

REPORT
ON
TOPOGRAPHIC MAPPING PROJECT
IN
EAST KENYA
(EIGHTH YEAR)
THE REPUBLIC OF KENYA

PRELIMINARY PHOTO INTERPRETATION
RANCHING PROJECT AREA
FIELD SURVEYS
RANCHING PROJECT AREA
FINAL PHOTO INTERPRETATION
&
THEMATIC MAP COMPILATION

MARCH 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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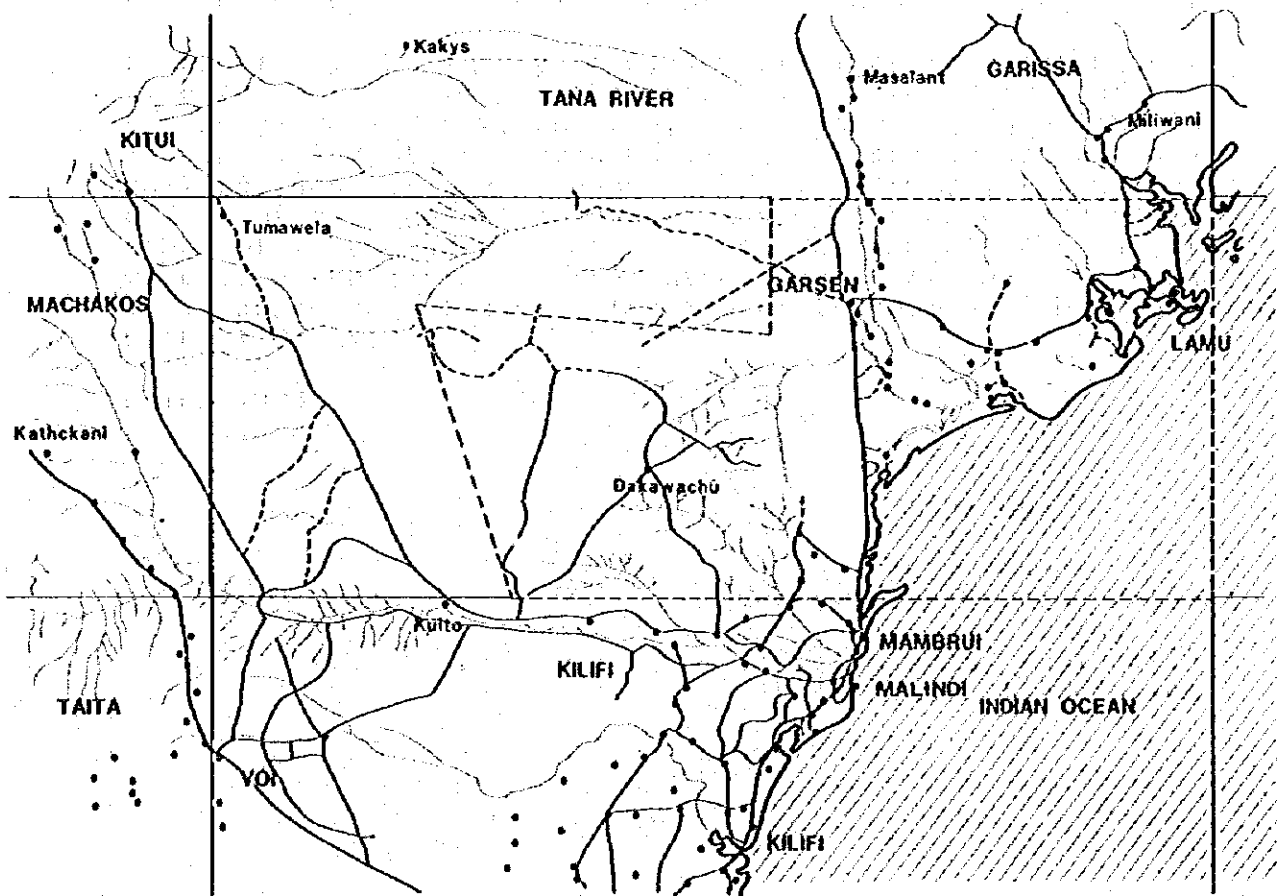
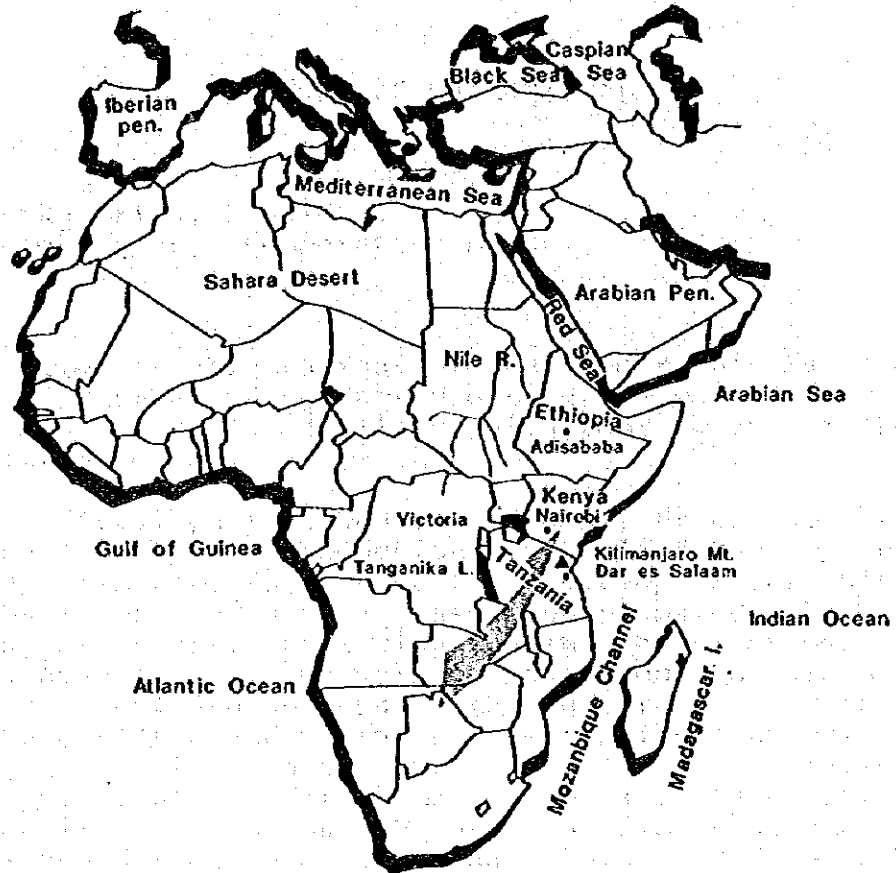
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Location Map of Project Area



Road
 Sea and River
 Project area

LETTER OF TRANSMITTAL

Mr. Keisuke Arita, President
Japan International Cooperation Agency

The Report on the Eighth Year of the Topographic Mapping Project in East Kenya conducted during the period from June 1982 to March 1983 in compliance with your request is here-
in submitted to you.

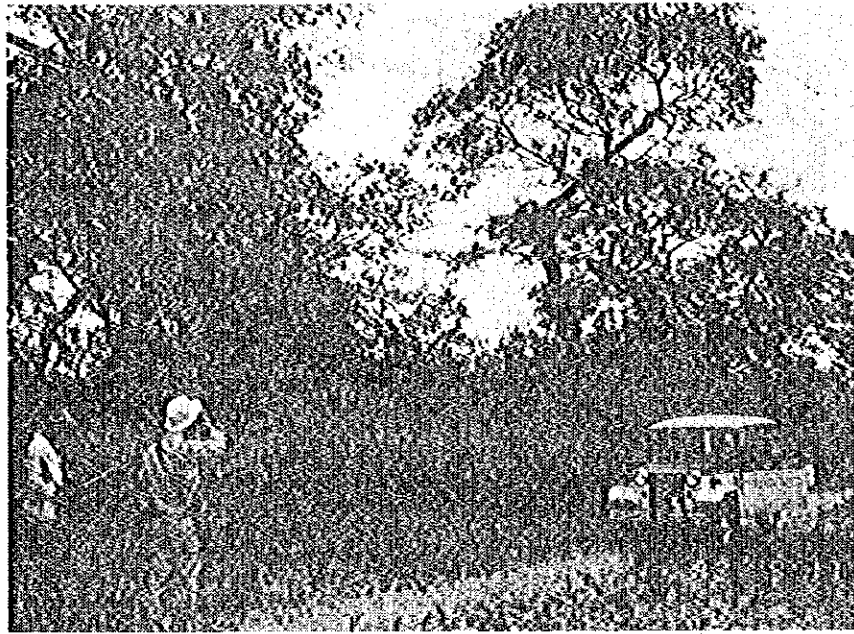
This past fiscal year marked the second year of the three year programme of the production of the land use map and other thematic maps to be used for development of this area on the basis of the national base maps prepared taking the preceding six years. Following the initial stage work done in the previous year, the work performed during this past fiscal year included surveys of the western half of the Ranching Project Area and making of compilation manuscripts covering the entire project areas as well as formulation of map specifications for thematic maps and policy for land use capability evaluation. We are confident that the results accomplished during this period have laid ground for subsequent phase of work and contributed significantly to the transfer of technology involved in the production of thematic maps.

On behalf of the survey team, I would like to express our sincere appreciation to the officials of the Survey of Kenya, the Kenya Soil Survey, the Kenya Rangeland Ecological Monitoring Unit, and other Kenyan Government agencies concerned as well as those of the Japanese Embassy in Kenya, the Nairobi Office of the Japan International Cooperation Agency and other offices concerned of Japanese Government, who assisted us during the period of the survey work. At the same time, it is hoped that the work for the ninth year will be conducted without delay.

March 1983

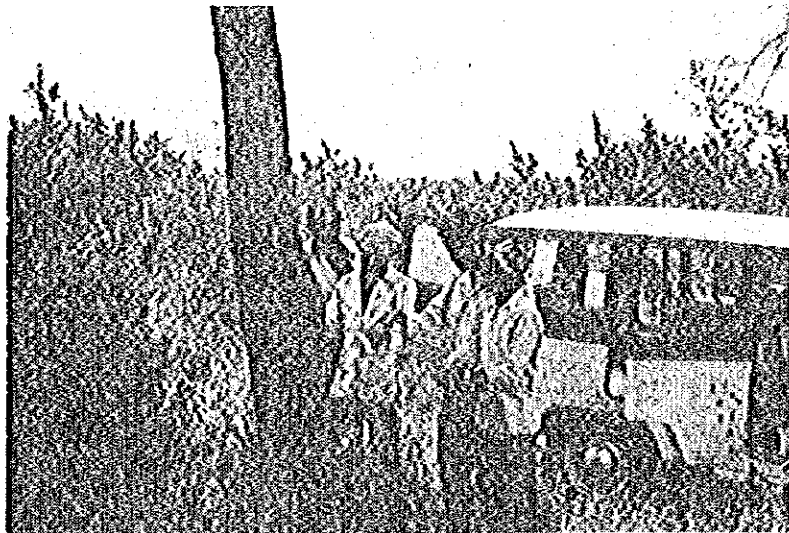
Eiji Gojo

Team Leader
Topographic Mapping Project
in East Kenya,
International Engineering
Consultants Association



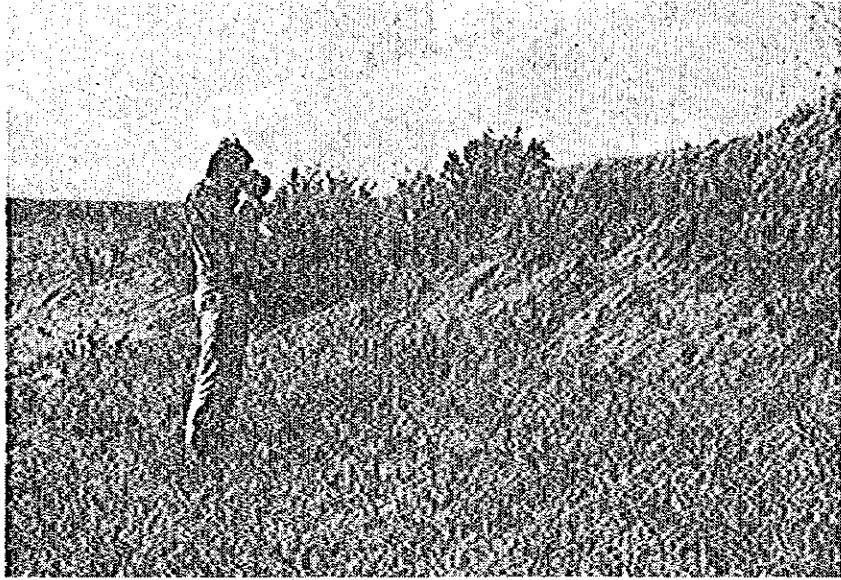
Vegetation survey near Musendzini (Map Sheet - Hadu)

The tree seen slightly to the right of the center, *Brachystegia spiciformis*, is being measured by blumeleiss for height, which is found to be 11.5m. Vegetation in the immediate area is F-2.



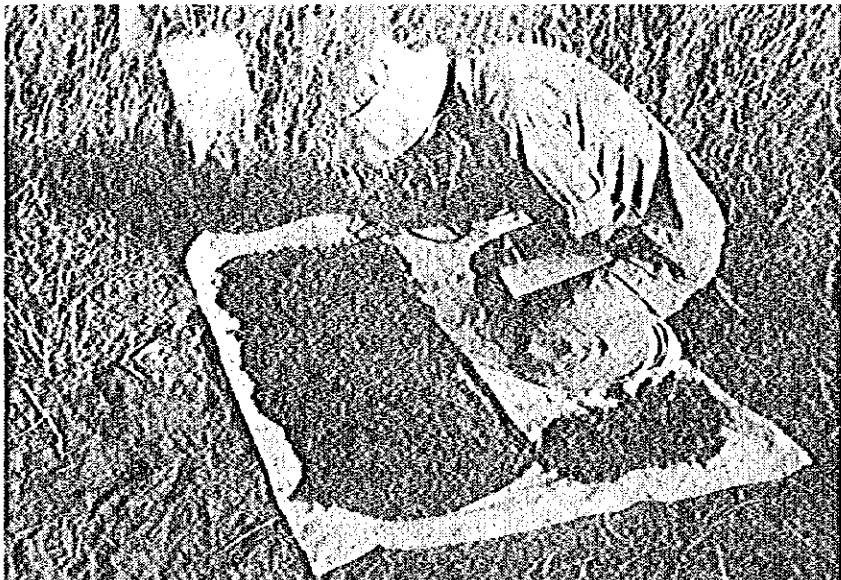
Vegetation survey near Hadu (Map Sheet - Hadu)

The tree in the center is being measured by diameter gauge for diameter of breast's height, which is found to be 43cm. Vegetation in this immediate area is WB-2.



