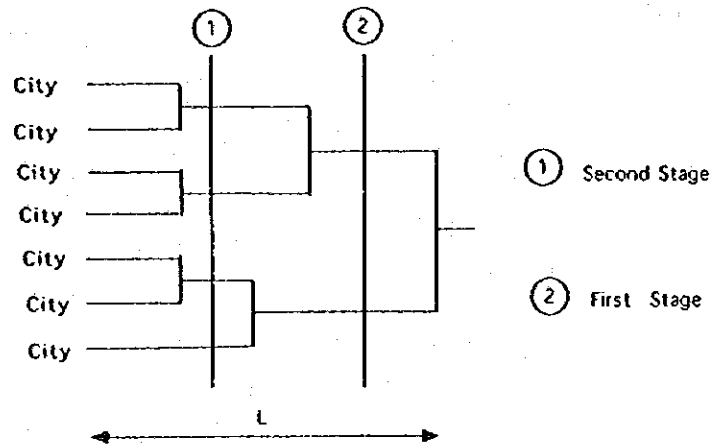
2) Formation of Clusters among Cities

The indices used for the cluster tree are summarized in Table 3.2.14. The results of the cluster analysis are visualized in the drawing shown in Figure 3.2.7. A stylized sample of the tabulation process is given in Figure 3.2.8.





Source : JICA Study Team



Note: L indicates a strength of relationship between cities or between a city and group of cities.

Figure 3.2.8 Cluster Tree

(3) Forming Territories

1) Basic Territories

Despite the fact that this cluster tree would imply several stages of territorial formation, nine definite basic territories can be observed from the established relationships. The nine basic territories may be summarized into three big territories, namely Mombasa, Nairobi and Kisumu. The stylized relationship and spatial location are shown in Figures 3.2.9 and 3.2.10.

2) Size of Population

a Mombasa Territory

As can be seen in Figure 3.2.10, Mombasa has a rather small territory alongside the coastal region. Only Malindi and Mombasa comprise a secondary territory. The total population size in this territory reaches about 552,000 inhabitants. One important feature has to be noted here, however, that is that Lamu is excluded from the Mombasa territory.

