LAND USE MAPPING

TOPOGRAPHIC MAPPING PROJECT

IN [illegible] KENYA

FINAL REPORT

ANNEX

JAPAN INTERNATIONAL COOPERATION AGENCY

THE REPUBLIC OF KENYA

LAND USE MAPPING

(TOPOGRAPHIC MAPPING PROJECT)

IN EAST KENYA

FINAL REPORT

ANNEX

MARCH 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

I. IMPLEMENTATION AND METHODOLOGY OF THE STUDY

This chapter covers the work flow and method of the thematic mapping carried out in the last 3 years of the Land Use Mapping Project in East Kenya, which would be helpful to the future projects of this kind.

I - 1 WORK FLOW

Fig. 1 shows the entire work flow. The following sections describe each step of the work flow.

I - 2 RECONNAISSANCE SURVEY

The area to be surveyed is vast, and the eastern Tana River Delta Area is quite different in climate, landform, vegetation and other natural conditions from the western Ranching Project Area. So it was necessary to understand the outline of the entire project areas before the start of work so as to provide for the survey standards, policy and a plan for effective work execution.

In the first stage, the reconnaissance survey on the project areas was carried out. Before departure to the field survey, we studied the 1/50,000 scale topographic maps, aerial photos, and existing documents and data to get a preliminary knowledge of the survey areas and made a general survey plan. The survey period was 54 days, and eight team members and one counterpart from the Survey of Kenya participated in the survey.

The major survey items were as follows:

(1) Reconnaissance on geology, landform, vegetation, present land use, and drainage.

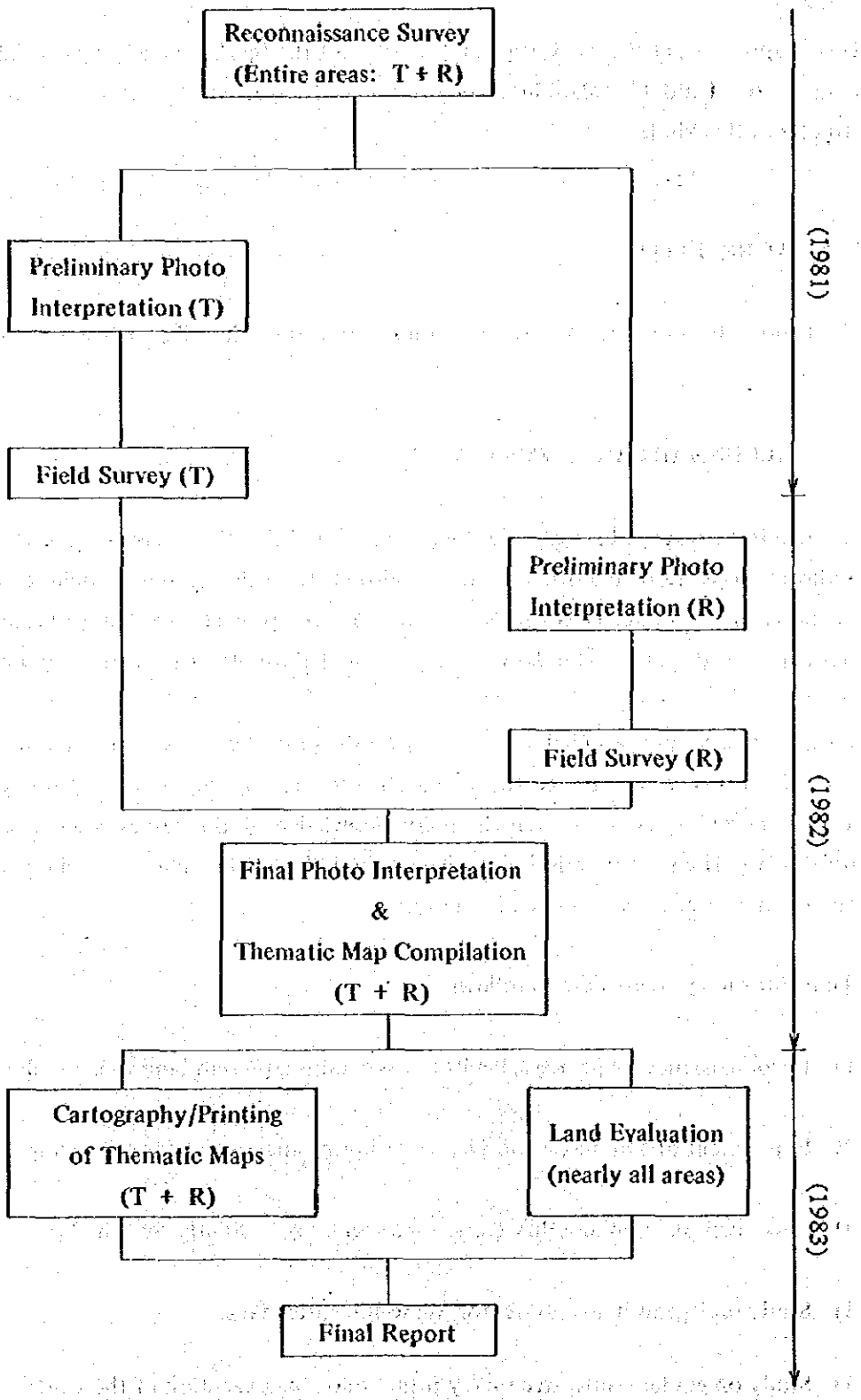
(2). Experiment of soil observation by auger boring and electrical prospecting.

(3) Reconnaissance on mobility conditions such as accessibility by vehicles.

(4) Study on legend items (draft) for use in thematic maps.

(5) Study on guide to effective survey inthe following execution of the work.

Fig. 1: Work Flow and Schedule



Note: T – Tana River Delta Area
R – Ranching Project Area

(6) Collection of reference books, documents and maps in Kenya.