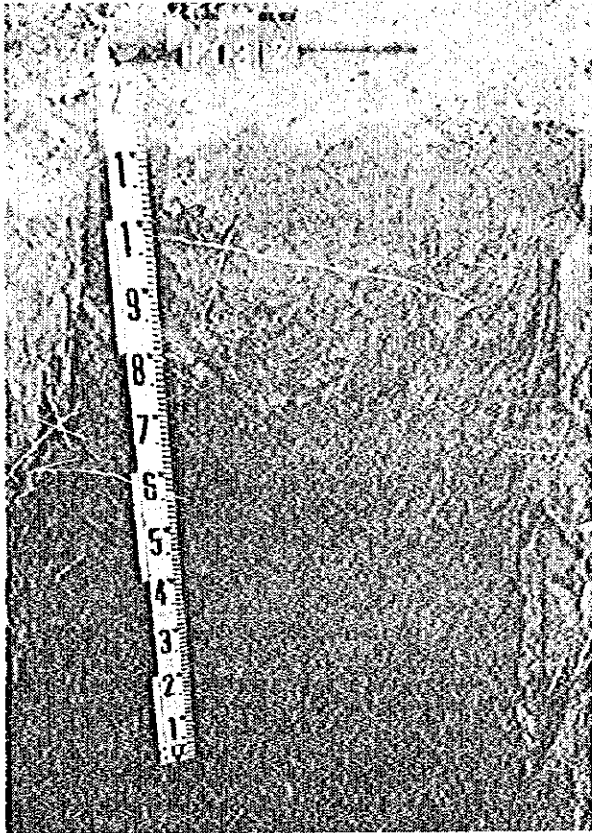
Landform survey northeast of Lale Hills (Map Sheet - Bisanmbala)

Outcrops on the edges of a reservoir and red coloured sands with developed cracks are observed.



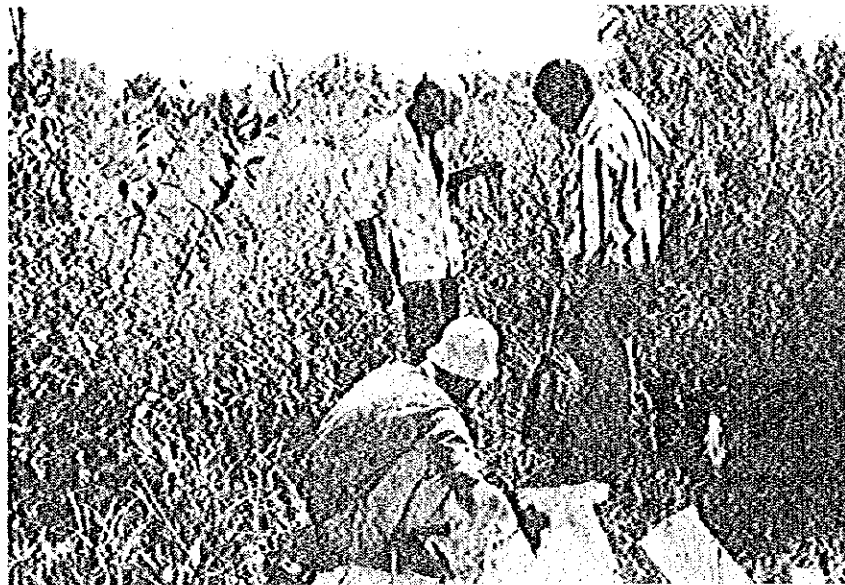
Landform survey south of Didima Bule (Map Sheet - Didima Bule)

Landform components are being observed using a hand auger.



Soil survey near Musumarini
(Map Sheet - Fundisa)

Soil profile at pit-32; listed
as red-coloured and sandy
ferric Luvisols.



Soil survey near Ramada (Map Sheet - Fundisa)

Soil boring under way with a hand auger; soil listed
as chromic Cambisols.



Geologic survey near Hoshingo Dikio
(Map Sheet - Daka-Wachu)

Outcrops of medium-size sandstones
from Triassic deposits. Strikes
dips are being measured.



Electric prospecting about 19km northeast of Lale Hills
(Map Sheet - Bisanmbala)

Apparent relative resistivity of earth is being measured
using an automobile battery as power source.

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- 2 - Minutes (October 1982)
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REPORT ON TOPOGRAPHIC MAPPING PROJECT IN EAST KENYA

(EIGHTH YEAR)

1. Outline

1 - 1 Outline of the Project

Starting in 1975, the Project accomplished the 1/50,000 scale topographic mapping of East Kenya by 1980 in its sixth year, and subsequently, as continuation of this base mapping, took on the three-year program (from the seventh year to the ninth year of the Project) to produce land use and other thematic maps for the same areas according to the Scope of Work agreed upon between Kenya and Japan in April 1981. The year just ended marked the second year of the program.

The areas to be covered by the land use and other thematic mapping encompass a total of approximately 14,700 km² (Tana River Delta Area - approx. 7,000 km² and Ranching Project Area - approx. 7,700 km²) (See Figure 1).

The final products from the Program are as follows.

Tana River Delta Area:

Thematic maps -

Vegetation and Present Land Use Map

... 1/50,000 (12 sheets)

Landform, Slope, and Drainage Map
 ... 1/50,000 (12 sheets)

Surface Geology and Soil Map
 ... 1/50,000 (12 sheets)

Land Use Capability Analysis Map
 ... Appropriate Scale (1-4 sheets)

Ranching Project Area:

Thematic maps -

Vegetation and Present Land Use Map
 ... 1/100,000 (4 sheets)

Landform and Drainage Map
 ... 1/100,000 (4 sheets)

Land Use Capability Analysis Map
 ... Appropriate Scale (1-4 sheets)

Final Report ... 1 set

LOCATION MAP
FOR
LAND USE MAPPING

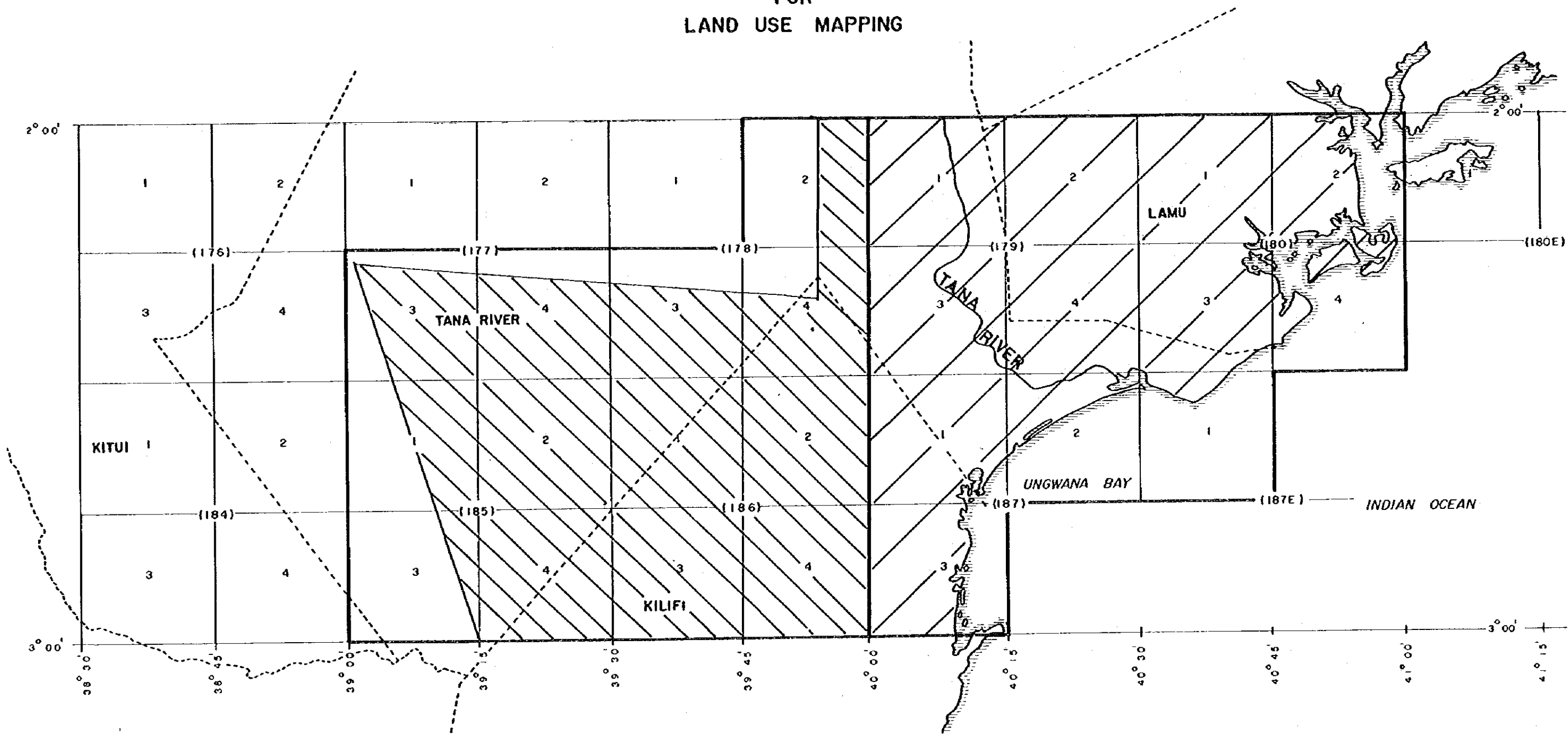




Fig. 1

-  TANA RIVER DELTA
-  RANCHING PROJECT AREA

1 - 2 Work Performed for This (Eighth) Year in Relation to the Program as a Whole

The work flow and schedule for the land use mapping and thematic mapping program are given in Figure 2. By this past fiscal year which marked the second year of the three-year program, the work stages have been covered as far as the preparation of compilation manuscripts of the respective thematic maps for the entire project areas.

Consultations were held with the Kenyan side to make decisions and agreements on matters related to the cartography and printing of the thematic maps and the preparation of the Land Use Capability Analysis Map prior to their implementation which is scheduled for the next year (the final year of the Project).

1 - 3 Outline of Work Performed during This Past Year

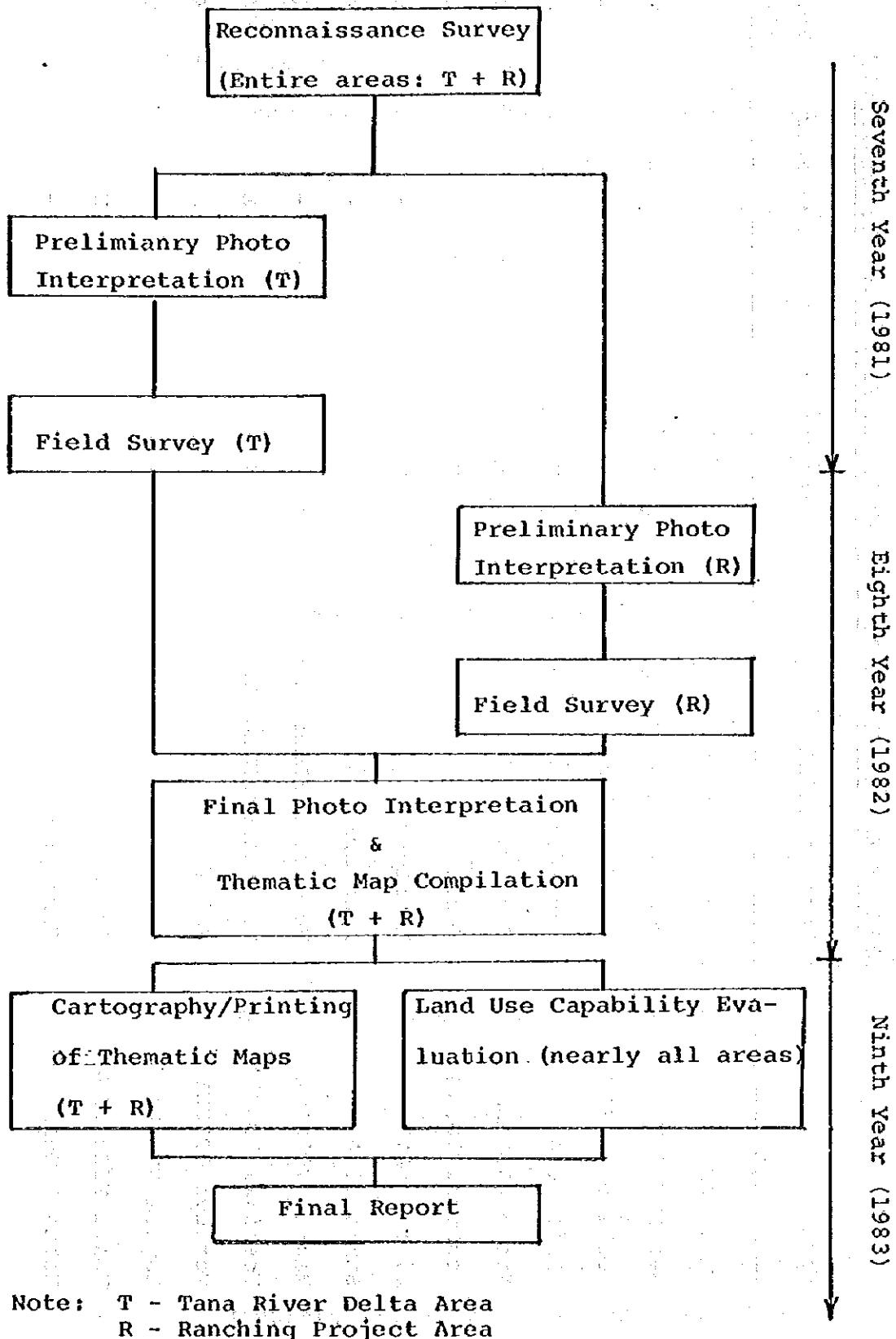
The work performed during this past year is summarized below.

1 - 3 - 1 Work Stages, Periods, and Volumes

	Period	Volume
(1) Preliminary photo interpretation (done in Japan)	June 25, 1982 to July 15, 1982	Ranching Project Area, approx. 7,700 km ²

- (2) Field identification July 16, 1982 to October 15, 1982 Mainly Ranching Project Area, approx. 7,700 km²
- (3) Final photo interpretation & thematic map compilation (done in Japan) October 16, 1982 to March 25, 1983 Entire project areas, approx. 14,700 km²
- (4) Supplementary survey and meetings January 28, 1983 to February 11, 1983

Fig. 2 : Work Flow and Schedule



1 - 3 - 2 Survey Team Members

LIST OF SURVEY TEAM MEMBERS AND THEIR FIELDS OF RESPONSIBILITY

Name	Responsibility	Field Survey	Supplementary Survey	Work in Japan
Eiji GOJO	Team Leader	X	X	-
Sei NAKAJIMA	Deputy Team Leader	X	X	X
Toshiyoshi SOH	Coordination	X	-	-
Akiji KOMA	Mechanic	X	-	-
Naoya UNOHARA	Geology	X	-	X
Toshiaki UDONO	Geology	X	-	X
Eiichi HAYAKAWA	Landform	X	-	X
Sumio IIDA	Landform	X	-	X
Makoto YOSHIDA	Vegetation/Land Use	X	-	X
Yoshiaki YOKOTA	Vegetation/Land Use	X	X	X
Tetsuya OTSUKI	Soils	X	X	X
Hayata KUSAKA	Soils	X	-	X
Tohru NISHIKAWA	Soils	X	X	X
Kohta INOHARA	Cartography	X	-	-

1 - 3 - 3 Field Inspection

(1) Field Surveys

Mr. Eisaku Tsurumi : Technical Adviser, Head of
First Geographic Division,
Geographic Department, GSI.

July 16, 1982 - August 6, 1982

Mr. Hiroshi Murakami : Development Survey First
Division, Social Development
Cooperation Department, JICA.