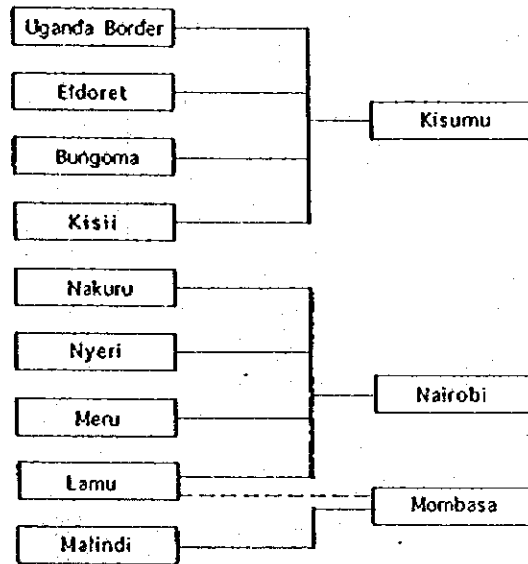


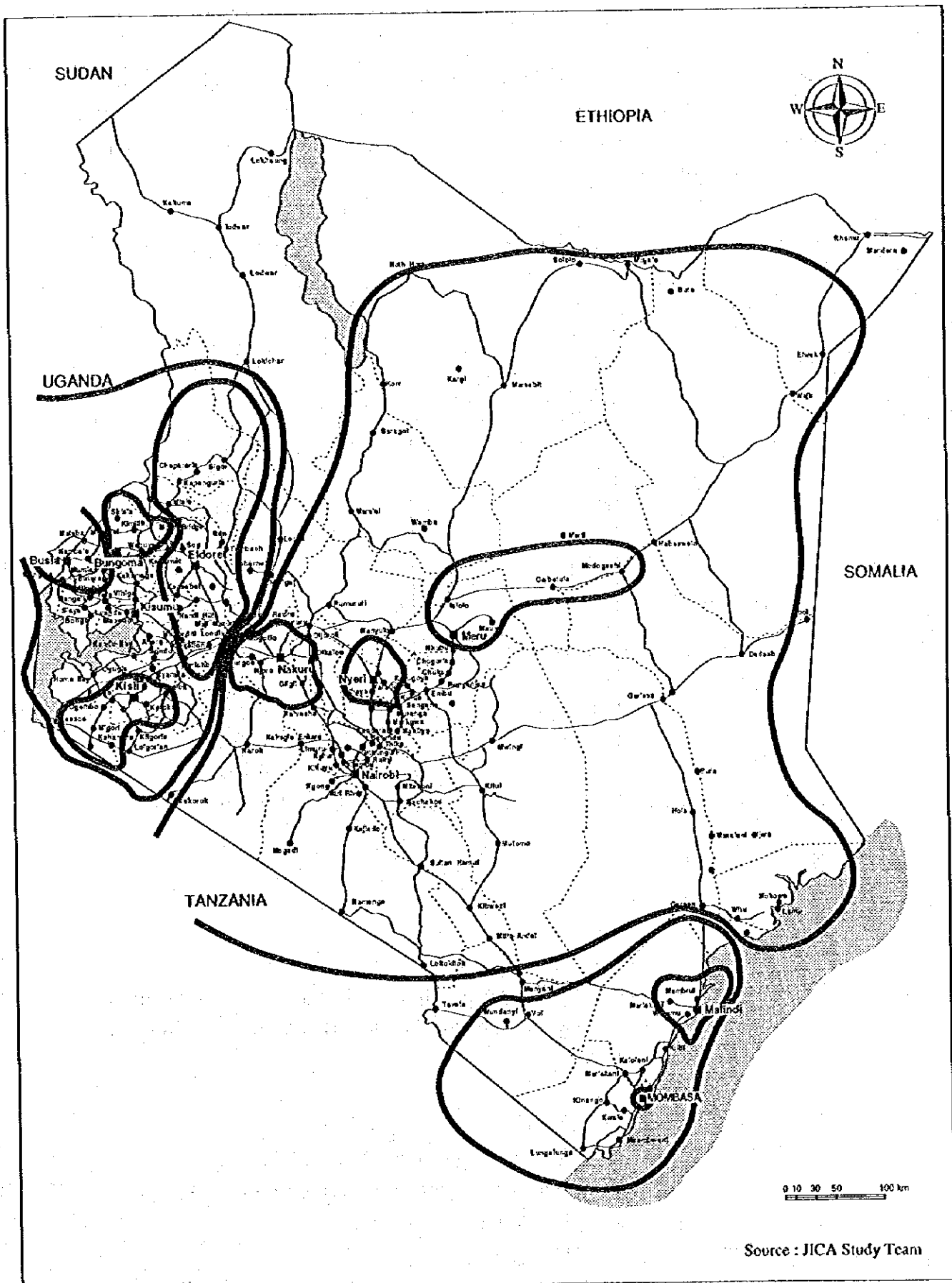
Figure 3.2.9 Hierarchy of Territory

b Nairobi Territory

The population size of each territory is tabulated as shown in Table 3.2.15. The Nairobi territory comprises six secondary territories, namely Nairobi city, Nakuru, Nyeri, Meru, Lamu and others. With a population of 1,346,000, Nairobi City territory has a dominant population in this secondary territory of Nairobi. One special feature is that the Lamu territory, which seems to belong to Mombasa, is actually included in the Nairobi territory. This relationship is also indicated in the traffic OD survey results, which show that Lamu has some strong potential ties with Nairobi.

c Kisumu Territory

The Kisumu territory consists of Kisumu, Eldoret, Kisii, Bungoma and the Ugandan border area.



Source : JICA Study Team

**Road Network Development  
Master Plan in Kenya**

**Figure 3.2.10  
Special Location Territory**

Such two comparatively large areas as Kisumu and Eldoret are included in this territory. Kisumu, however, seems to be in a dominant position judging from the extent of territorial area and the number of cities being subordinated into secondary territory.