I-3 PRELIMINARY PHOTO INTERPRETATION

I-3-1 PRELIMINARY AERIAL PHOTO INTERPRETATION

Aerial photo interpretation was performed based on the results of reconnaissance survey.

(1) As for landform classification, vegetation and present land use, boundaries according to legend items (draft) were put on aerial photos.

(2) Boundaries of surface geology and soil presumed from the interpreted landform boundaries were put on aerial photos.

(3) Drainage was also put on aerial photos.

(4) Those points to be identified in the field survey were marked on aerial photos for each theme. Morphometry for slope classification was performed from the 1/50,000 scale topographic maps.

I-3-2 PREPARATION OF RECONNAISSANCE MAPS

The results of the preliminary aerial photo interpretation were dropped onto the 1/50,000 scale topographic maps to make reconnaissance thematic maps.

I-3-3 PREPARATION OF LEGEND ITEMS (REVISED DRAFT) FOR THEMATIC MAPS

Legend items (revised draft) for thematic maps were prepared based on the results of the aerial photo interpretation.

1-4 FIELD IDENTIFICATION

The field survey was conducted to confirm and complement aerial photos and reconnaissance maps bearing the results of the preliminary photo interpretation. The survey period was about three months each in the 1st and 2nd years. The number of survey members was 14. Two counterparts from the Survey of Kenya (both in the 1st and 2nd years) and two counterparts from the Kenya Soil Survey (in the 1st year only) joined the field survey. Major survey items were as follows:

(1) Checking on the preliminary aerial photo interpretation by field observation of geology, landform, drainage, vegetation and present land use.

(2) As for geology complementary survey of parent materials of soil by auger boring and in a certain area, electric prospecting serving also as a check for shallow ground water.

(3) Survey for component materials of landform by auger boring.

(4) Vegetation sampling survey (139 pcs) for use as standard in making detailed vegetation classification.

(5) Survey on soils by auger boring (320 points) and pit excavation (30 points) and collection of samples for analysis from pits (Tana River Delta Area only).

(6) Hearings from local residents about vegetation, land use, flood, water utilization and other necessary items.

(7) Analysis of soil samples after return to Japan (a part of analysis conducted during stay on the spot).

(8) Correction of reconnaissance thematic maps based on the results of the above survey.

(9) Preparation of legend items (final draft) for thematic maps.

I - 5 CONSTITUTION OF MAP SPECIFICATIONS

In preparing thematic maps, it is an important problem to determine map specifications, i.e. legend items, colour design and sheet layout.

Since the start of reconnaissance survey in the 1st year, study and correction of legend items for thematic maps had been carried out in parallel with progress of the survey. In the 2nd year, study on color design corresponding to legend items and sheet layout started. After holding meetings with the Kenya side to discuss the matter, map specifications were finalized at the meeting held in February, 1983 (end of the 2nd year).

I - 6 MAP COMPILATION

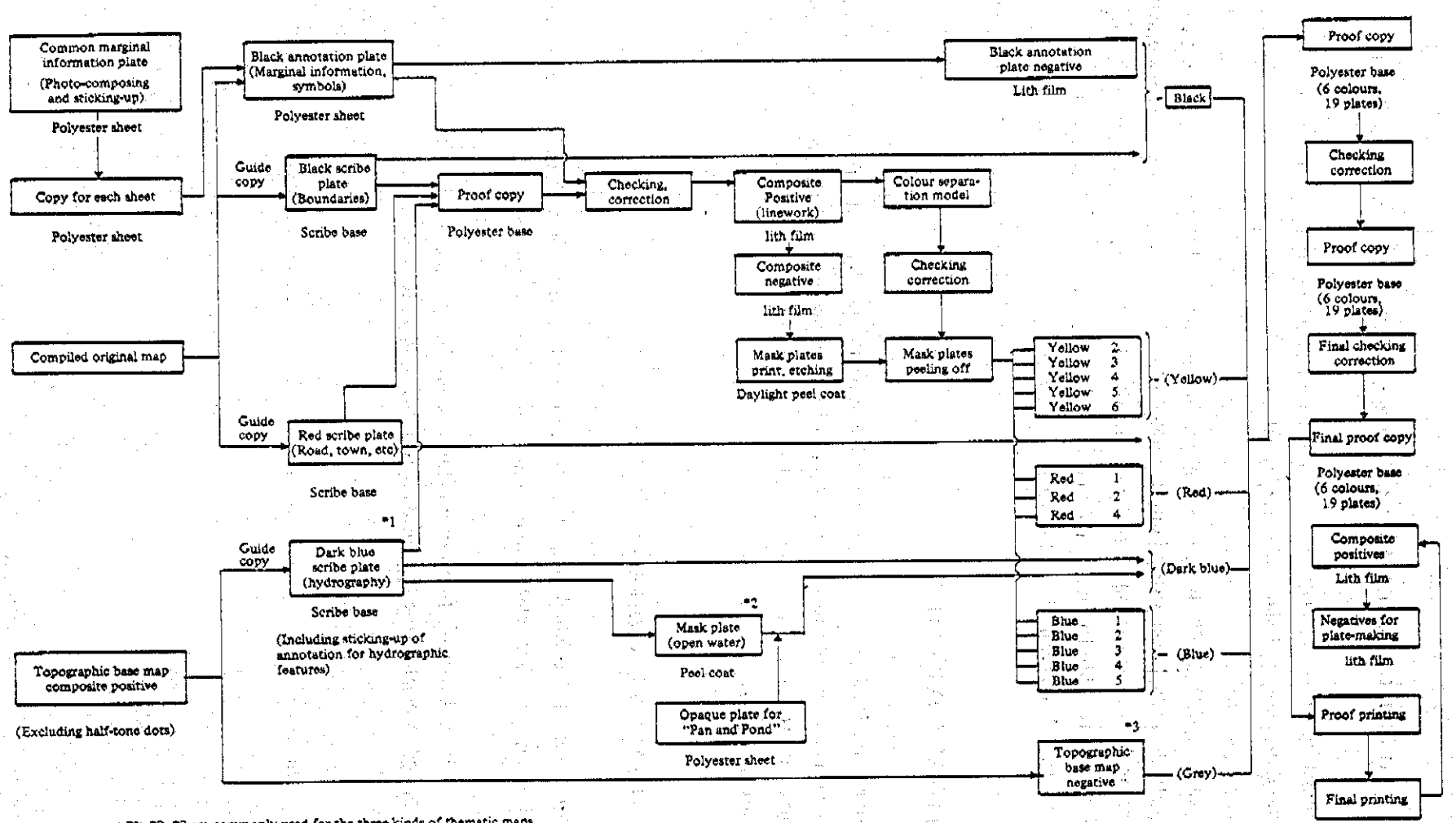
Through the final photo interpretation based on the results of the field survey, reconnaissance maps corrected on the basis of the results of the field identification were complemented and the thematic draft maps were compiled. Then, the original maps in a single colour for drafting were prepared.