July 16, 1982 - August 6, 1982

Mr. Eisaku Tsurumi : Technical Adviser, Head of
First Geographic Division,
Geographic Division, GSI.

October 1, 1982 - October 15, 1982

Mr. Hideki Murayama : Development Survey First
Division, Social Development
Cooperation Department, JICA.

October 1, 1982 - October 15, 1982

(2) Meetings with Kenyan Side

Mr. Eisaku Tsurumi : Technical Adviser, Head of
First Geographic Division,
Geographic Department, GSI.

January 28, 1983 - February 11, 1983

Mr. Hideki Murayama : Development Survey First
Division, Social Development
Cooperation Division, JICA.

January 28, 1983 - February 11, 1983

1 - 3 - 4 Results of Work

The results of work performed for this fiscal year
are as follows.

(1) Compilation Manuscripts (compiled original maps)
of Thematic Maps

Tana River Delta Area:

Vegetation and Present Land Use Map	...	1/50,000	12 sheets
Landform, Slope and Drainage Map	...	1/50,000	12 sheets
Surface Geology and Soil Map	...	1/50,000	12 sheets

Ranching Project Area:

Vegetation and Present Land Use Map	...	1/100,000	4 sheets
Landform and Drainage Map	...	1/100,000	4 sheets

(2) Report on the Eighth Year Work of the Project

Attachment: "Records of Vegetation Sampling Survey,
Data Sheets of Soil Analysis and Soil
Profile, and Electric Prospecting"

Attachment: "Field Photo Album"

2. Preliminary Aerial Photo Interpretation

Prior to field surveys, in addition to the preliminary photo interpretation of the Ranching Project Area, morphometry of the Tana River Delta Area and drainage mapping of the entire project areas were made.

2 - 1 Study of Existing Documents and Data/Information

The documents and other existing data and information collected last year (seventh year) were studied to understand vegetation and present land use, landform, soils, geology, of the project areas.

2 - 2 Preliminary Photo Interpretation and Compilation of Interpretation Maps

On the basis of the findings of the field reconnaissance survey of the entire project areas, the field identification in the Tana River Delta Area, and study of existing documents, aerial photo interpretation was performed

with respect to vegetation and present land use, landform, soils, geology. The interpretation was made according to the legend items which were still under joint review as of February 1982.

Interpreted boundaries of vegetation and present land use, landform, and geology were plotted on aerial photos, and dropped onto the topographic maps to make the interpretation maps. Problems or questions raised in the course of interpretation and matters that required verification were noted on the interpretation maps as reminders for checking in the field. The soil interpretation map was made on the basis of the landform and geology boundaries.

2 - 3 Morphometry of the Tana River Delta Area

Of the Tana River Delta Area, morphometry was performed from the 1/50,000 scale topographic map. The area was uniformly divided into 500m x 500m grid cells on the map and the elevations of the cells represented by the values at the center of each cell were fed into a computer. Once input in the computer, they were automatically (by a computer program) converted into slopes for each grid cell. From the data base thus built, the slopes were output in terms of the following ranges to make the slope map.

0 - 2% (0° - 1.1°)
2 - 5% (1.1° - 2.9°)
5 - 8% (2.9° - 4.6°)
8 - 16% (4.6° - 9.1°)
16 - (9.1° -)

3. Field Survey

3 - 1 Preparation before Departure

Prior to the departure for the field, the following were made in preparation.

- (1) A summary of the work performed during the preceding year (the seventh year).
- (2) Draft specifications and schedules for this year and the following year.
- (3) Draft specifications for cartography and printing of thematic maps (colour design, sheet layout, etc.)
- (4) Draft specifications for land use capability analysis mapping.
- (5) Detailed action plans for field work.
- (6) Documentation for equipment procurement, packaging, shipping and customs clearance.

3 - 2 Summary Progress Records of Field Survey

<u>Year</u>	<u>Month</u>	<u>Day</u>	<u>Activities</u>
1982	Jul.	17	Mr. Tsurumi, Technical Adviser from GSI, Mr. Murakami of JICA, Team Leader, and an 8-member advance party arrived in Nairobi.
		20 to 26	Meetings with Kenyan officials of SK KSS.
		24	The later party (15 members) arrived in Nairobi. Air-lifted materials checked out.
		27 & 28	Mr. Murakami of JICA, Deputy Team Leader, team members, left for Malindi via Mombasa.
		27 to 29	Mr. Tsurumi, Team Leader, and one team member had a meeting with Kenyan officials.
		29 & 30	Mr. Tsurumi, Team Leader, and one team member left for Malindi via Mombasa. Base Camp was set up at Malindi.
Aug.		2 & 3	Mr. Tsurumi, Mr. Murakami, Team Leader, and one team member left for Nairobi via Mombasa (on their way back to Japan).

Aug.	4	Sub-camp was set up at Galana and
	to	field surveys conducted from it
Sep.	7	(mainly, vegetation, landform, and
		geology group). Field survey (soil
		group) working out from Malindi Base
		Camp.
Sep.	8	Field surveys on vegetation, lanform,
	to	soils, geology, working out from
	21	Malindi Base Camp.
	22	Sorting of collected data and demo-
	to	bilization of Base Camp. (Team Leader
	27	arrived in Nairobi, Sep. 25.)
	28	Deputy Team Leader and team members
	&	
	29	left for Nairobi via Mombasa.
Sep.	28	Meetings with Kenyan officials.
	to	(Messrs. Tsurumi and Murakami arrived
Oct.	5	in Nairobi Oct. 2)
	6	First party of 5 team members left
		Nairobi for return to Japan via London.
	6	Meetings with Kenyan officials. Signing
	to	of the Minutes.
	12	
	13	Messrs. Tsurumi and Murakami, Team
		Leader and 7 team members left Nairobi
		for return to Japan via London.

3 - 3 Preparation in Kenya

The advance of eight team members after their arrival on July 17 performed the following for preparation in Nairobi.

- (1) Meetings with Kenyan officials for arrangements.
- (2) Customs clearance and checking out (July 26) of equipment and materials air-lifted from Japan.
- (3) Check-up of vehicles provided by the SK.
- (4) 3 vehicles (Range Rovers) rented from a car rental company as originally planned.
- (5) Acquisition of additional meteorological data in need.

3 - 4 Meetings with Kenyan officials (at the outset of field survey)

At the outset of field surveys, meetings were held with the Kenyan side on five occasions of the 20th, 21st, 26th, 28th, and 29th days of July. The places and the attendants of the meetings were as listed in the Minutes annexed to this report. At these meetings, field survey schedules and methods, cooperations to be provided by the Kenyan side, colour design and sheet layout, scope and criteria, were discussed and agreed upon. The minutes of these meetings prepared for the respective meetings were

summarily edited by the Japanese side for signing by both parties scheduled originally for August 2 - 3 but postponed to early October when the survey work would end. (See Appendix 1 - The Minutes.)

3 - 5 Field Survey

3 - 5 - 1 General

(1) Survey Headquarters (Base Camp)

The Base Camp was set up at the Malindi Chalets in the northern part of urban Malindi located at the same place as in the previous year. The adjoining premise was leased with permission of the police for storage of camping goods and equipment as well as for parking. During July 29 - 30, a pit for maintenance and repairs of vehicles, a tent for supplies storage, and aerials for the wireless were set up as base camp facilities. After the completion of the field surveys, the camping goods and equipment and survey equipment were stored in the warehouse in Mombasa on September 22 to 27 and the base camp was demobilized on September 28.

(2) Sub-camp

A sub-camp was continuously maintained at a location close to the Galana Ranch management office on the

left bank of the Galana River from August 4 to September 7, equipped with such facilities as aerials for wireless, storages, washrooms, parking space. Gasoline and foods, which were not available at the sub-camp, were supplied from Malindi by truck every two or three days. Drinking water was made available at the Galana Ranch office in as much as needed.

(3) Vehicles and Drivers

From the start of the survey, a full fleet of 4 Mitsubishi Jeeps (owned by JICA), 3 Range Rovers (rental), and 1 Isuzu truck (owned by SK) were operational. The Mitsubishi Jeeps and the Isuzu truck were well maintained by regular check-ups. Most of the break-downs experienced with these vehicles were flat tires, some of which had to be replaced. Other breakdowns involved the undergurd, parking brakes, and the shock absorber but they were few in number.

On the other hand, the commercially rented Range Rovers were superannuated and most trouble-prone, which was aggravated by limited supply of replacement parts. Most frequently experienced were flat tires. Other troubles involved shock absorbers, gear box,

door lock, speedometer, and leaks in the fuel tank.

On every survey trip into the field, emergency supplies of food, drinking water, gasoline, tires, were taken along. It was fortunate enough to have experienced no major accidents or mechanical troubles.

Five drivers were assigned by the SK to work for the survey team. Their overtime work was paid for by the Japanese side according to the provisions of SK.

(4) Equipment

The equipment air-lifted from Japan arrived in Nairobi on July 26 to be transported to the base camp at Malindi on July 28.

(5) Counterparts

As Kenyan counterparts, two specialists from SK (Messrs. J.K. Katunga and C. Mwangi) joined the Japanese to stay with them for the entire survey period from July 27 to September 29.

(6) Game Guard

At the request of the survey team to the Game Office of Malindi, a game guard was dispatched to ensure the safety of the field work. Due to his scheduling,

he could not stay with the team for the entire period but he accompanied the team for a total of 62 man-days with 24 days in August and 7 days in September.

(7) Labourers

Twelve labourers were locally hired to help field work such as pit making, auger boring, electric prospecting, and camp setting and demobilization for a duration of approximately two months.

(8) Weather Conditions

The weather was good throughout the survey period with no rainfall but it was extremely hot every day, the heat reaching well over 30° C. For safety precautions, therefore, the team tried to make it a rule to leave for field early in the morning and come back to the sub-camp early in the afternoon.

(9) Major Tools and Equipment

<u>Item</u>	<u>Number of Units</u>
Hammer	8
Clinometer	8
Binocular	5
Camera	5
Reflecting Stereo Scope	1
Earth Resistivity Measuring Machine	1

Drier for Soil Sample	1
Down Transformer	1
Hand Auger	4
Earth Auger	2
Soil Hardness Meter	4
PH Meter	2
EC Meter	2
Water Purifier	1
Balance	2
Shovels	4
Soil Colour Chart	6
Desicator	2
Blumeleiss	2
Diameter Gauge	2

3 - 5 - 2 Execution of Surveys

Vegetation and present land use, landform, and geology were studied through field observation and examination by auger boring mainly working out from Galana Camp. Out of Malindi Base Camp, soils were studied in the southern part of the Tana River Delta Area (Fundisa).

For vegetation, sampling survey was conducted following the listing format of KSS as for the previous year. 69 sampling points were selected on the basis of photo interpretation maps prepared

in Japan. Villages, cultivated land, and various types of facilities were also surveyed.

Landform was observed for macro-, mesa-, and micro-relief and examined by auger boring at 74 locations, and photo interpretations were checked against these results.

Soils were listed according to the KSS formula. Pits were made at 10 location points and auger boring at 120. Each pit was dug to a depth of 1.5m and auger boring to 2.0m for observations of texture, colour, depth, and other properties of soils, which then were listed. Three samplings were acquired from each pit totalling 30 samplings.

Geology was studied not only by observation of outcrops but also by means of auger boring (at 65 points) to define the geologic composition and history of the survey area. In addition, electrical prospecting was conducted at 20 locations mainly in the northern part of the Ranching Project Area.

In the course of the above surveys, assistance was provided by the Kenyan counterparts in such areas: as origins and detailed classification of landform,

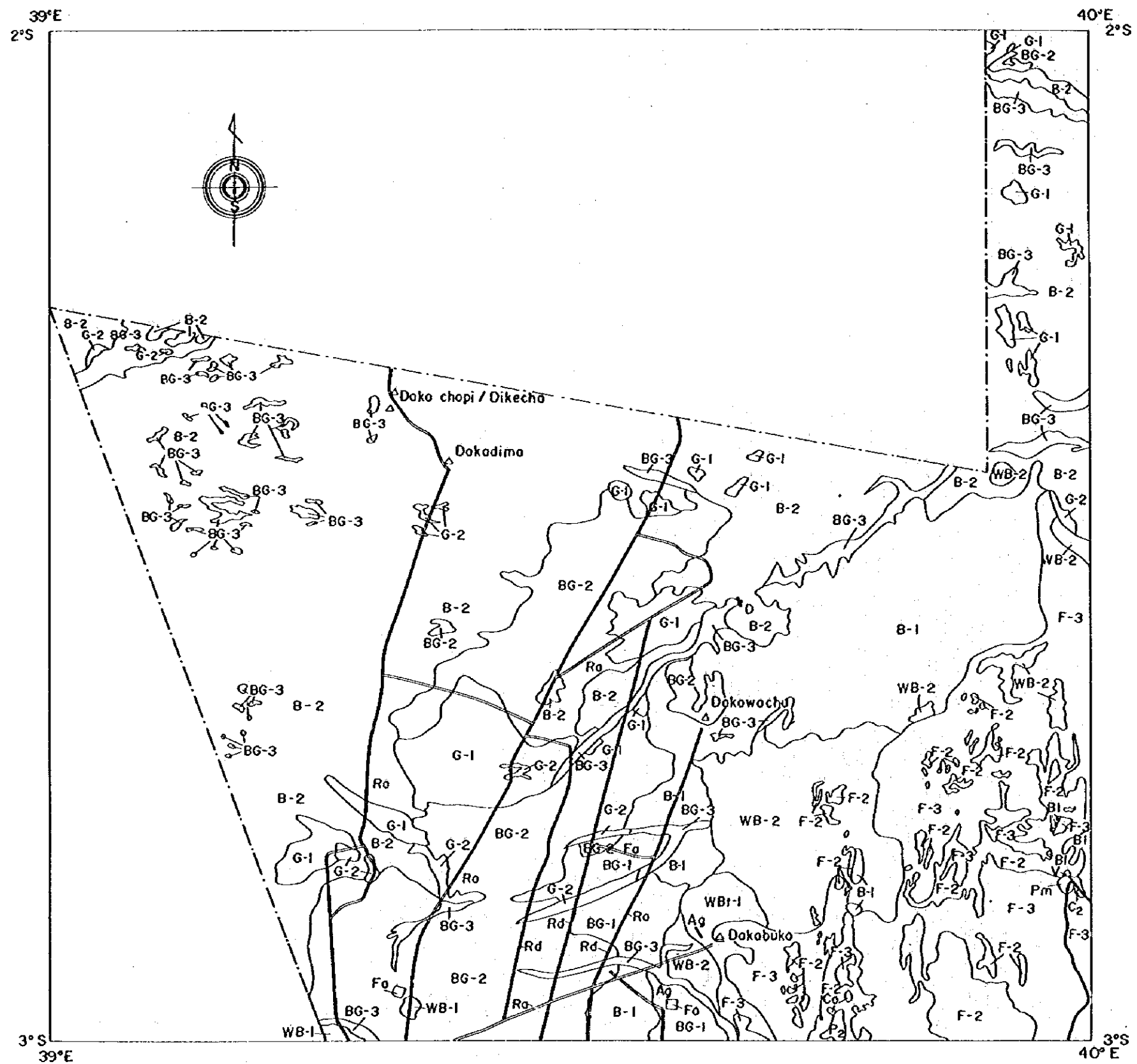
identification of vegetation, hearings from local residents.