Table 3.2.15 Population of Each Territory

Territory	Primary Territory	Population
Mombassa	Malindi	40300
	Mombassa	511800
	Total	552100
Nairobi	Nairobi City	1346000
	Nakuru	186900
	Nyeri	98200
	Meru	101900
	Lamu	23100
	Others	662100
	Total	2418200
Kisumu	Kisumu	384100
	Eldoret	206800
	Kisii	98800
	Bungoma	61700
	Border	14200
	Total	765600
Grand Total		3735900

#### (4) Regional Center

##### a Regional Center

Cities with a large population size and/or with many integrated service facilities are automatically given a function as regional center. This forms a hierarchy of cities in the following order.

- First stage                      Mombasa, Nairobi and Kisumu
- Second stage                    Malindi, Lamu, Meru, Nyeri, Nakuru, Kisii,  
Bungoma, Eldoret, Uganda border area and  
Homa Bay.
- Third stage                        Other cities.



Homa Bay is added, because of its port facility connecting it to neighboring countries through Lake Victoria.

**b. Implication of the Regional Center**

The roles of these regional centers are summarized as follows :

- Integrated administrative development center
- Industrial development center
- Center to be provided with social infrastructure, such as hospitals, educational facilities, and so forth
- Commercial activity center.

Each city, which is designated as a regional center on every hierarchy level, has its own service facilities. Though high hierarchy cities may have more sophisticated facilities and stronger economic power as compared to those of lower hierarchy cities or subordinated cities. It can be expected to promote the prospective economic activities and an efficient development path in regions through forming this hierarchy and classifying cities into a pyramid relationship.

### 3.2.6 Environmental Constraints

#### (1) Nationwide Environmental Constraints in Kenya

In some areas environmental conditions have worsened nowadays as a result of economic development and Kenya's high population growth. Kenya's nationwide environmental constraints are defined as follows :

- Soil erosion
- Deforestation
- Desertification and drought, and
- Wildlife conservation.

These constraints are elaborated on below.