I - 7 DRAFTING AND PRINTING

Drafting from the original maps was carried out in accordance with the finalized colour design and sheet layout. Then, plate making and printing were conducted.

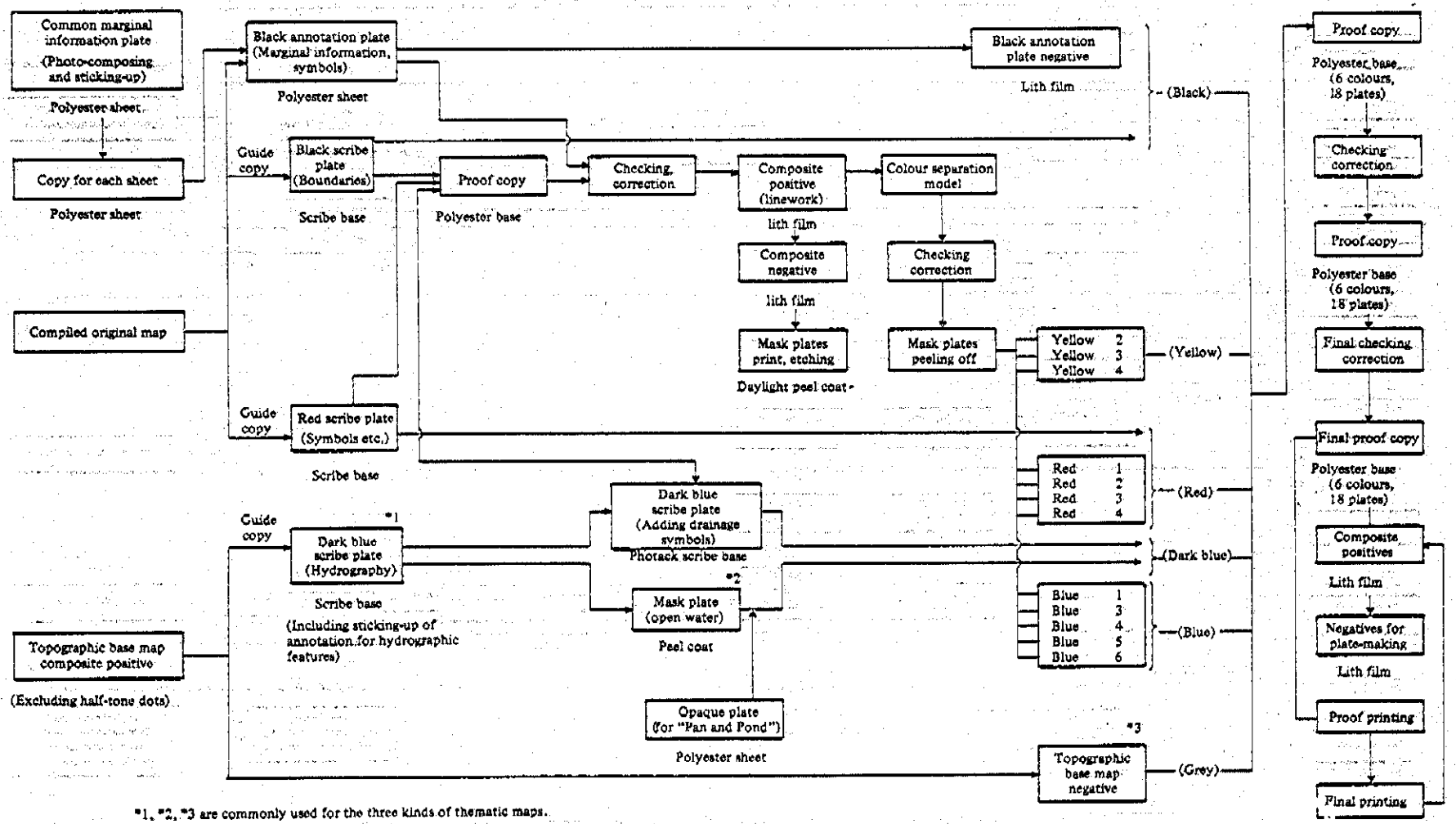
Fig. 2–4 show the work flows of drafting and printing for the thematic mapping. Colour separation applied in drafting the thematic maps is shown in Table 1–3.