3 - 5 - 3 Results of Field Surveys

Field surveys were conducted for about two months from July 27 to September 29 covering the Ranching Project Area and the Fundisa area in the southern part of the Tana River Delta Area. Findings of the field surveys were compiled into small scale schematic maps as shown in Figures 3 - 6.

The legend items for the respective thematic maps, also in view of the above results, were modified in the field and later presented at a meeting with the Kenyan side held in October.

In the following, vegetation and present land use, landform classification, surface geology of the Ranching Project Area and soils of the southern part of the Tana River Delta Area (Fundisa) are described according to these schematic maps.



Legend

- F-2 Forest (2)
- F-3 Forest (3)
- WBt-1 Wooded Bushland thicket (1)
- WB-1 Wooded Bushland (1)
- WB-2 Wooded Bushland (2)
- B-1 Bushland (1)
- B-2 Bushland (2)
- BG-1 Bushed Grassland (1)
- BG-2 Bushed Grassland (2)
- BG-3 Bushed Grassland (3)
- G-1 Grassland (1)
- G-2 Grassland (2)
- Cr Cropland
- C₂ Cropland (mixed cropland and grazing area)
- Pm Plantation (Cashew nut and Mango)
- P₂ Plantation (other)
- Fa Farm (cattle enclosure)
- V Village
- Ag Air strip (Ag: Grass surface)
- Ro, Rd Motorable road (Ro: All weather road, Rd: Dry weather road)
- BI Barren land
- D / Dam

Scale 1:500,000

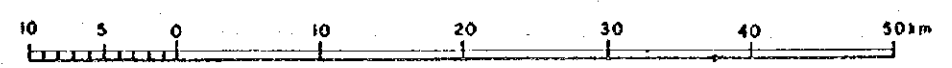
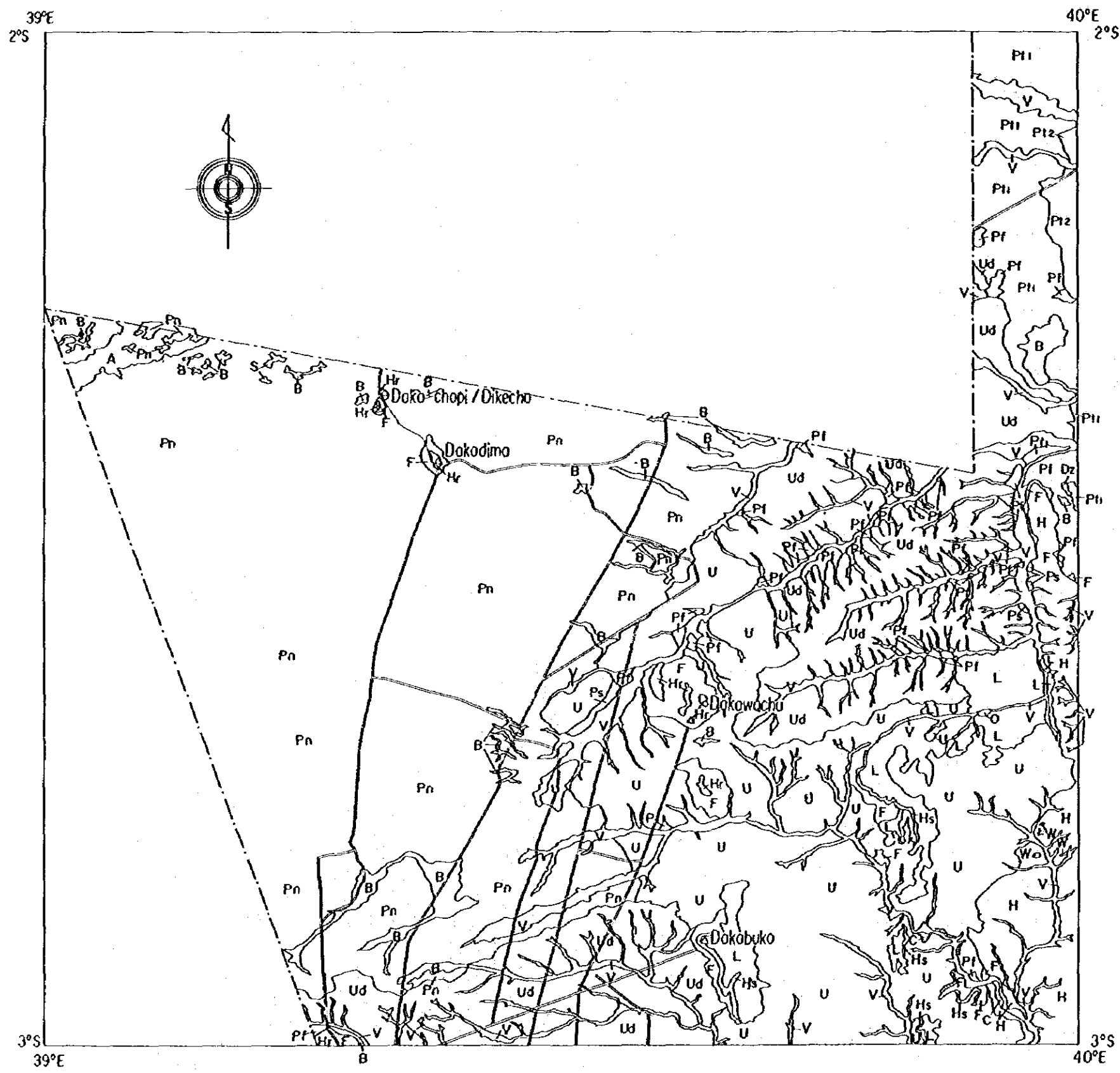


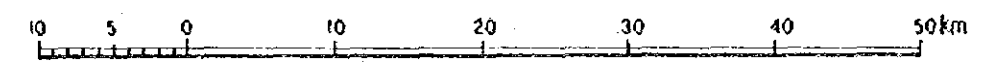
Fig. 3 Schematic map of vegetation/present land use

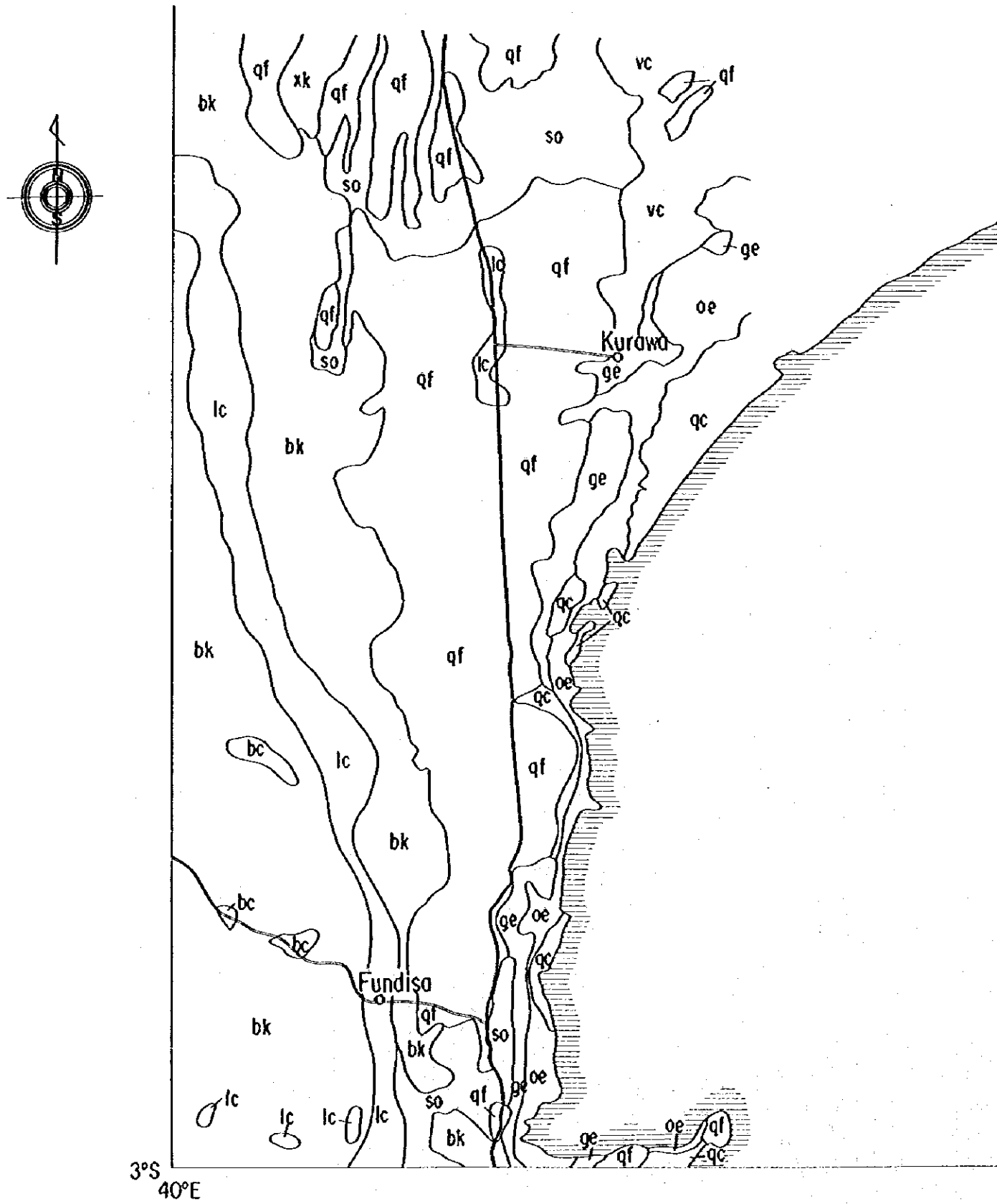


Legend

- | | | |
|---------------|---------|----------------------------------|
| Hills | [H] | Hills |
| | [Hr] | Residual hills |
| | [Hs] | Minor scarps |
| Foot slopes | [F] | Foot slopes |
| | [C] | Talus (Scree) slopes |
| Plateaus | [L] | Plateaus |
| Uplands | [U] | Uplands |
| | [Ud] | Dissected peneplains |
| Plains | [Pn] | Peneplains |
| | [Ps] | Sedimentary plains |
| | [Pt1] | Higher terraces |
| | [Pt2] | Middle terraces |
| | [Pf] | Younger fans |
| | [A] | Flood plains |
| | [V] | Volley bottom lowlands |
| Bottom lands | [Dz] | Old dunes and old coastal ridges |
| | [B] | Bottom lands |
| Miscellaneous | [S] | Swamps |
| | [O] | Pans and ponds |
| | [W] | Bad lands |
| | [/] | Cliff |

Fig. 4 Schematic map of Landform





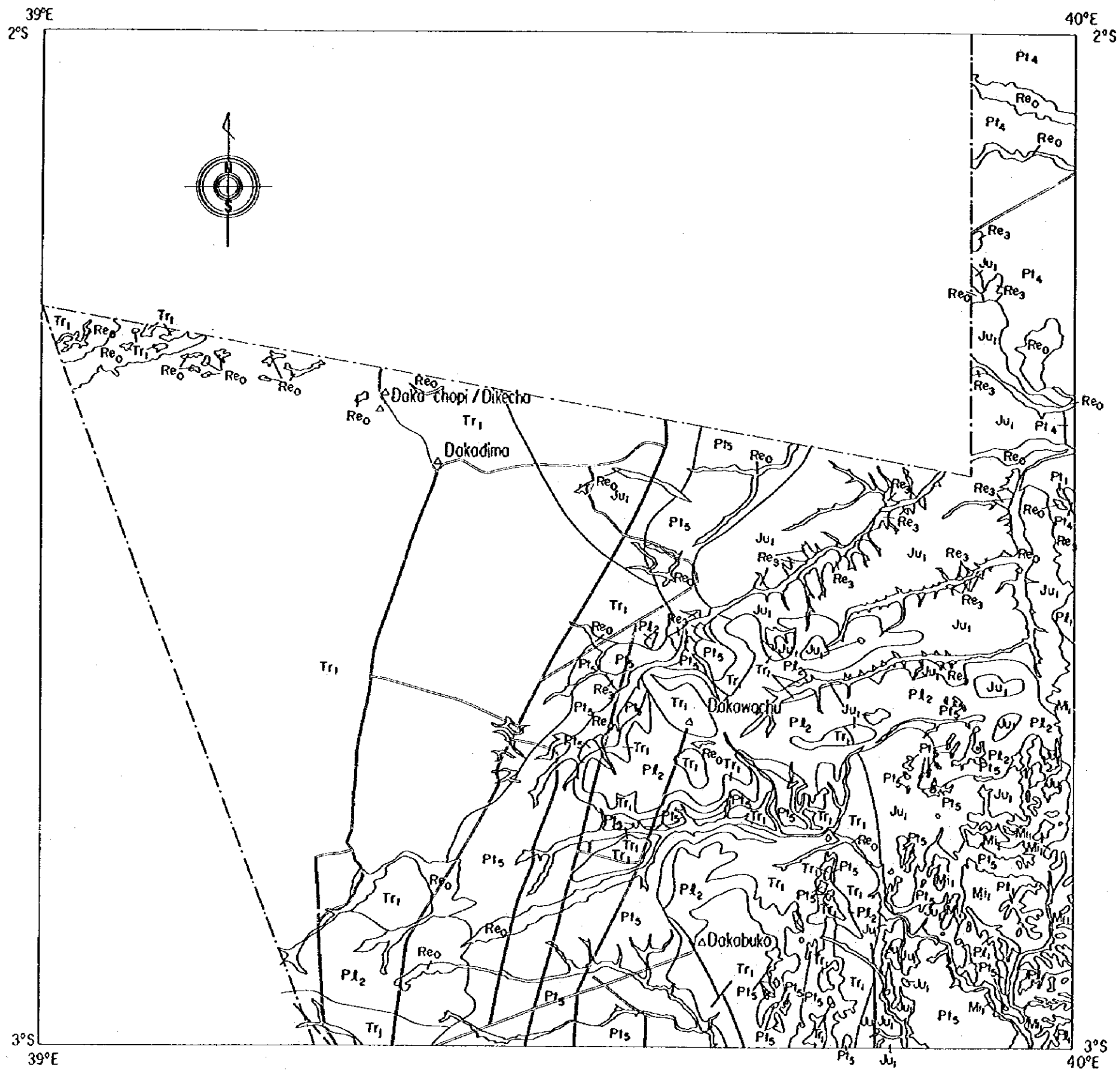
LEGEND

- | | |
|----|--------------------|
| oe | eutric Histosols |
| ge | eutric Gleysols |
| vc | chromic Vertisols |
| qf | ferralic Arenosols |
| qc | cambic Arenosols |
| lc | chromic Luvisols |
| so | orthic Solonetz |
| bk | calcic Cambisols |
| bc | chromic Cambisols |
| xk | calcic Xerosols |

Scale 1: 250,000



Fig. 5 Schematic map of Soil (Fundisa area)



Legend

- | | | | |
|------------|-------------|-----------------|-----------------------------|
| Quaternary | Recent | Re ₀ | Alluvial deposits |
| | | Re ₃ | Fan deposits |
| | Pleistocene | Pt ₁ | Old dune sands |
| | | Pt ₄ | Lagoonal sands and clays |
| | | Pt ₅ | Pleistocene river sediments |
| Tertiary | Pliocene | Pl ₁ | Pliocene marine sediments |
| | | Pl ₂ | Pliocene river sediments |
| | Miocene | Mi ₁ | Miocene sediments |
| Jurassic | | Ju ₁ | Jurassic sediments |
| Triassic | | Tr ₁ | Triassic sediments |
| | | / | Fault |

Scale 1: 500,000

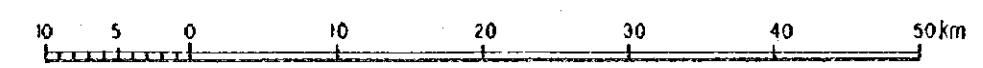


Fig. 6 Schematic map of Geology

(1) Vegetation and Present Land Use (Ranching Project Area)

As a result of the field surveys, seven new items were added to the legend which had been decided in the previous year for the Tana River Delta Area.