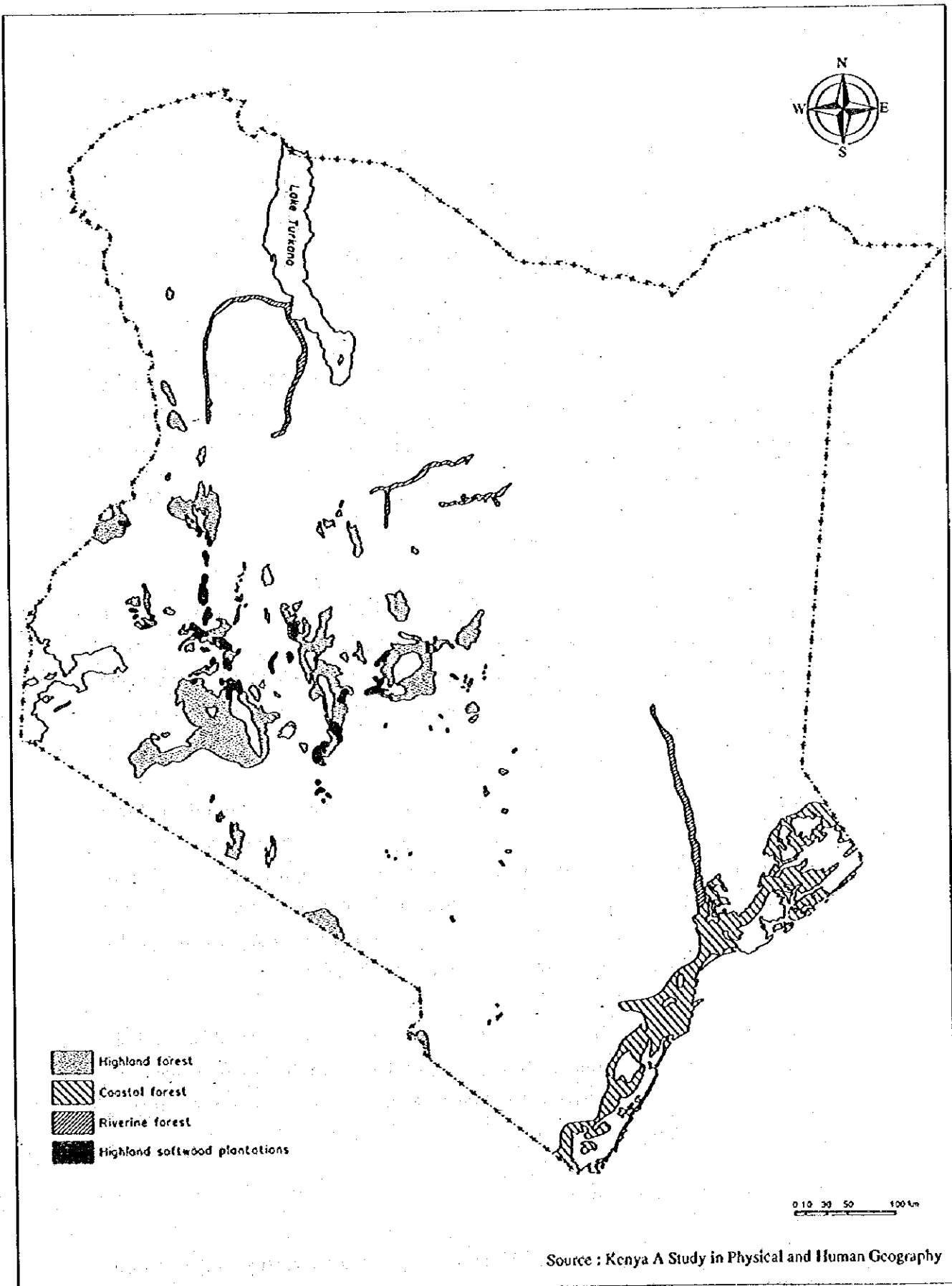
##### a Soil Erosion

The danger of soil erosion increased in Kenya in the 1960s. Soil erosion is most severe in areas where there is overstocking of and overgrazing by livestock and wildlife in arid and semi-arid areas. In high and medium potential regions, inappropriate farming practices in high and medium potential with high intensity rainfall and steep slopes would likewise result in severe soil erosion.

The loss of soil fertility due to erosion decreases agricultural productivity and reduces the potential grazing areas.

##### b Deforestation

Figure 3.2.11 shows Kenya's forest areas. Table 3.2.16 indicates the forest areas and the average annual deforestation in Kenya in 1981-90. The causes of deforestation are : cultivation in private forests; over-exploitation of commercial species; forest fires; grazing of domestic animals and illegal tree cutting to meet the fuelwood needs of the local people.



Source : Kenya A Study in Physical and Human Geography

Figure 3.2.11  
Distribution of Forest Area

Table 3.2.16 Forest Resources and Rate of Deforestation

Natural Forest (000 ha)		Annual Deforestation 1981-1990 (000 ha)	
1990	1980	Extent (000 ha)	Rate (%)
1,187	1,256	7	0.5

Source: WRI, UNEP and UNDP World Resources 1994-95

Improper management and the consequent destruction of forests is bound to threaten their critical functions, such as carbon sink functions, prevention of soil erosion, protection of water catchments, wildlife habitat and conservation of biodiversity.

#### c Desertification and Drought

Although desertification takes place in most areas of Kenya, it mainly occurs in the arid, semi-arid and sub-humid areas. In general, desertification in the arid and semi-arid areas is triggered by the destruction of rangeland vegetation and overgrazing accompanied by water resource depletion, declining crop yields and land fragmentation.

More and more people are moving into the ASALs in search of farming land and employment opportunities. Depending on the influence of migration, population growth rates vary greatly in the ASALs, ranging from a high of 6.84% in Narok District to a low of -0.93% in Wajir. Immigrants from high potential areas bring with them the land use practice they are familiar with. These practices are usually inappropriate for the ASALs and lead to land exploitation.

Other factors, which affected population dynamics in the ASALs include temporary emigration/immigration of pastoralists and the displacement of pastoralists to allow for agricultural expansion or urbanization and the influx of refugees from neighboring countries.