Fig.-2 FLOW OF REPRODUSING 1:50,000 AND 1:100,000 VEGETATION AND PRESENT LAND USE MAP



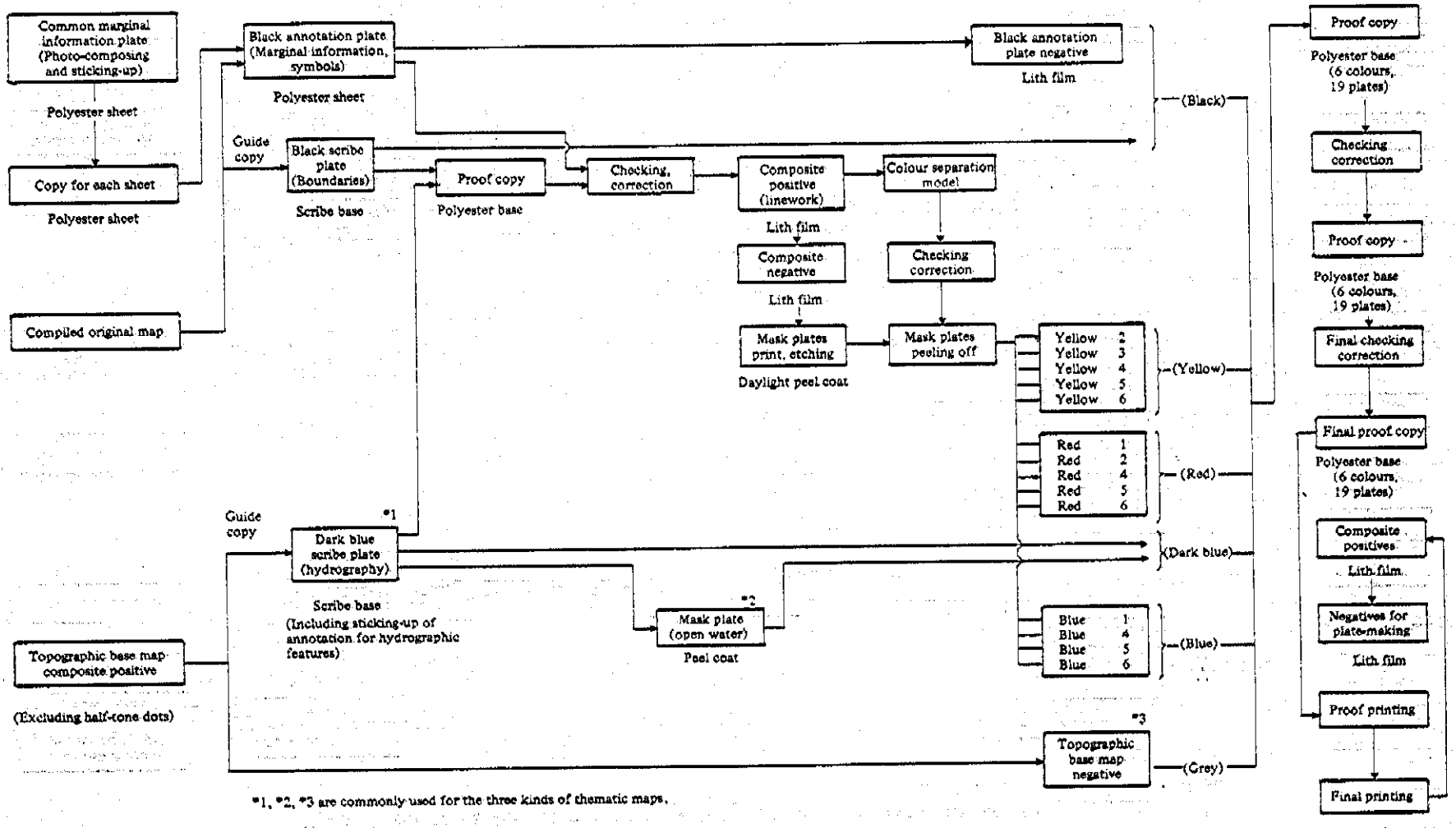
*1, *2, *3 are commonly used for the three kinds of thematic maps.

Fig.—3 FLOW OF REPRODUSING 1:50,000 LANDFORM, SLOPE AND DRAINAGE MAP AND 1:100,000 LANDFORM AND DRAINAGE MAP



*1, *2, *3 are commonly used for the three kinds of thematic maps.

Fig.—4 FLOW OF REPRODUSING 1:50,000 SURFACE GEOLOGY AND SOIL MAP



*1, *2, *3 are commonly used for the three kinds of thematic maps.

Table 1 COLOUR SEPARATION OF 1:50,000 AND 1:100,000 VEGETATION AND PRESENT LAND USE MAP

Item	Colour	YELLOW					RED				BLUE					DARK BLUE		BLACK		GREY
	Plate	Y2	Y3	Y4	Y5	Y6	R1	R2	R4	Scribe	B1	B2	B3	B4	B5	Dots	Scribe	Annotation	Scribe	Base Map
	No. of Dots/Inch	133	133	133	133	–	133	133	133		133	133	133	133	133					
	Angle	15°	15°	15°	15°	–	45°	45°	45°		75°	75°	75°	75°	75°					
	Density	28%	43%	59%	77%	100%	14%	28%	59%		14%	28%	43%	59%	77%					
Forest	F-1			O											O					
	F-2			O										O						
	F-3				O										O					
	F-4				O									O						
	F-5					O									O					
	F-6					O	O								O					
Woodland	WBt-1			O			O							O						
	WBt-2				O		O							O						
	WBt-3				O								O							
	WB-1			O									O							
	WB-2					O	O						O							
	WB-3					O						O								
Bushland	Bt				O			O			O									
	B-1				O			O					O							
	B-2				O		O					O								
	BG-1			O			O				O									
	BG-2	O					O						O							
	BG-3		O				O					O								
Shrubland	S	O					O					O								
Grassland	G-1					O					O									
	G-2				O		O													
	G-3		O					O			O									
	G-4		O				O													
Cultivated land	C_r · Co					O			O											
	C_s					O			O			O								
	Pm · Pco · Pb			O					O											
	P_s			O					O			O								
Farmland	Fa				O		O				O									
Others	T									Built										
	V									////										
	Ab									■										
	Am								O	□										
	Ag						O			□										
	Ra									—										
	Rd				O					=										
	Sf	O							O					O						
	P														O		O			
	Bl																		////	
	D																		/	