(Table 1). Vegetation and present land use of this survey area is briefly described below according to Figure 3.

a. Forest

Forest refers to an area of trees sighted as having a height of over 10m and crown density of more than 20%. In the Ranching Project Area, two types of Forest are observed, i.e., F-2 and F-3.

F-2 is a forest characterized by *Brachystegia spiciformis*, a plant of the bean family, and distributed sporadically over the Fundisa Hills.

F-3, characterized by *Diospyros cornii*, covers most of the Fundisa Hills.

b. Woodland

Woodland refers to shrubs with a height of less than 10m and crown density of over 20% occurring

among trees of more than 10m in height and 5 - 20% in crown density. Three types of Woodland are observed in this area, i.e., Wbt-1, WB-1, and WB-2.

Wbt-1 is higher in thicket (shrubs of less than 6m in height) density compared with WB-1 and WB-2, and distributed over the western slopes of the Daka-Buko Hills.

WB-1 occurs in areas near the Lale Hills on the southwestern end. WB-2 corresponds to the secondary forest of F-3 as characterized by *Diospyros cornii*, and occurs in the western part of the Fundisa Hills.

c. Bushland

Bushland refers to an area of trees taller than 10m dominated by shrubs of less than 10m in height and less than 5% in crown density. They are further divided into shrubs of less than 10m in height and over 20% in crown density as Bush and those with a crown density of 5 - 20% and grass coverage in excess of 20% as Bushed grassland. There are five types of B-1, B-2, BG-1, BG-2, and BG-3 observed in this survey area.

B-1 is distributed to surround the western side of the Fundisa Hill. In B-1, compared with B-2, shrubs are more dense and dominant species are different.

B-2 is distributed widely in the northern part of this area. This is a type of vegetation that occurs commonly over wide areas extending to Wema and Garsen in the Tana River Delta Area.

BG-1 is where shrubs are reduced artificially to make way for more grasses and B-1 type vegetation for grazing and its dominant species are similar to B-1.

BG-2, by the same token, is where B-2 vegetation was artificially cleared for grazing and dominant species are similar to B-2.

BG-3 is a type that has *Acacia zanzibarica* *Sporobolus helvolus* as a dominant species and occurs in areas where water collects during the rainy season.

d. Grassland

Grassland refers to an area of trees taller than 10m and crown density of less than 5%, with shrubs of less than 10m in height accounting for less than 5% and grassland more than 20%. G-1 and G-2 are observed in this area.

G-1 occurs in the central part of this area. Like BG-1 and BG-2, it is a grassland where shrubs were artificially burned out to make way for grasses.

G-2 is a grassland that has resulted from floods during the rainy season preventing the growth of shrubs.

e. Cultivated land

Cultivated land includes Cropland and Plantation. In this area, there are distributions of C_0 , C_2 , P_m and P_2 .

C_0 occurs in the south of the Fundisa Hills near Hadu, where corn, cotton, sesame, cassava, etc. are grown, whereas C_2 is a C_0 mixed with grazing land.

P_m is plantation of cashew nuts and mangos combined, and distributed in the southern part of the Fundisa Hills.

P_2 refers to plantations not well kept or those where vegetation types are irregular.

f. Farmland

Farmland refers to areas where cattle is raised in the stacked ground equipped with cattle barns and water supply facilities.

g. Others

As others, this survey area includes V, Ag, Ra, Rd, P, Bl, and D.

V represents groups of dwellings in Hadu.

Ag refers to grass-covered air-strips scatteredly seen in this area.

Ra are roads that are passable even during the rainy season whereas Rd become impassable.

P refers to pans and ponds distributed in this area.

Bl is bare land with no growth of vegetation distributed in the Fundisa Hills.

D refers to small dams that scatteredly exist in this area.

Table 1 : Vegetation and Present Land Use Legend Items (Ranching Project Area)

Division	Subdivision	Symbol	Land Use	New Items
Forest	Forest (2)	F-2	Timber Production	
	Forest (3)	F-3	Wildlife grazing, charcoal production	o
Woodland	Wooded bushland thicket (1)	WBT-1	Wildlife grazing	o
	Wooded bushland (1)	WB-1	Wildlife grazing	o
Bushland	Wooded bushland (2)	WB-2	Wildlife grazing	
	Bushland (1)	B-1	Livestock grazing, Wildlife grazing	o
	Bushland (2)	B-2	Livestock grazing, Wildlife grazing	
	Bushed grassland (1)	BG-1	Ranching area	o
	Bushed grassland (2)	BG-2	Ranching area	
	Bushed grassland (3)	BG-3	Livestock grazing,	
Grassland	Grassland (1)	G-1	Ranching Area	o
	Grassland (2)	G-2	Livestock grazing, Wildlife grazing	
Cultivated land	Cropland	Co		
	Cropland (Mixed cropland and grazing area)	C2		
Farmland Others	Plantation	Pm		
	Plantation (other)	P2		
	Farm	Fa		
	Village	V		
	Airstrip	Ag		
	Motorable road	Ra, Rd		
	Pan and pond	P		
	Barren land	Bl		
	Dam	D		o

Note: o indicates a newly added item.

(2) Landform Classification (Ranching Project Area)

There was no addition to the legend items resulting from the field surveys (Table 2). Landform of this survey area is briefly described below according to Figure 4.

a. Hills

Hills consist of H, Hr, and Hs.

H refers to the Fundisa Hills which are dissected by dendritic drainage. But there remain two tiers of flat areas at the top of the hills.

Hr refers to the Lale Hills in the southwestern end of the area, the Daka-Dima Hills in the northwest, Daka-Wachu, Hashingo in the central part, with relative heights of 20 - 120m.

Hs refers to the steep cliffs bordering on the edges of plateaus in Daka-Buko and so on.

b. Footslopes

Footslopes consist of F and C.

F is distributed substantially at the foot of steep cliffs in Daka-Buko in the neighborhood of Hr, and at the foot of steep cliffs rising

at the narrowed parts of the Gandi River (south-east of the survey area).

C is smaller in scale and distributed along small rivers and stream in the Fundisa Hills.

c. Plateaus

Plateaus are distributed in Daka-Buko and north-east of the Gandi River and usually bounded by steep cliffs on both ends. They have flat lands gently sloping towards northeast. At a close look, however, they have undulating surfaces moving into V.

d. Uplands

Uplands consist of V and Vd.

V occurs widely in surrounding areas of Daka-Wachu extending to the Gandi River. Land surfaces are marked with micro-relief and undulations rising to a relative height of tens of meters at a cycle of 1 - 2km.

Vd is found commonly in areas about the Lale Hills to Daka-Buko and further to the Mukale area.

Land surfaces assume undulations rising at a cycle of 4 - 5km.

e. Plains

Plains are divided into Erosional plains and Sedimentary plains as two major types.

[Erosional plains]

These are of one type, i.e., Pn.

Pn is distributed widely in the western half of this area. Land surfaces are flat or gently undulating. Except for the undulated areas around Hr in Daka-Dima, it is simple in appearance.

[Sedimentary plains]

This is divided into Ps, Pt, Pt2, Pf, A, V, and Dz.

Ps is distributed along the Adadi River running northeast in the central part of the area and areas on the right bank of downstream Buna River to the east which merges into the Adadi River.

Land surfaces are flat or gently undulating.

Pt is distributed downstream of the Adadi River and the Buna River after the two rivers merged together in the northeast at the Ida-Sa-Godana Ranch and the Giritu Ranch. Land surface is flat.

Pt2 is found on the downstream of small rivers of the Giritu Ranch. Land surface is very flat. Major distributions of Pf are found at the confluences of small rivers of the Fundisa Hills and to the east of the Hills. Land surfaces are nearly flat except for those of downstream Gandi and Buna.

A is observed only along the Kokani River in the northwest. Land surface is marked with micro-relief with well developed sink holes and cracks of 5 - 10cm in width and 45 - 50cm in depth.

V is distributed along the Gandi River, the Adadi River and the Buna River.

Dz is found downstream of the confluences of the Adadi and the Buna.

f. Bottom land

Bottom land is distributed in the north of the Lale Hills, around Pn and inside of Pt, as basin-like lowland. There are well-developed cracks in the land surface. Sink holes and gilgai micro-relief are also observed.

g. Miscellaneous

Miscellaneous includes S, O, W, and Cliff.

S is distributed on a small scale inside of Pn.

It was formed by braided channels of the Kokani River.

O occurs inside of V, Vd, and H.

W occurs in the Fudisa Hills with numerous gullies developed to turn it into bare land.

Cliff occurs downstream of the Gandi River.

Table 2 : Landform Legend Items (Ranching Project Area)

Macro ~ Meso relief	Landform type	Symbol		
Hills	Hills	H		
	Pesidual hills	Hr		
	Minor scarps	Hs		
Footslopes	Foot slopes	F		
	Talus (Scree) slopes	C		
Plateaus	Plateaus	L		
Uplands	Uplands	U		
	Dissected peneplains	Ud		
Plains	Erosional Plains	Peneplains	Pn	
	Sedimentary Plains	Sedimentary plains	Ps	
		Terraces	Higher Terraces	Pt ₁
			Middle Terraces	Pt ₂
		River Al-luvial plains	Younger fans	Pf
			Flood plains	A
			Valley bottom lowlands	V
		Coastal plains	Old dunes and old coastal ridges	Dz
		Bottom lands	Bottom lands	B
	Miscellaneous	Swamps	S	
Pans and ponds		O		
Bad lands		W		
Cliff				

(3) Soils (Southern Part of the Tana River Delta Area)

As a result of the field surveys, 11 new items at the sub-division level were added, but there was no change in the main soil division, in the legend that had been decided after the previous year's survey. (Table 3)

Soils of this area are described below according to Figure 5.

a. eutric Histosols (oe)

Organic in property and having a thick humic horizon, eutric Histosols appears mainly in Kurawa area running in the north-south direction almost in parallel with the coastline.

b. eutric Gleysols (ge)

Eutric Gleysols usually appears in areas with high ground water levels. It is distributed mainly on the inland side of oe.

c. chromic Vertisols (vc)

High in clay contents, this type of soils are distributed from Kurawa to the north along the Tana River.

d. ferralic Arenosols (qf)

ferralic Arenosols has coarse grains and look reddish due to high contents of iron oxide.

It is widely distributed in the lower terraces and the old sand dunes to the west of Kurawa.

e. cambic Arenosols (qc)

Consisting of coarse quartz sands, cambic Arenosols appears in the sand dunes on the coast of Kurawa.

f. chromic Luvisols (lc)

This type of soils was formed by clay concentration in the B horizon. It is distributed to surround the Fundisa Hills.

g. orthic Solonetz (so)

Formed by sodium concentration in the B horizon, this type of soils is distributed in the terraces to the north of Kurawa.

h. calcic Cambisols (bk)

Rich in calcium, this type is widely distributed over the Fundisa Hills and the fans.

i. chromic Cambisols (bc)

Characterized by deep colours of brown or red, chromic Cambisols appear in spots over the top of the Fundisa Hills.

j. calcic Xerosols (xk)

Xerosols usually appears in semi-arid areas.

Containing calcium concentrations, calcic Xerosols is distributed south of Garsen.

Table 3 : Soils Legend Items (southern part of Tana
River Delta Area)

Group of Major Soils	Subdivions	Symbol
Histosols	eutric Histosols	oe
Gleysols	eutric Gleysols	ge
Vertisols	chromic Vertisols	vc
Arenosols	ferralic Arenosols	qf
	cambic Arenosols	qc
Luvisols	chromic Luvisols	lc
Solonetz	orthic Solonetz	so
Cambisols	calcic Cambisols	bk
	chromic Cambisols	bc
Xerosols	calcic Xerosols	xk

(4) Geology (Ranching Project Area)

As a result of the field survey, 4 new items were added to the legend that had been prepared in the previous year for the Tana River Delta Area. (Table 4) Geology of this area is described below according to Figure 6.

Table 4: Geology Legend Items
(Ranching Project Area)

Geological age		Symbol	Lithology	New item
Cainozoic	Quaternary	Re ₀	Alluvial deposits: Silts, sands, clays	
		Re ₃	Fan deposits: Clays, sands and gravels	
	Pleistocene	Pt ₁	Old sand dunes: sands	
		Pt ₄	Lagoonal sands and clays	
		Pt ₅	Sandy clays, sands, gravels	X
	Tertiary	Pliocene	Pl ₁ Pl ₂	Sandy clays Silty gravels
Miocene		Mi ₁	Limestones, calcareous sandstones	
Mesozoic	Jurassic	Ju ₁	Calcareous sandstones, conglomerates	X
	Triassic	Tr ₁	Medium sandstones, shales, conglomerates	X

Note: X indicates a new item added to those decided for the Tana River Delta Area in the previous year.

a. Tr₁

With light yellow medium-size grain sandstones as a major component, this is comprised also by dark grey - reddish brown shales and grey - reddish brown conglomerates. It is widely distributed from the central part over to the western half of this area. Areas such as the Lale Hills, Daka-Dima, Daka-Wachu are entirely of Tr₁.

b. Ju₁

Composed mainly of calcareous sandstones and conglomerates, this is widely distributed in the hills of the eastern half of this area.

c. Mi₁

This is composed mainly of limestones containing large amounts of fossils of sea shells and foraminiferas, accompanied by calcareous sandstones. Mi₁ is distributed along the Fundisa Hills running in the north-south direction.

d. P1₂

Consisting of grey silty gravels, this is distributed north of the Lale Hills and in the hills of the eastern half of the area. From its facies, P1₂ is alluvial.

e. Pl₁

Consisting of dark brown - dark olive grey sandy clays, this is distributed along the Fundisa Hills running in the north-south direction. From its facies, Pl₁ is marine.

f. Pt₄

Consisting of dark grey - dark brown lagoonal sands and clays, this is distributed north of the Fundisa Hills only.

g. Pt₅

This consists of dark grey sandy clays and reddish brown sands as main components accompanied by pebble bed. Pt₅ occurs in areas at the foot of the Lale Hills, fanning out to east. From its facies, it is alluvial deposits.

h. Pt₁

This is comprised by reddish brown - yellow grey brown old sand dunes. It appears only as micro-relief at one location of the Fundisa Hills.

i. Re₃

This consists mainly of dark brown sandy clays accompanied by gravels, distributed in spots in areas at the foot of the hills in the eastern half of this area. It is considered formed as fan deposits.

j. Re₀

This is a formation of alluvial deposits composed of dark grey sandy silts and clays. It is distributed in river valleys and lowland. Along the Kokani River on the northwestern end in particular are observed deposits of dark grey clays.