#### d Wildlife Conservation

From the viewpoint of tourism development and biodiversity conservation, wildlife is one of most important resources in Kenya. Hence, wildlife

conservation has been of main concern to the Government. However, the number and habitats of wildlife have been decreasing rapidly for decades. For example, according to Kenya Wildlife Service (KWS), the number of elephants and rhinos was reduced from 130,000 (1973) to 16,000 (1980) and from 20,000 (1970) to under 500 (1980s), respectively. The number of threatened animal species (1990) is shown in Table 3.2.17.

Table 3.2.17 The Number of Threatened Species (1990)

Mammals	Known Species	314
	Threatened Species	15
Birds	Known Species	1,067
	Threatened Species	18
Reptiles	Known Species	191
	Threatened Species	2
Amphibians	Known Species	88
	Threatened Species	0
Freshwater Fish	Known Species	180
	Threatened Species	0

Source: WRI, World Resources 1992-93

In Kenya, agriculture, industry and human settlements have been at the forefront in the elimination of the species and their habitats. The illegal ivory and rhino horn trade has also reduced Kenya's elephant and rhino population.

Approximately 8% of Kenya's total land area is set aside as National Parks and Reserves for the purpose of wildlife conservation. The main problems confronting wildlife management are encroachment of protected areas, poaching, pollution, and pressures brought on by tourism.

Furthermore, much of the wildlife from core protected areas moves to surrounding areas for part of the year. Maintaining the present size and biodiversity of Kenya's wildlife population depends on them having continued access to traditional seasonal dispersal areas. In this case, conflicts between wildlife and the people living on the animal migration routes would occur, even outside the protected areas.

(2) Regional Environmental Constraints

The environmental constraints that appear only in limited areas are :

- Water pollution
- Air pollution, and
- Waste management.

a Water Pollution

Surface water quality in Kenya is generally good, except in several areas where the water is polluted, for example in Lake Nakuru and in the marine area.

Water bodies are subjected to pollution from different sources, the most important of which are spills from agricultural land, and the discharge of municipal and industrial waste water. For example, although the quantities of these discharges are not accurately known, it has been estimated by UNEP that about 10,000 m<sup>3</sup>/day of untreated municipal waste water (mainly from Mombasa) and about 1,660 m<sup>3</sup>/day of industrial effluents (mainly from the petrochemical industry) are discharged into the marine environment.

Also, silt-laden waters flowing from rivers such as the Tana and Sabaki into the coastal sea, affect the growth of mangroves and coral negatively.

b Air Pollution

According to measurements carried out within the framework of the GEMS project on air quality in selected urban areas (1977- 1978), the concentration of sulfur dioxide in the air in Nairobi was found to range from 36 ug/m<sup>3</sup> in suburban areas to 57ug/m<sup>3</sup> in industrial areas.

However, as there is no systematic air quality monitoring in Kenya's urban areas, trends in air quality cannot be established at present. This problem is not crucial at present, but in future precautions and monitoring will be needed.

**c Waste Management**

While the issue of waste management is of general concern to rural and urban areas, it has become more critical in urban areas. Urban garbage collection fell far short of what can be considered environmentally safe in terms of human health. In Nairobi, the City Council collected only a quarter of the nearly 340 thousand tons of garbage generated in 1992.

The environmental constraints mentioned in this chapter are summarized and shown for each area in Table 3.2.18 and Figure 3.2.12.

**Table 3.2.18 Environmental Constraints in Kenya**

Area	Characteristics of the Area	Environmental Constraints
Whole Area	Various types of climate and vegetation	Wildlife conservation
Afro-alpine to Highland	Moderate to high density rainfall. Afro-alpine moor land, woodland, bushland	- Soil erosion caused by rainfall - Deforestation caused by development for farming land and commercial cutting
ASALs	Arid, semi-arid area grassland, bushed grassland, wooded grassland, bushland	- Soil erosion caused by wind - Deforestation caused by grazing of domestic animals and fuel wood collection by local people - Desertification and drought
Coastal Area and Inland Lakes	-----	Water pollution
Urban Areas	Lively economic activity	- Air pollution - Waste management