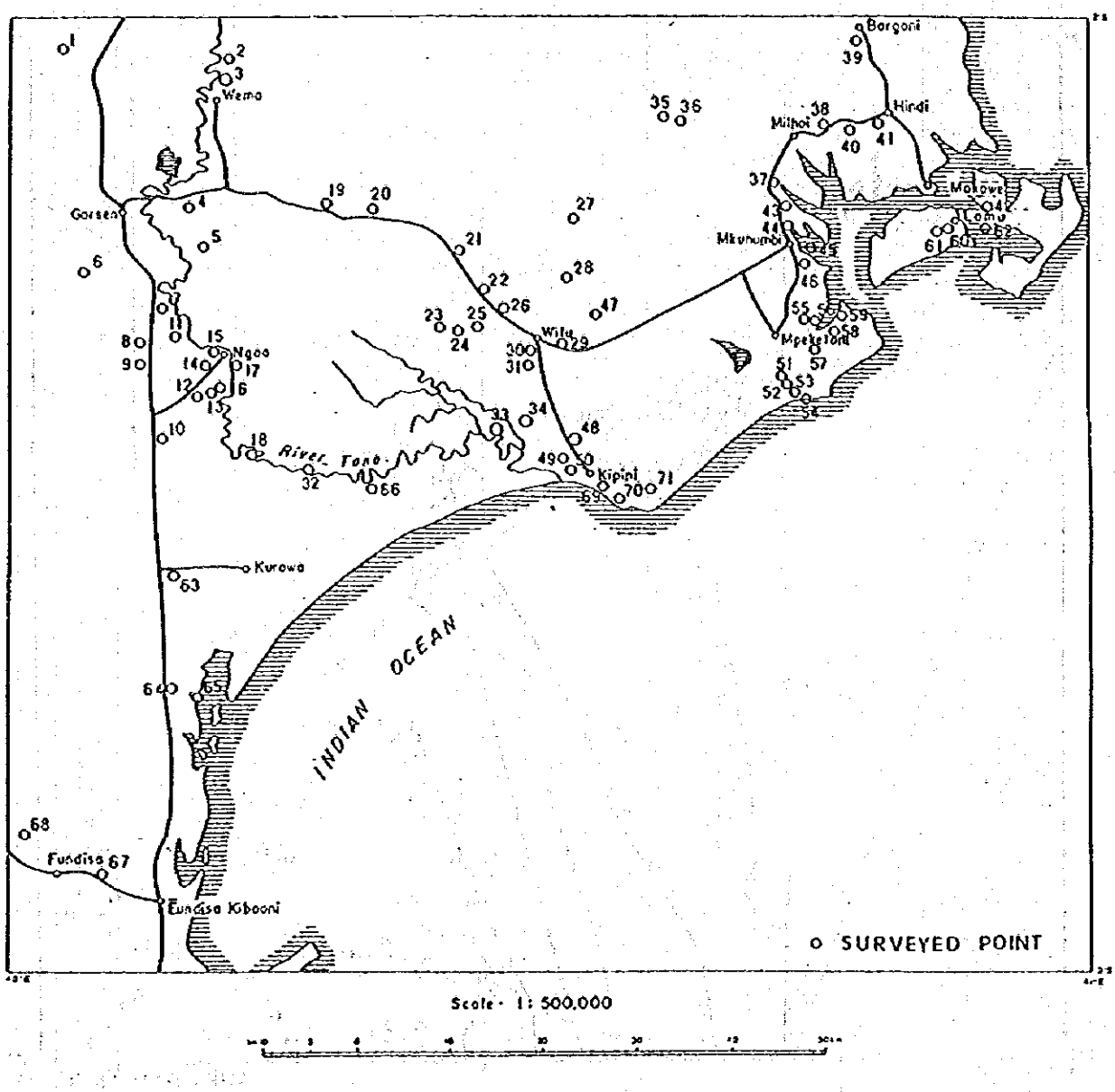
Table 2 COLOUR SEPARATION OF 1:50,000 LANDFORM, SLOPE AND DRAINAGE MAP AND 1:100,000 LANDFORM AND DRAINAGE MAP

Item \ Colour / Plate / No. of Dots/Inch / Angle / Density	YELLOW			RED					BLUE					DARK BLUE		BLACK		GREY
	Y2	Y3	Y4	R1	R2	R3	R4	Scribe	B1	B3	B4	B5	B6	Dots	Scribe	Annotation	Scribe	Base Map
	133	133	133	133	133	133	133		133	133	133	133	-					
	15°	15°	15°	45°	45°	45°	45°		75°	75°	75°	75°	-					
	28%	43%	59%	14%	28%	43%	59%		14%	43%	59%	77%	100%					
Hill							O			O								
Residual hill							O		O									
Minor scarp		O					O						O					
Footslope	O						O					O						
Talus (Scree) slope			O				O					O						
Plateau	O						O			O								
Upland		O				O						O						
Dissected Peneplain		O				O				O								
Peneplain		O					O				O							
Piedmont plain			O		O					O								
Higher terrace			O				O											
Middle terrace		O				O												
Lower terrace	O				O													
Fan			O	O					O									
Natural levee			O															
Flood plain			O							O								
Valley bottom lowland	O											O						
Old river bed		O			O								O					
Coastal plain		O		O							O							
Raised coral reef	O			O					O									
Interlevee lowland	O				O							O						
Coastal ridge		O		O														
Dune	O																	
Old dune and old coastal ridge	O																	
Marsh, Mangrove flat					O					O								
Sand flat	O					O					O							
Bottom land	O			O									O					
Swamp																		
Oxbow lake												O						
Pan and pond												O						
Bad land																		
River														O				
Cliff																		
Drainage																		