3 - 6 Meeting with Kenyan Side (upon conclusion of field surveys)

A meeting was held with the Kenyan side on October 5 upon conclusion of the field surveys. The place and the names of those present at the meeting were as shown in the minutes attached as Appendix 2. Prior to this meeting, preliminary contacts were made between Sk and KSS during the period of September 28 - October 4.

At this meeting, legend items and colour designs for the respective thematic maps were generally determined and sheet layouts were decided upon in their framework. Their details were to be studied by the Japanese side and proposed, together with criteria for land use capability evaluation and compilation manuscripts of thematic maps, at the next meeting scheduled for February. (See Appendix 2 - Minutes)

3 - 7 Supplementary Information/Data Collection

After the field surveys were finished, supplementary information/data were collected. The list of collected information is given in Table 5. (It includes partly those collected in February 1983.)

Table 5 : List of Collected Information/Data

No.	Description	Format	Size	Page	Original (O) or Copied (C)	Volume	Publisher/ Supplier	Purchase (P) or Donation (D)
1	Meteorological data recorded at agricultural hydrological and synoptic stations in Kenya during the year 1972	book		130	O	1	Meteorological Department	P
2	Summary of rainfall Part I	"		52	C	1	"	D
3	"	"		56	C	1	"	D
4	"	"		66	C	1	"	D
5	"	"		54	C	1	"	D
6	"	"		50	O	1	"	D
7	Summary of rainfall in East Africa	"		59	C	1	"	D
8	"	"		51	C	1	"	D
9	"	"		48	C	1	"	D
10	Summary of rainfall in Kenya and Seychelles Part I	"		42	C	1	"	D
11	"	"		41	C	1	"	D
12	Summary of rainfall in Kenya Part I	"		39	C	1	"	D
13	"	"		37	O	1	"	P
14	"	"		42	O	1	"	P
15	East African crops	"		252	O	1	FAO Text Book Centre	P
16	The wild flowers of Kenya	"		160	O	1	"	P
17	People and culture of Kenya	"	A4	167	O	1	"	P
18	Forest resources of tropical Africa	"		108	O	1	"	P
19	Reconnaissance vegetation map of the Mtito Andii Area	Map					Kenya Soil Survey Regional remote sensing facility	P
20	Landsat imagery (colour)	Photo		2	O	1	"	P
21	"	"		4	O	1	"	P
22	"	"		1	O	1	"	P
23	Proposed criteria for land use suitability classification for irrigation	Book	A4	6	C	1	Kenya Soil Survey	D
24	Some aspects of soil map compilation and correlation	"		28	C	1	"	D

4. Final Photo Interpretation and Thematic Map Compilation

After return to Japan having concluded the field surveys, the survey team performed the following.

(1) Sorted field records into field notes, field photos, vegetation sampling survey records, soils profile survey records, electric prospecting records, aerial photos, and photo interpretation maps.

(2) Conducted analyses of soil samplings acquired in the field.

(3) Based on the above data, conducted final photo interpretation and compiled the vegetation and present land use map, the landform classification map, the soils map, and the geology map. In this connection, the following were noted.

Vegetation and present land use mapping at the stage of preliminary photo interpretation was based on physiognomical classification whereas after compilation it was made into the one based on further detailed dominant vegetation species.

With respect to the landform classification map, there were no major changes made in preliminary interpretations

at the compilation stage except for some slight changes in distributions of Vd, Pn, and L.

In the soils map, there were little changes in classification boundaries resulting from compilation. As for the geology map, however, the boundaries of Tr_1 and Ju_1 changed substantially from the preliminary interpretations as a result of the compilation.

- (4) Finalized these compiled maps as well as the drainage map and the slope map that were produced separately, as follows.

Tana River Delta Area:

Vegetation and Present Land Use Map	1/50,000	12 sheets
Landform, Slope, and Drainage Map	1/50,000	12 sheets
Surface Geology and Soil Map	1/50,000	12 sheets

Ranching Project Area:

Vegetation and Present Land Use Map	1/100,000	4 sheets
Landform Classification and Drainage Map	1/100,000	4 sheets

- (5) Produced the Report on the Eighth Year Work including Attachments.

5. Supplementary Survey and Meetings

It was necessary at this time before proceeding to the next year's work to decide on map specifications, legend items, colour designs, sheet layouts, etc. for the respective thematic maps and policy for land use capability analysis criteria. Contacts had been made with the Kenyan side in a series of meetings discuss these subjects while the field surveys were under way. And a mission was sent from Japan to meet with the Kenyan side to finalize them.

5 - 1 Preparation before Departure

(1) Map Specifications for Thematic Maps

The items, concerning map specifications for the thematic maps, that had been left undecided for further consideration at the meeting of October 1982 with the Kenyan side were reviewed and finalized for approved.

a. Legend Items

Two or three modifications in soil names were made as a result of the soil sampling analysis. There was no other change made in the legend items.

b. Colour Design

In regard to the Vegetation and Present Land Use Map, the number of plates for cartography was reduced to three for savings and some of the colours were replaced to make the colour schemes more gradational between the Division and the Sub-Division. And several new colours were added to the colour design plan proposed in October 1982. New colours were also added to the soil map as a result of changes made in the legend items.

c. Sheet Layout for Thematic Maps

Based on the decisions on principles made at the meetings of October 1982, marginal information related items such as legend space, index to adjoining sheets, sheet history, topographic key, (note: the surface geology and soil map has other keys for slope classes, textural classes, and depth classes.) were laid out.

(2) Policy for Land Use Capability Evaluation

Analysis and evaluation are to be made on the five subjects as mentioned at the meeting of July 1982 (soil fertility, soil erosion potential, flood

potential, possibility of mechanization, and irrigation potential for the Tana River Delta Area; ranching potential for the Ranching Project Area). Based on agreements reached at the meeting of October 1982, several evaluations were attempted for testing for each subject and criteria were developed for proposal.

The evaluation assumes as its basis that the results should serve as basic data for development planning on the regional scale based on rural land use in general, namely, major kinds of land use and, therefore, concerns major land qualities at the level of the first stage of the two-stage approach. (See Appendix 3 - Minutes, appendix 2)

(3) Documentation and Preparation for Meetings

Based on (1) and (2) above, necessary documentation was made for subsequent meetings. Compilation of manuscripts of thematic maps, sheet layout specimen, samples of evaluation performed on an experimental basis, etc. to be presented at the meetings were prepared.

5 - 2 Meetings with Kenyan Side

A survey mission was dispatched for the period of January 28 to February 11, 1983, (note: members comprising the mission were as listed in 1 - 3 - 2) for meetings with the Kenyan side. The dates and the results of these meetings are attached as Appendix 3 - Minutes.

As a result, the proposed map specifications for thematic maps were agreed to with a few modifications made in the legend items, wording of marginal information, letter sizes and types. With respect to land use capability evaluation, the proposed principles were agreed to incorporating KSS's views in the form of modifications to provide for more specific types of land use.

5 - 3 Work after Return to Japan

The decisions and agreements made above were sorted out for implementation and necessary steps were taken to prepare for the next phase of work.

6. Processes of Map Specifications Formulation

Map specifications determine the quality of map as a means of representation and they have critical bearings on the contents, appearances, and utility of map. Their importance is more apparent for thematic maps than other maps. Particularly when the maps are concerned with such subjects as vegetation, landform, geology and soils, it is vitally important to set forth their map specifications in such a manner as to deal with characteristics of individual areas properly and systematically.

In view of their importance as viewed above, the map specifications for the thematic maps as finalized this year are reviewed in the following in terms of the contents and processes that led to their formulation.

6 - 1 Map Specifications for Thematic Maps

(1) Legend Items

The legend items for thematic maps are generally as shown in Appendix 3 - Minutes, appendices 1A, 1B, and 1C, and summarized below in specific terms.

In Vegetation and Present Land Use Map, names

at the sub-division level, dominant species as well as land use are represented as shown in Table 6.

In Landform, Slope, and Drainage Map, slope classes and drainage classification are additionally included as shown in Table 7. (For the Ranching Project Area, there are no slope classes but landform and drainage alone are represented.)

In Surface Geology and Soil Map, soils are represented in name for macro-relief and geology classification, and each name accompanied by description of properties as given in Table 8.

The legend items for the Surface Geology Map to be produced in a single colour (reproducible by blue printing) are as shown in Table 9, and as for the Soil Map to be similarly produced, they are a listing of soil names.

(2) Colour Design

Colour designs for the respective thematic maps are as given in Appendix 3 - Minutes, appendices 1A, 1B, and 1C.

Table 6: Legend of Vegetation/Present Land Use

Division	Symbol	Sub-division	Dominant species	Land Use
Forest	F-1	Forest (1)	<i>Mallotia zanzibarensis</i> , <i>Terminalia brownii</i> , <i>Chlorophora excelsa</i> / <i>Brachylaena brachantha</i>	Timber production
	F-2	Forest (2)	<i>Brachystegia spiciformis</i> , <i>Surgheda zanzibarensis</i> , <i>Cissus rotundifolia</i> , <i>Adenium obeum</i> , <i>Euphorbia grandicornis</i> , <i>Ahelia euzanensis</i> / <i>Marrubium macrocarpum</i> , <i>Marrubium</i> sp., <i>Panicum maximum</i>	Timber production
	F-3	Forest (3)	<i>Dioppyros corallii</i> , <i>Thespesia dania</i> , <i>Grewia</i> sp., <i>Dobers glabra</i> / <i>Panicum maximum</i> , <i>Leptochloa senegalensis</i>	Wildlife grazing, charcoal production
	F-4	Forest (4)	<i>Hyphaene coriacea</i> , <i>Hartmannia abyssinica</i> / <i>Panicum maximum</i> , <i>Panicum infestum</i> , <i>Hypertheca rufa</i>	Wildlife grazing
	F-5	Forest (5)	<i>Phoenix reclinata</i> , <i>Barthelemya racemosa</i>	Wildlife grazing
	F-6	Forest (6)	<i>Artocarpus maritima</i> , <i>Rhizophora mucronata</i> , <i>Bruguiera griseoventris</i> /	Timber production
Woodland	WB-1	Wooded bushland thicket (1)	<i>Elaeodendron aquifolium</i> , <i>Rhoicarpus revoluti</i> , <i>Melicope lasiantha</i> , <i>Croton dichogamus</i> , <i>Nectaroperalum Karumet</i> / <i>Marrubium macrocarpum</i> , <i>Enteropogon</i> sp.	Wildlife grazing
	WB-2	Wooded bushland thicket (2)	<i>Dobers glabra</i> , <i>Grewia</i> sp., <i>Commiphora schimperi</i> / <i>Panicum infestum</i> , <i>Leptochloa senegalensis</i> , <i>Cenchrus ciliaris</i> , <i>Panicum maximum</i>	Wildlife grazing
	WB-3	Wooded bushland thicket (3)	<i>Sporobolus setiopus</i> , <i>Combretum</i> sp. / <i>Echinochloa</i> sp., <i>Cynodon dactylon</i>	Wildlife grazing
	WB-4	Wooded bushland (1)	<i>Delonix elata</i> , <i>Platycephalum wense</i> , <i>Boscia coriacea</i> , <i>Idigodera spinosa</i> , <i>Grewia forbesii</i> , <i>Cassia singuata</i> / <i>Acrida keniensis</i> , <i>Schoenefeldia transiens</i>	Wildlife grazing
	WB-5	Wooded bushland (2)	<i>Dioppyros corallii</i> , <i>Thespesia dania</i> , <i>Terminalia spinosa</i> , <i>Croton dichogamus</i> / <i>Sporobolus marginatus</i> , <i>Schoenefeldia transiens</i>	Wildlife grazing Livestock grazing
	WB-6	Wooded bushland (3)	<i>Hyphaene coriacea</i> , <i>Terminalia spinosa</i> , <i>Thespesia dania</i> / <i>Digitalis malabarica</i> , <i>Panicum infestum</i>	Wildlife grazing Livestock grazing
Bushland	B	Bushland thicket	<i>Dombeya</i> sp., <i>Grewia similis</i> / <i>Panicum maximum</i> , <i>Enteropogon macrostachyus</i>	Wildlife grazing
	B-1	Bushland (1)	<i>Dobers glabra</i> , <i>Thespesia dania</i> , <i>Grewia tenax</i> , <i>Combretum hereroense</i> , <i>Echollum setatum</i> , <i>Dioppyros corallii</i> , <i>Idigodera schimperi</i> / <i>Schoenefeldia transiens</i> , <i>Digitalis malabarica</i>	Livestock grazing Wildlife grazing
	B-2	Bushland (2)	<i>Boscia coriacea</i> , <i>Combretum hereroense</i> , <i>Commiphora campestris</i> , <i>Commiphora erythraea</i> , <i>Commiphora africana</i> , <i>Dobers glabra</i> , <i>Cordia alliodora</i> , <i>Hermannia albigi</i> , <i>Salvadora persica</i> , <i>Euphorbia robeckii</i> / <i>Schoenefeldia transiens</i> , <i>Sporobolus helvolus</i> , <i>Panicum</i> sp.	Livestock grazing Wildlife grazing
	BG-1	Bushed grassland (1)	<i>Dobers glabra</i> , <i>Thespesia dania</i> , <i>Grewia tenax</i> , <i>Combretum hereroense</i> , <i>Echollum setatum</i> / <i>Cynodon dactylon</i> , <i>Cenchrus ciliaris</i> , <i>Schoenefeldia transiens</i>	Ranching area
	BG-2	Bushed grassland (2)	<i>Cordia alliodora</i> , <i>Boscia coriacea</i> , <i>Dobers glabra</i> , <i>Grewia villosa</i> / <i>Erigeron superba</i> , <i>Enteropogon macrostachyus</i> , <i>Schoenefeldia transiens</i>	Ranching area
	BG-3	Bushed grassland (3)	<i>Acacia zanzibarensis</i> / <i>Sporobolus helvolus</i>	Livestock grazing, Wildlife grazing
Shrubland	S	Dwarf shrubland	<i>Meynesia modesta</i> , <i>Balanites orbicularis</i> / <i>Panicum infestum</i> , <i>Cyperus articulatus</i>	Wildlife grazing
Grassland	G-1	Grassland (1)	/ <i>Schoenefeldia transiens</i> , <i>Cenchrus ciliaris</i>	Ranching area
	G-2	Grassland (2)	/ <i>Echinochloa hypoleuca</i> , <i>Echinochloa stagnina</i> , <i>Sporobolus helvolus</i> , <i>Panicum maximum</i> , <i>Cynodon dactylon</i>	Livestock grazing Wildlife grazing
	G-3	Grassland (3)	/ <i>Cyperus rotundus</i> , <i>Echinochloa colona</i>	Wildlife grazing, seasonal rice fields
	G-4	Grassland (4)	<i>Suaeda monoica</i> / <i>Sporobolus spicatus</i>	Wildlife grazing
Cultivated land	Cr - Co	Cropland (Cr: Rice / Co: Other)		
	C ₁	Cropland (mixed cropland and grazing area)		
	Pin - Pto - Ph	Plantation (Pin: Cashew nut and Mango / Pto: Coconut / Ph: Banana and Mango)		
	P ₁	Plantation (other)		
Farmland	Fa	Farm (cattle enclosure)		
Others	T	Town		
	V	Village		
	Ab-Am-Ag	Air strip (Ab: Bound surface / Am: Murrum surface / Ag: Grass surface)		
	Ra-Rd	Motorable road (Ra: All weather road / Rd: Dry weather road)		
	SF	Salt field		
	P	Pan and pond		
	Bf	Barren land		
	O	Dun		

Notes
 * : Heights of trees are sometimes lower than 10 m.
 * : Percent of grasses are sometimes scattered.
 / : In the column of dominant species, the former are trees, shrubs and herbs, the latter are grasses and sedges.