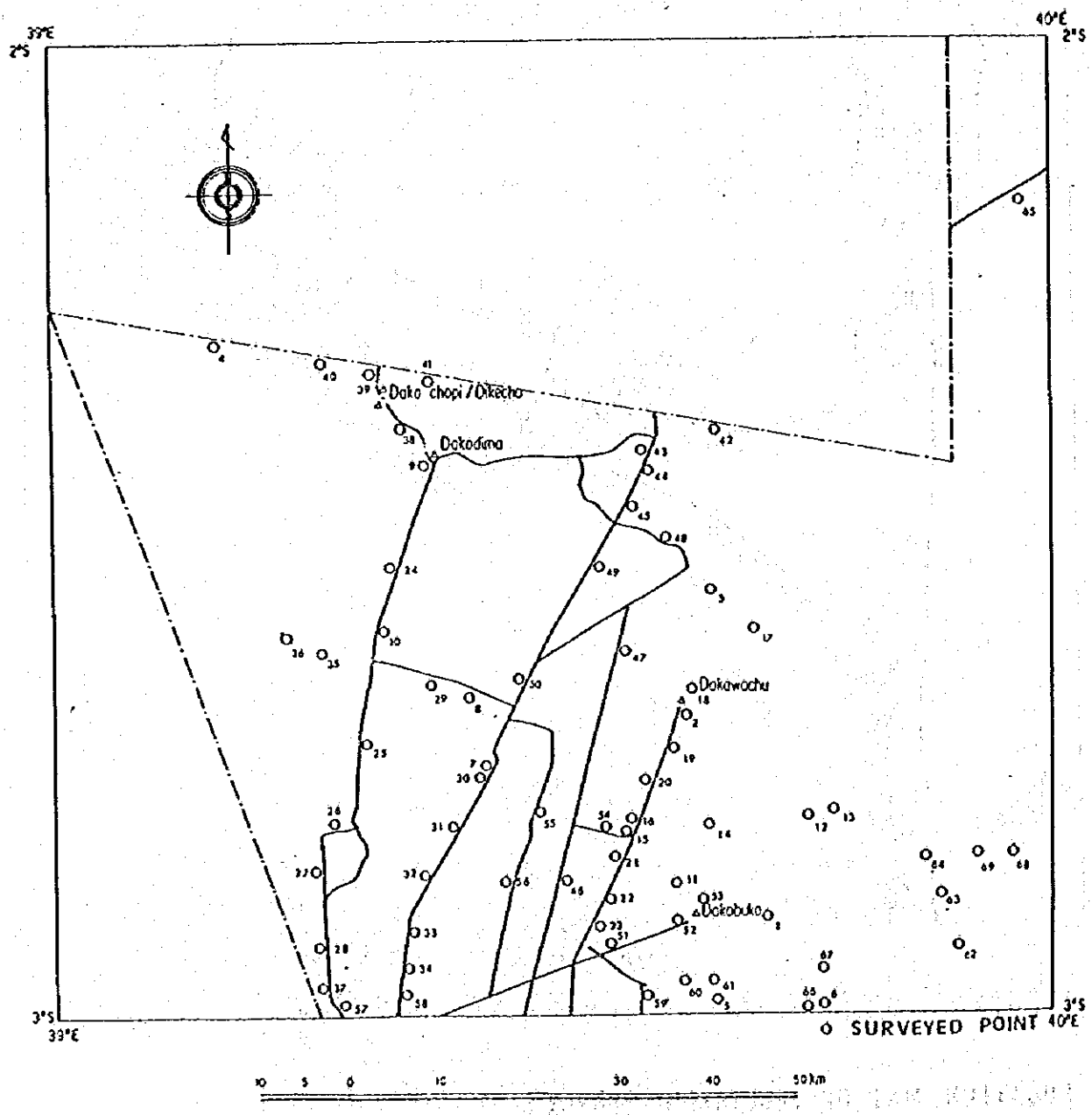
Table 3 COLOUR SEPARATION OF 1:50,000 SURFACE GEOLOGY AND SOIL MAP

Item	Colour	YELLOW					RED					BLUE				DARK BLUE		BLACK		GREY
	Plate	Y2	Y3	Y4	Y5	Y6	R1	R2	R4	R5	R6	B1	B4	B5	B6	Dots	Scribe	Annotation	Scribe	Base Map
	No. of Dots/Inch	133	133	133	133	–	133	133	133	133	–				–					
	Angle	15°	15°	15°	15°	–	45°	45°	45°	45°	–	75°	75°	75°	–					
	Density	28%	43%	59%	72%	100%	14%	28%	59%	72%	100%	14%	59%	72%	100%					
HLS	HLSqf	O					O													
	HLSbk				O		O					O								
HO	HOlc					O			O			O								
	HObk			O								O								
	HObc			O					O											
PtJ	PtJqf				O			O												
	PtJqs		O																	
	PtJqc				O		O													
	PtJso		O							O				O						
	PtJxk	O																		
	PtJlc					O				O		O								
	PtJbk			O			O													
	$PtJC_1$				O							O								
PtJ'	PtJ1c					O			O											
PrA	PrAvp													O						
	PrAvc							O						O						
	PrAj(c-v)					O								O						
	PrAqs			O																
	PrAso		O							O			O							
	$PrAC_1$		O				O							O						
PrA_1	PrA_1bk					O						O								
PcA	PcAge	O												O						
PcA_1	PcA_1qc					O	O													
PcA_2	PcA_2qf		O					O												
	PcA_2qc					O	O					O								
	PcA_2be			O				O				O								
	PcA_2bk			O			O					O								
	PcA_2C_1	O											O							
PcL	PcLqf		O					O				O								
	PcLe	O								O			O							
	PcLlc					O				O										
PcS	PcSqf			O				O												
	PcSe	O									O		O							
PcJ	PcJge	O						O							O					
	PcJso			O						O				O						
	$PcJC_1$		O					O					O							
TA_1	TA_1oe									O				O						
	TA_1ge	O													O					
BA	BAvp														O					
	BAso		O							O					O					
	BAge	O					O							O						
	BAC_1		O					O						O						
	BAC_2												O							
SA	SAge	O					O								O					

VEGETATION



LOCATION MAP OF VEGETATION SURVEY



LOCATION MAP OF VEGETATION

SUMMARY TABLE OF THE DOMINANT SPECIES USING THE MODIFIED BRAUN BLANQUET COVER-ABUNDANCE SCALE (1)

Vegetation Unit	Dominant Species / Location No.	F-1		F-2					F-3							F-4					F-5			F-6						
		T47	presence %	G6	G12	G62	G67	presence %	T19	T20	T35	T68	G63	G69	presence %	T28	T29	T34	T39	presence %	T18	T66	presence %	T45	T49	T59	T62	T65	presence %
Forest F-1	Manilkara zanzibarensis	5	100																										
	Terminalia brownii	4	100																										
	Chlorophora excelsa	3	100																										
	Brachiaria brizantha	6	100		4			25		6			3		33														
F-2	Brachystegia spiciformis			6	7	6	6	100																					
	Suregada zanzibarensis			4	2	5	2	100																					
	Clausa rotundifolia			3	4	3	2	100																					
	Adenium obesum				2	2	+	75																					
	Euphorbia grandicornis			6		3	4	75																					
	Afzelia cuanzensis	2	100			1		25																					
	Mariscus macropus			2		1		50		4					17														
	Mariscus sp.			3	4		3	75		4					17														
	Panicum maximum			4		4	3	75														2	50						
F-3	Diospyros cornii									5	6	6	5	6	83														
	Thespesia dania								5	2	5	4	4	5	100			5	5	50						2	2		20
	Grewia sp.				3			25			3	3	2	1	67	2	3			50	3		50						
	Dobera glabra			6		+		50	5	6			+		50														
	Panicum maximum													4	16							2	50						
	Leptothrium senegalense										4				16														
F-4	Hyphaene coriacea															6	5	6	6	100		3	50						
	Harrisonia abyssinica															5	6	3	3	100									
	Panicum maximum															4	6	4		75		2	50						
	Panicum infestum															6			6	50									
	Hyperhenia rufa																5	5		50									
F-5	Phoenix reclinata																				7	7	100						
	Barringtonia racemosa																				5	3	100						
F-6	Avicennia marina																							6	6	6	+	7	100
	Rhizophora mucronata																							3		5	6	7	80
	Bruguiera gymnorrhiza																							3		4	7	7	80
Bare ground		10		10	35	20	20		10	5	10	5	5	15		5	10	5	5		30	20		30	40	5	20	30	
Tree cover		40		30	30	35	30		20	25	20	25	20	25		20	20	25	20		50	5						40	
Tall shrub cover		15		45	20	15	20		20	20	30	40	20	29		20	20	20	20		20	25		80	40	60	80	15	
Small shrub cover		15				10	25		20	20	20	25	15	20		25	10	10	30			5			20			5	
Grass cover		20		5	10	10	3		30	30	20		30	10		30	40	40	25			35				30		10	

SUMMARY TABLE OF THE DOMINANT SPECIES USING THE MODIFIED BRAUN BLANQUET COVER-ABUNDANCE SCALE (2)

Vegetation Unit	Dominant Species	WBt-1						WBt-2						WBt-3	
	Location No.	G11	G52	G53	G61	G66	presence %	T3	T10	T11	T12	T63	presence %	T5	presence %
Woodland WBt-1	Elaeodendron aquifolium		3	3	5		60								
	Rhoicissus revoilii	4	2	3	2	4	100								
	Millettia lasiantha					3	20								
	Croton dichogamus	3	5	5		3	80					2	20		
	Nectaropetalum kaessneri		4	2	3	+	80								
	Mariscus macropus		1	1	1	2	80								
	Enteropogon sp.	3	3		2		60								
WBt-2	Dobera glabra							5	1	1	2	5	100		
	Grewia sp.		1			3	40	3	4	4	1	3	100		
	Commiphora schimperi								5	5	5		60		
	Panicum infestum								4	2	4		60		
	Leptothrium senegalense								3	6	3	2	80		
	Cenchrus ciliaris								2		2	6	60		
	Panicum maximum	3				3	40		6	2	6		60	3	100
WBt-3	Borassus aethiopum													6	100
	Combretum sp.					5	20							5	100
	Echinochloa sp.													5	100
	Cynodon dactylon													5	100
WB-1	Delonix elata														
	Platycelyphium voense														
	Boscia coriacea	4	4			+	60		4	4	4		60		
	Indigofera spinosa		3				20								
	Grewia forbesii														
	Cassia singueana		3				20								
	Aristida keniensis														
	Schoenefeldia transiens	3					20								
WB-2	Diospyros cornii		1			2	40								
	Thespesia danis					+	20	3					20		
	Terminalia spinosa														
	Croton dichogamus											2	20		
	Sporobolus marginatus														
	Schoenefeldia transiens	3													
WB-3	Hyphaene coriacea														
	Terminalia spinosa														
	Thespesia danis					+	20	3					20		
	Digitaria milanjiana														
	Panicum infestum														
Bare ground		5	20	35	15	10		30	10	15	10	15		5	
Tree cover		5	5	5		8		15				10		15	
Tall shrub cover		50	15	20	25	20		25	20	20	20	20		20	
Small shrub cover			35	25	25	42		30	30	40	30	30		30	
Grass cover		20	15	10	25	15			35	20	35	25		30	