Table 7: Legend of Land form, Slope and Drainage

Macro ~ Meso Relief	Symbol	Landform Type	
Hills	H	Hills	
	Hr	Residual hills	
	Hs	Minor scarps	
Footslopes	F	Footslopes	
	C	Talus (Scree) slopes	
Plateaus	L	Plateaus	
Uplands	U	Uplands	
	Ud	Dissected peneplains	
Plains Sedimentary Plains	Erosional plains	Pn	Peneplains
		Ps	Sedimentary plains
	Terraces	Ps ₁	Higher terraces
		Ps ₂	Middle terraces
		Ps ₃	Lower terraces
	River alluvial plains	Pf	Younger fans
		Pl	Natural levees
		A	Flood plains
		V	Valley bottom lowlands
		Or	Old river beds
		Pc	Coastal plains
	Coastal plains	PcU	Raised coral reefs
		Il	Interlevee lowlands
		Z	Coastal ridges
		D	Dunes
		Dz	Old dunes and old coastal ridges
	Tidal flats	Tm	Marsh, Mangrove flats
		Ts	Sand flats
	Bottom lands	B	Bottom lands
	Miscellaneous	S	Swamps
Ol		Orbital lakes	
O		Pans and ponds	
W		Bad lands	
		River	
	Cliff		

KEY TO SLOPE CLASSES

Slope(%)	Symbol	Name of Macrorelief
0 - 2	1	flat to very gently undulating
2 - 5	2	gently undulating
5 - 8	3	undulating
8 - 16	4	rolling
16 - 30	5	hilly

KEY TO DRAINAGE

Division	Symbol
Permanent river	_____
Seasonal river	_____

Table 8: Legend of Surface Geology and Soil

H HILLS (low relief intensity, slopes 5–16%)

HLS Soils developed on Miocene sediments; limestones and clayey sandstones

HLSqf somewhat excessively drained, very deep, weak red, loose sand
(ferralic Arenosols)

HLSbk moderately well drained, very deep, light olive brown, friable, strongly
calcareous, moderately sodic, slightly gravelly silty clay loam
(calcic Cambisols sodic phase)

HO Soils developed on Pliocene sediments; sandy clays and bright red sands

HOlc well drained, very deep, reddish brown, friable, slightly calcareous silt
(chromic Luvisols)

HObk moderately well drained, deep to very deep, dark yellowish gray,
friable, strongly calcareous, moderately sodic, slightly gravelly silty
clay loam
(calcic Cambisols sodic phase)

HObc well drained, moderately deep to very deep, red, friable, slightly
calcareous silt
(chromic Cambisols)

Pt PLAINS OF RIVER TERRACES (slopes 0–2%)

PtJ Soils developed on lagoonal sands and clays

PtJqf somewhat excessively drained, very deep, yellowish red, loose, sand to
sandy loam
(ferralic Arenosols included ferric Luvisols)

PtJqa somewhat excessively drained to well drained, very deep, yellowish
brown, mottled, loose to firm, sand to sandy loam; in places over
psoferric material
(albic Arenosols)

PtJqc somewhat excessively drained, very deep, brownish yellow to brown,
loose, sand to sandy loam; in places mottled
(cambic Arenosols)

PtJso moderately well drained, very deep, grayish brown, firm to very firm,
strongly calcareous, slightly saline, strongly sodic, clay loam to clay
(orthic Solonetz)

PtJxk moderately well drained, very deep, dark brown, very firm, strongly
calcareous sandy loam; in places moderately sodic
(calcic Xerosols partly sodic phase)

PtJlc moderately well drained, very deep, red to brown, slightly calcareous,
firm loam
(chromic Luvisols)

PtJbk moderately well drained to imperfectly drained, very deep, brown, very
firm, strongly calcareous, moderately sodic, sandy loam to silty clay
loam
(calcic Cambisols sodic phase)

- PtJC₁ complex of :
 – well drained, very deep, light olive brown, mottled, loose to firm, sand to loamy sand
 (albic Arenosols)
 – somewhat excessively drained, very deep, light olive brown, loose sand
 (cambic Arenosols)
- PtJ' Soils developed on calcareous lagoonal sands and clays
- PtJ'lc well drained, deep to very deep, dusky red, firm, very few stone, loam to sandy clay loam; in places slightly calcareous
 (chromic Luvisols)
- Pr RIVER ALLUVIAL PLAINS (slopes 0–2%)
- PrA Soils developed on Recent alluvial deposits; sands, silts and clays
- PrAvp imperfectly drained, very deep, very dark brown, firm, moderately calcareous, slightly saline, cracking clay
 (pellic Vertisols)
- PrAvc moderately well drained to imperfectly drained, very deep, dark brown, mottled, very firm, cracking clay; in places slightly calcareous and moderately sodic
 (chromic Vertisols)
- PrAj(e-v) well drained, very deep, stratified cracking soils of varying colour, consistence and texture; in places slightly calcareous and moderately sodic
 (eutric and vertic* Fluvisols)
- PrAqa moderately well drained, very deep, light gray, mottled, loose, sand to loamy sand
 (albic Arenosols)
- PrAso moderately well drained, very deep, black, firm, moderately calcareous, strongly sodic clay loam
 (orthic Solonetz)
- PrAC₁ complex of :
 – moderately well drained, very deep, brown, mottled, very firm, cracking silty clay
 (chromic Vertisols)
 – well drained to moderately well drained, very deep, stratified cracking soils of varying colour, consistence and texture; in places moderately calcareous and sodic
 (eutric and vertic* Fluvisols)
- PrA₃ Soils developed on fan deposits; clays, sands and gravels
- PrA₃bk moderately well drained, very deep, dark grayish brown, friable, strongly calcareous, moderately sodic, slightly gravelly silty clay loam to silty clay
 (calcic Cambisols sodic phase)

- Pc COASTAL PLAINS (slopes 0–16%)**
- PcA Soils developed on Recent alluvial deposits; sands, silts and clays**
- PcAge** moderately well drained, very deep, pinkish gray, mottled, loose sand
(eutric Gleysols)
- PcA₁ Soils developed on beach sands and muds of the coastal creeks**
- PcA₁qc** excessively drained, very deep, light brownish gray, loose, strongly calcareous, slightly saline sand
(cambic Arenosols)
- PcA₂ Soils developed on dune sands**
- PcA₂qf** somewhat excessively drained to well drained, very deep, red, loose to friable, sand to sandy loam; in places slightly calcareous
(ferralic Arenosols)
- PcA₂qc** somewhat excessively drained to well drained, very deep, yellowish brown, loose, sand to sandy loam; in places mottled and slightly calcareous
(cambic Arenosols)
- PcA₂be** well drained to moderately well drained, very deep, dark brown, mottled, friable, sandy loam to clay loam
(eutric Cambisols)
- PcA₂bk** well drained, very deep, very pale brown, very firm, strongly calcareous, sandy loam to sandy clay loam
(calcic Cambisols)
- PcA₂C₁** complex of:
– imperfectly drained, very deep, light gray, mottled, friable silty clay loam
(eutric Gleysols)
– well drained, very deep, pale brown, mottled, loose sandy
(albic Arenosols)
- PcL Soils developed on coral limestones**
- PcLqf** well drained, very deep, red, loose sand
(ferralic Arenosols)
- PcLe** well drained, shallow, dusky red, strongly calcareous, silty clay loam
(Rendzinas)
- PcLlc** well drained, deep to very deep, red, firm, slightly calcareous, loam; in places very few stones
(chromic Luvisols)
- PcS Soils developed on calcareous lagoonal sandstones**
- PcSqf** somewhat excessively drained, very deep, red, loose sand
(ferralic Arenosols)
- PcSe** well drained, shallow, dusky red, strongly calcareous silty clay loam
(Rendzinas)

PcJ Soils developed on lagoonal sands and clays

- PcJge** moderately well drained to poorly drained, very deep, yellow to pale yellow, mottled, friable, slightly calcareous, loam to clay
(eutric Gleysols)
- PcJso** imperfectly drained, very deep, light brownish gray, firm, strongly calcareous, strongly sodic, clay
(orthic Solonetz)
- PcJc₁** complex of:
— moderately well drained, very deep, light gray, mottled, friable sandy clay to clay loam
(eutric Gleysols)
— moderately well drained, very deep, dark brown, mottled, loose sand
(albic Arenosols)

T TIDAL FLATS (slopes 0–2%)

TA₁ Soils developed on beach sands and muds of the coastal creeks

- TA₁oe** poorly drained, very deep, very dark grayish brown, strongly saline, humic material overlain by 0–40 cm of loose sand; in places slightly calcareous
(eutric Histosols)
- TA₁ge** poorly drained, very deep, yellowish brown, mottled, loose, moderately saline, sand to sandy loam
(eutric Gleysols)

B BOTTOMLANDS (slopes 0–2%)

BA Soils developed on Recent alluvial deposits; sands, silts and clays

- BAvp** imperfectly drained, very deep, very dark gray, mottled, firm, cracking clay; in places strongly calcareous and moderately sodic
(pellic Vertisols)
- BAso** poorly drained, very deep, light gray, firm, strongly calcareous, strongly sodic, clay loam
(orthic Solonetz)
- BAge** poorly drained, very deep, gray, mottled, friable, sandy clay to clay
(eutric Gleysols)
- BAC₁** complex of:
— imperfectly drained, very deep, very dark grayish brown, mottled, friable, clay loam to clay
(eutric Gleysols)
— moderately well drained, very deep, dark grayish brown, mottled, loose sand
(albic Arenosols)
- BAC₂** complex of:
— imperfectly drained, very deep, very dark gray, mottled, firm, cracking clay
(pellic Vertisols)

— moderately well drained, very deep, light yellowish brown, mottled,
loose, loam to clay
(eutric Gleysols)

S SWAMPS (slopes 0–2%)

SA Soils developed on Recent alluvial deposits; sands, silts and clays

Sage Imperfectly drained, very deep, pinkish gray, mottled, friable, silty
loam to clay
(eutric Gleysols)

The name marked with * is quoted from "The Application of the FAO/UNESCO Terminology of the Soil Map of the World Legend for Soil Classification in Kenya".

Table 9: Legend of Geology

Geological Age		Symbol	Explanation
Quaternary	Recent	Re ₀	Alluvial deposits; silts, sands and clays
		Re ₁	Beach sands and muds of the coastal creeks
		Re ₂	Dune sands
		Re ₃	Fan deposits; clays, sands and gravels
	Unconformity		
	Pleistocene	Pt ₁	Old dune sands
		Pt ₂	Raised coral reef
		Pt ₃	Lagoonal calcareous sandstones
		Pt ₄	Lagoonal sands and clays
		Pt ₅	Pleistocene river sediments; sandy clays, sands and gravels
Unconformity			
Tertiary	Pliocene	Pt ₁	Pliocene marine sediments, sandy clays and bright red sands
		Pt ₂	Pliocene river sediments; gray silty sands and gravels
	Miocene	Mi ₁	Miocene sediments; limestones, calcareous sandstones and clayey sandstones
Unconformity			
Jurassic	Ju ₁	Jurassic sediments; calcareous sandstones and conglomerates	
Unconformity			
Triassic	Tr ₁	Triassic sediments; sandstones, conglomerates and shales	
		/	Fault

In these tables, each of the three digits in which the numbers are given, represent from left to right yellow, red, and blue respectively, and the figure in each digit indicates density levels of half-tone dots (133 lines/inch) expressed as follows.

0 :	
1 :	14%
2 :	28%
3 :	43%
4 :	59%
5 :	77%
6 :	100% (solid)

In Landform, Slope and Drainage Map, drainage symbols are shown in dark blue. Classification symbols (except for slope classes) and classification boundaries are in black in all maps and dark blue (for waters and their annotations) and grey (for the rest) in the base map.

Printing is done in six colours (yellow, red, blue, dark blue, grey, black) for all thematic maps, and the numbers of plates are as follows.

	Base Map Plate	Annotation Plate	Scribed Plate	Mask Plate	Total
Vegetation and Present Land Use Map	1 (grey)	1 (black:classification symbol, marginal annotation)	1 (black:symbol, neat-line, boundary) 1 (red:symbol, solid)	13	20
	1 (dark blue: shoreline)				
Landform, Slope and Drainage Map	1 (half-tone dots, water surface)	1 (black:classification symbol, marginal annotation)	1 (black:symbol, neat-line, boundary) 1 (red:symbol) 1 (dark blue: water classification)	12	16
	1 (dark blue: annotation for water areas)				
Surface Geology and Soil Map		1 (black:classification symbol, marginal annotation)	1 (black:neat-line, boundary)	14	16

Note: Base Map Plates are common to all maps and included in the total for Vegetation and Present Land Use Map.

(3) Sheet Layout

The sheet layout specimens is given as Figure 7 (specimen of Surface Geology and Soil Map). The marginal information includes the following as major items.

a. Titles (Map Name, Sheet Name)

VEGETATION AND PRESENT LAND USE MAP — GARSEN
LANDFORM, SLOPE AND DRAINAGE MAP — GARSEN
SURFACE GEOLOGY AND SOIL MAP — GARSEN

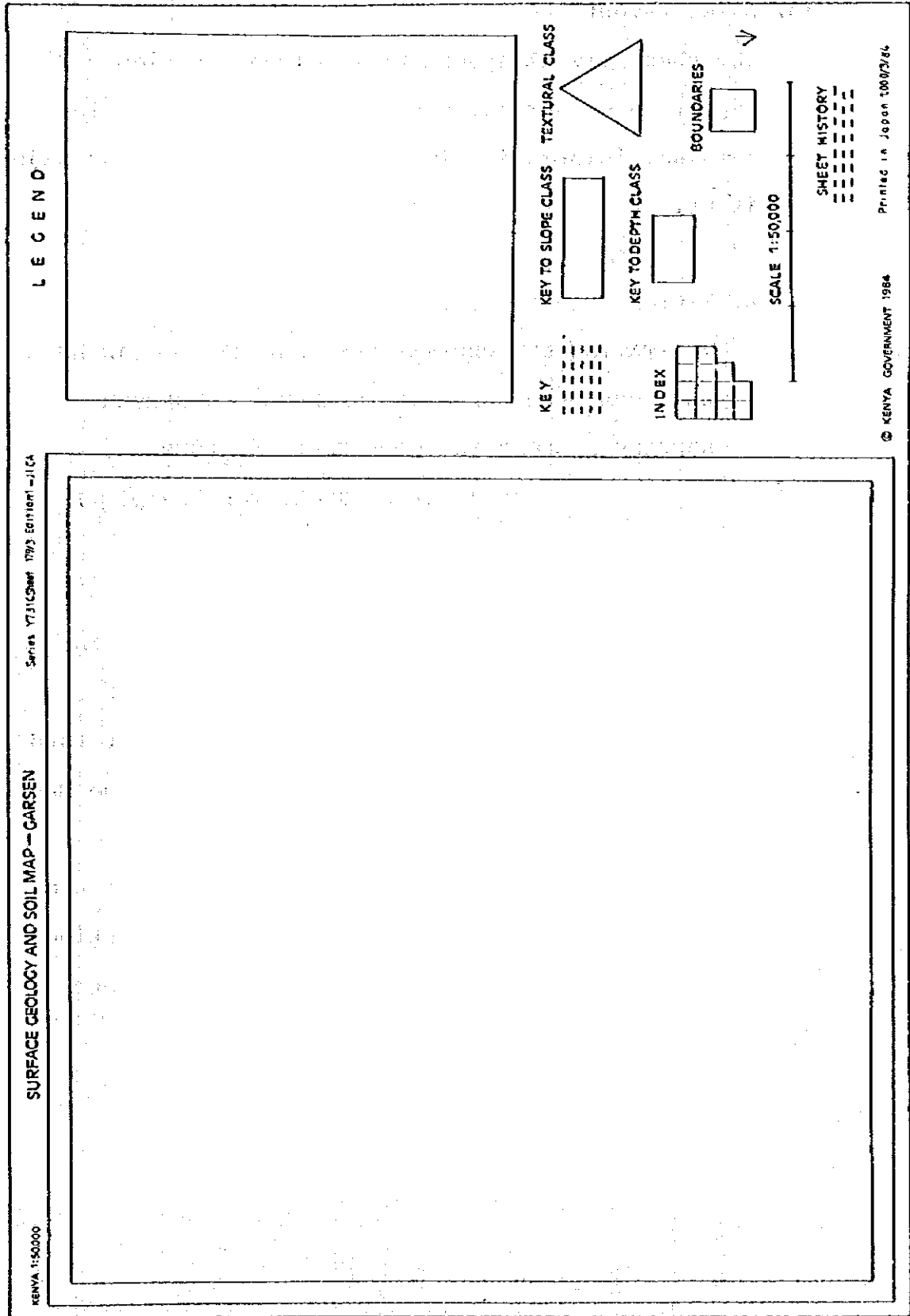
(For Garsen Sheet for example.)

b. Series Numbers

For the Tana River Delta Area (1/50,000), the series numbers are Y731A, Y731B, and Y731C respectively (A for Vegetation and Present Land Use Map, B for Landform, Slope and Drainage Map, and C for Surface Geology and Soil Map).

For the Ranching Project Area, the numbers are Y633A and Y633B respectively (A for Vegetation and Present Land Use Map, and B for Landform, Slope and Drainage Map).

Fig. 7: Sheet Layout Specimen



c. Sheet History

First Edition prepared by Japan International Cooperation Agency (JICA) under the Japanese Government's Technical Aid Programme.

Mapping work conducted by JICA in cooperation with Survey of Kenya (SK) and Kenya Soil Survey (KSS) 1981 - 1983.

Field Identification 1981 (or 1982)

Base Map JICA-[], Y731.

Publication by SK.

(The numbers to come in the place of [] as in

Base Map JICA-[], vary depending on map sheets.)

d. Legend Columns

As shown in Tables 6 - 8.

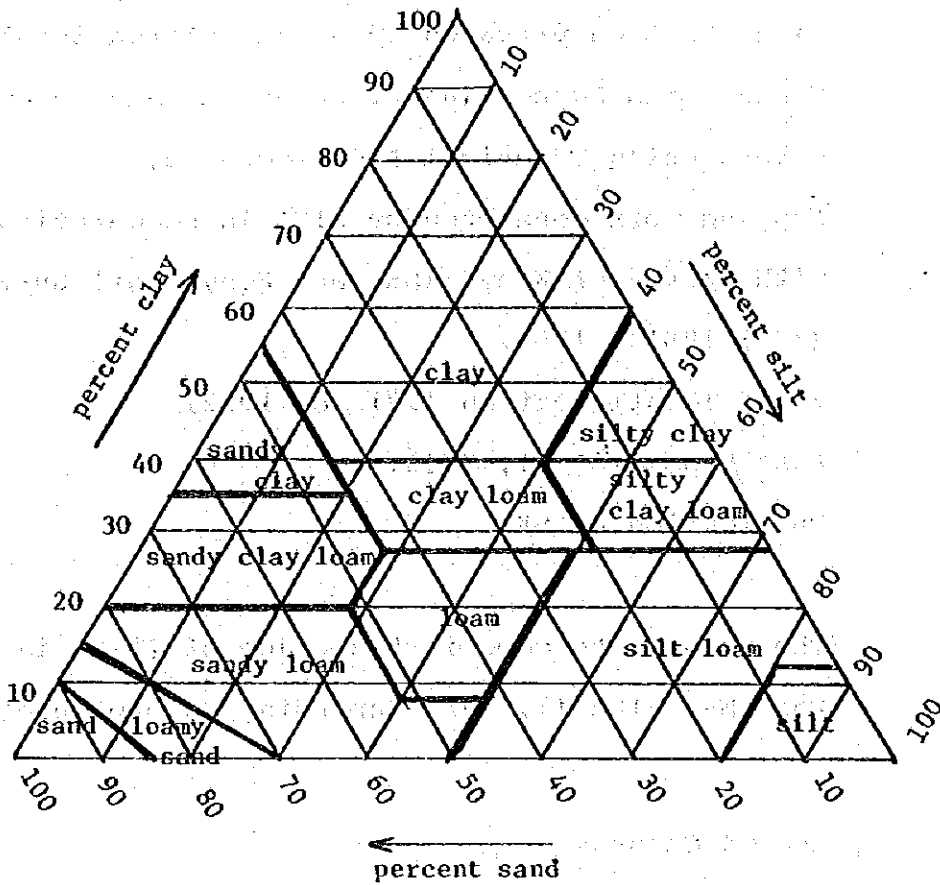
e. Keys to Slope Classes, Textural Classes, Depth Classes

In the Surface Geology and Soil Map, they are shown as follows.

KEY TO SLOPE CLASSES

Slope %	Slope Class Symbol	Name of Macrorelief
0 - 2	..A..	flat to very gently undulating
2 - 5	..B..	gently undulating
5 - 8	..C..	undulating
8 - 16	..D..	rolling
16 - 30	..E..	hilly

TEXTURAL CLASSES



KEY TO DEPTH CLASSES

Thickness of Soil in cm	Soil Name
0 - 50	shallow
50 - 80	moderately deep
80 - 120	deep
more than 120	very deep

f. Topographic Key

To be shown in terms of the following.

Tana River Delta Area:

- Main road
- Minor road
- Provincial boundary
- District boundary
- Spot height
- Contour

Ranching Project Area:

- Main road
- Minor road
- Provincial boundary
- District boundary
- Park boundary
- Spot height
- Contour

g. A square of 1cm with the area in hectares

This is included in all maps except for Landform, Slope and Drainage Map.

Sheet Layout for the Surface Geology Map and the Soil Map to be produced in a single colour (reproduceable by blue printing) is made separately from above.

6 - 2 Processes of Map Specifications Formulation

The processes that led to the formulation of map specifications are summarized in Table 10 that follows.

Table 10 : Processes of Map Specifications Formulation

Legend Item	1981				1982			1983
	Jul. - Sep, Reconnaissance survey	Nov. Meetings	Nov. - Feb. Field Survey Tana Riv, Dieta	Feb. Meetings	Jul. Meetings	Jul.-Oct. Field Survey Rauching Pro. Area	Oct. Meetings	Feb. Meetings
Vegetation/Present Land Use Map							○	○
Landform/Slope/ Drainage Map							○	
Surface Geology/ Soil Map							○	○
Vegetation/Present Land Use Map								○
Landform/Slope/ Drainage Map							○	
Surface Geology/ Soil Map							○	○
Sheet Layout							○	○
Titles (Map name, sheet name)							○ (1/50,000)	○ (1/100,000)
Series Number							○	○
Sheet History							○	○
Legend							○	○
Soil Textural Classes, etc.							○	○
Topographic Key							○	○
Others							○	○

Note: — Review, meeting. ○ Generally decided. ⊙ Decided.

7. Future Tasks

Following are the points to be made before proceeding to the final phase of work planned for the next fiscal year (the Final Year of the Project).

7 - 1 Cartography and Printing of Thematic Maps

(1) Cartographic Work

Cartographic specifications for the respective thematic maps are described in 6 - 1. Cartographic work is to be done in an appropriate work flow with processes accuracies controlled and managed to meet the specifications.

Cartography includes window marks as well as register marks on the four corners of a map sheet so that (taking into account reprinting to be made by SK in the future) the scribed and mask plates will be punched to make small holes or windows which are to be matched in plate making and printing.

(For trimming lines, see (2) that follows.)

The Kenyan views expressed on sizes of classifi-

cation symbols (colour symbols as well as letter symbols) to be used inside of the neatlines of thematic maps, types and sizes of letters to be used in the legend of Surface Geology and Soil Map, are to be incorporated into the specifications.

Dot screens are of 133 lines/square inch and made closet to those listed in 6 - 1 (2).

(2) Cartography and Printing

Press proofs including colour tones are to be inspected by the Kenyan counterparts expected to be in Japan.

The Kenyan side is thinking of their printing machine (Heiderberg SORD) for use in reprinting of the maps. This machine allows a maximum sheet size of 64cm x 91.5cm (25"1/4 x 36"), and a printing area of 61.4cm x 88.9cm (24"3/8 x 35"). Trimming lines are shown 2cm outside of the outline (60.0cm x 87.5cm) on the sheet layout. But the Kenyan side requests 93cm x 140cm for printing plate.

SK has requested that the Japanese side supply the following to SK.

Colour progressives
Colour strengths
Colour pack (if possible)
Size of printing machine to be used

It is hoped that these will be discussed for more details with the Kenyan counterparts when they come to Japan.

In addition to the printing of 1,000 copies each of the thematic maps, there is reprinting (blue printing) of Surface Geology Map and Soil Map respectively.

7 - 2 Land Use Capability Evaluation

As mentioned in 5 - 2 and seen from Appendix 3 - Minutes, it has been decided that land use evaluation will be made on the following subjects.

For Tana River Delta Area (excluding areas covered by three 1/20,000 topographic map sheets, 179-1, 2, and 180-1.):

Irrigation Potential
Rain-fed Agricultural Potential
Soil Erosion Hazard

For Ranching Project Area:

Ranching Potential

Criteria for evaluation on each subject must be developed with due consideration given to the comments made by KSS which include:

- a. For irrigation potential, "F.N. Muchena: Proposed Criteria for Land Suitability Classification for Irrigation, Table 2, 1981, KSS", should serve as reference. Possibilities of rice and cotton growing are to be considered.
- b. For rain-fed agricultural potential, land qualities to be studied should include climate zone, soils (in terms of water moisture, fertility, mechanization, salinity, sodicity), soil erosion hazard. "R.F. van de Weg, Conversion Tables for Land Suitability Rating, 1978, KSS", should serve as reference.
- c. For soil erosion potential and other land qualities, "KSS Internal Communication No. 7, Proposals for Rating of Land Qualities, 2nd Approximation, 1977" should be referenced. Potential is related not to the land with present vegetation but to possible cultivation in the future.

d. For ranching potential, land qualities to be studied should include soil fertility, slopes, water resources, soil erosion. The KSS document listed in b. above should be referenced. Current suitability based on water resources as they presently are (water holes, wells, and bore holes) is distinguished from potential suitability which will be rated regionally.

7 - 3 Final Report and Final Meeting with Kenyan Side

During the next fiscal year which marks the final year of the Project, the final report is supposed to be produced describing the methodology and chronological account of work performed, results, and recommendations for their useful applications in future development projects. The report in draft and the land use evaluations produced should be reviewed and discussed before being finalized in consultation with the Kenyan side at meetings expected in early December 1983.

CONCLUSIONS AT THE MEETINGS BETWEEN
SURVEY OF KENYA (SK, KENYA SOIL SURVEY
(KSS) AND JAPANESE MAPPING TEAM (JMT)
HELD FROM 20TH TO 29TH JULY, 1982

Five meetings were held from 20th to 29th, whose minutes are herewith annexed. Conclusions reached at the series of meetings are as follows:

1. REVIEW OF 1981 YEAR WORK

With respect to the JMT's report on the 1981 fiscal year work; the KSS pointed out questionable points on soil profile description and analytical data, which were agreed to be checked later in Japan.

Description on soil characteristics in the legend of the soil map was amended in accordance with the KSS's standards. (Appendix 1)

2. 1982 - 1983 YEAR WORK

Specifications and schedule of 1982 and 1983 year work were agreed to be as the JMT proposed on 20th July.

3. COLOUR DESIGN OF THE THEMATIC MAPS

The KSS colour chart was adopted instead of the JMT's one for the soil map because it was found that similar dot screens to those of the KSS are available in Japan, and colour design of the soil map was decided with some modifications of the KSS's standard colours from viewpoint of reducing the number of original negatives (scribed plates, mask plates etc.). (Appendix 2)

As for the other two thematic maps, the KSS colour chart was also adopted, and it was agreed that the SK and KSS would make a proposal of colour design on the basis of the colour expressions proposed by the JMT by the next meetings scheduled for the end of September and the beginning of October, when it would be decided.

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The following were also agreed: (1) The current topographic base will be shown in dark grey except for the hydrographic features and names which will be in dark blue. (2) Classification boundaries and symbols and, in the soil map, slope class symbols will be shown in black.

The JMT accepted to add necessary screens for reprinting to the final delivery items to the SK, so that the SK could reprint and revise the maps in future.

4. SHEET LAYOUT OF THE THEMATIC MAPS

The following were agreed: (1) The SK will complete a specimen map on sheet layout taking the printable size of the SK's machine (60cm x 87.5cm) into consideration. The specimen map should also indicate the position of register crosses and trimming lines. (2) In the marginal information of the soil map, slope class, texture triangle, topographic key and a square of 1cm with the area in hectares will be included. (3) Titles of the thematic maps will be as "VEGETATION AND PRESENT LAND USE MAP-GARSEN", "LANDFORM, SLOPE AND DRAINAGE MAP-GARSEN" and "SURFACE GEOLOGY AND SOIL MAP-GARSEN" respectively. (4) The series will be Y731A, Y731B and Y731C respectively. (5) The edition number will be 1 JICA. (6) The sheet number will be the current topographic map sheet number.

5. LAND USE CAPABILITY ANALYSIS

For the Tana River Delta Area, the area excluding three sheets of 1:50,000 topographic maps (179-1,2, 180-1) was decided to be analyzed, and items of evaluation will be "soil fertility", "mechanization", "soil erosion", "Flood potential" and "irrigation suitability".

For the Ranching Project Area, it was agreed that "suitability for ranching" would be analyzed using vegetation, soil, landform and suitability for water hole as land qualities.

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6. MATTERS RELATED TO FINAL RESULTS

The following were agreed: (1) 1,000 copies of each thematic map will be printed. (2) The original negatives (scribed plates, mask plates etc.), one of the final delivery items to the SK, will be punched and have both register crosses and window marks, and the studs fitting the punched holes will be sent together. (3) Land use capability analysis maps will be reproduced by computer outputting for the Tana River Delta Area and by blue printing for the Ranching Project Area. (4) Explanation in the final report will be given by each theme, i.e. vegetation and present land use; landform, slope and drainage; surface geology and soil.

7. LOGISTIC SUPPORT BY THE SK

The SK promised to prepare two counterparts, one Izuzu truck, five drivers, ID cards, National Park passes and other logistic supports for the field identification.