Vegetation Unit	Dominant Species	WB-1				WB-2											
	Location No.	G15	G57	G58	presence %	T23	T25	T27	T64	T67	G1	G5	G13	G60	G64	G68	presence %
Woodland WBt-1	Elaeodendron aquifolium																
	Rhoicissus revoilii																
	Millettia lasiantha																
	Croton dichogamus	4	1		67												
	Nectaropetalum kaessneri																
	Mariscus macropus						1				3	3	4				36
	Enteropogon sp.																
WBt-2	Dobera glabra						1	1					4	4			36
	Grewia sp.	3	3	3	100						2	4	4			2	36
	Commiphora schimperi																
	Panicum infestum						3	4		4	3						36
	Leptothrium senegalense								6								9
	Cenchrus ciliaris		1		33					5							9
	Panicum maximum					4		2				3			3		36
WBt-3	Borassus aethiopum																
	Combretum sp.		4	1	67												
	Echinochloa sp.																
	Cynodon dactylon																
WB-1	Delonix elata	1	3	1	100												
	Platycelyphium voense	4	2	2	100												
	Boscia coriacea	5	4	4	100												
	Indigofera spinosa		4	4	67												
	Grewia forbesii		3	3	67												
	Cassia singueana		3	1	67												
	Aristida keniensis		4	4	67												
	Schoenefeldia transiens	3	+	+	100												
WB-2	Diospyros cornii					3	4	5	5	3	3	5	4	4	5	5	100
	Thespesia danis					5	4	6		6	3	5		2	4		72
	Terminalia spinosa		1		33		5	2	2								27
	Croton dichogamus	4	1		67					5	3	5	4	3	5	6	64
	Sporobolus marginatus						5	5									19
	Schoenefeldia transiens											4	3	5	3		36
WB-3	Hyphaene coriacea						2	2									18
	Terminalia spinosa		1		33												
	Thespesia danis																
	Digitaria milanjiana						2	5									18
	Panicum infestum					4	3	4			3						36
Bare ground		10	55	25		10	10	5	5	5	5	5	10	20	10	10	
Tree cover		3	5	5		10	5	10	20	15	7	10	7	7	10	15	
Tall shrub cover		60	10	15		20	20	15	20	20	30	55	58	10	30	40	
Small shrub cover			15	20		20	20	15	20	30				20	30	28	
Grass cover		20	10	30		40	45	55	35	30	55	25	20	40	10	5	

Vegetation Unit	Dominant Species	WB-3													
	Location No.	T14	T21	T31	T37	T38	T40	T43	T44	T48	T55	T56	T57	T58	presence %
Woodland WBt-1	Elaeodendron aquifolium														
	Rhoicissus revoilii														
	Millettia lasiantha														
	Croton dichogamus														
	Nectaropetalum kaessneri														
	Mariscus macropus		3												8
	Enteropogon sp.														
WBt-2	Dobera glabra														
	Grewia sp.		2									3			15
	Commiphora schimperi	4													8
	Panicum infestum														
	Leptothrium senegalense	6													8
	Cenchrus ciliaris		1												8
	Panicum maximum	5	4	1			3								31
WBt-3	Borassus aethiopum														
	Combretum sp.														
	Echinochloa sp.														
	Cynodon dactylon														
WB-1	Delonix elata														
	Platycelyphium voense														
	Boscia coriacea														
	Indigofera spinosa														
	Grewia forbesii														
	Cassia singueana									3				6	15
	Aristida keniensis														
	Schoenefeldia transiens														
WB-2	Diospyros cornii					1		+							15
	Thespesia danis														
	Terminalia spinosa														
	Croton dichogamus														
	Sporobolus marginatus														
	Schoenefeldia transiens														
WB-3	Hyphaene coriacea	5	5	5	7	7	7	3	3	6	4	5	7	7	100
	Terminalia spinosa	1			3	5	5		4		5	5	2		62
	Thespesia danis		2					5	3			1			31
	Digitaria milanjiana		5	5		5	5	7		6					46
	Panicum infestum			1			3	4	3			2		3	46
Bare ground		20	10	15	20	5	10	5	15	10	35	35	25	10	
Tree cover		5	5		15	15	15			5	5		5		
Tall shrub cover		15	15	15	15	20	30	10	10	20	20	20	15	15	
Small shrub cover		30	15	15	20	10	10	20	20	25	30	30	30	15	
Grass cover		30	50	50	30	15	30	60	50	40	10	10	20	60	

SUMMARY TABLE OF THE DOMINANT SPECIES USING THE MODIFIED BRAUN BLANQUET COVER-ABUNDANCE SCALE (3)

Vegetation Unit	Dominant Species	Bt				B-1							
	Location No.	T 42	T 52	T 71	presence %	G 14	G 17	G 18	G 19	G 20	G 23	G 51	presence %
Bushland	Dombeya sp.	4	1	6	100								
Bt	Grewia similis	3	6	4	100				3				14
	Panicum maximum	3	6		67		2						14
	Enteropogon macrostachyus	2		7	67			3					14
B-1	Dobera glabra					5	6	4	2	3	3	4	100
	Thespesia danis					5	4	6	5	4	4	5	100
	Grewia tenax					5	5	4	3	6	3	4	100
	Combretum hereroense					4	6	5		1	4	3	86
	Ecbolium striatum					3	5		4	3		3	71
	Diospyros cornii										4	1	29
	Indigofera schimperi	+		3	67	3	4	2		3	3		71
	Schoenefeldia transiens							3	6	4	3	4	71
	Digitaria milanjiana						4		3	5			43
B-2	Boscia coriacea								3		4		29
	Combretum hereroense												
	Commiphora campestris												
	Commiphora erythraea												
	Commiphora riparia												
	Dobera glabra												
	Cordia sinensis								3				14
	Hermania uhligii												
	Salvadora persica									3			14
	Euphorbia robecchii												
	Schoenefeldia transiens												
	Sporobolus helvolus												
	Panicum sp.					4						2	29
BG-1	Dobera glabra												
	Thespesia danis												
	Grewia tenax												
	Combretum hereroense												
	Ecbolium striatum												
	Cynodon dactylon												
	Cenchrus ciliaris	2			33					3			14
	Schoenefeldia transiens												
BG-2	Cordia sinensis												
	Boscia coriacea								3		4		29
	Dobera glabra												
	Grewia villosa								2	2	3	+	57
	Eragrostis superba												
	Enteropogon macrostachyus							3					14
	Schoenefeldia transiens												
BG-3	Acacia zanzibarica												
	Sporobolus helvolus												
Bare ground		5	10	10		10	10	15	25	20	20	30	
Tree cover													
Tall shrub cover		30	30	35		50	60	60	25	25	25	15	
Small shrub cover		30	20	30					15	20	20	30	
Grass cover		15	40	25		35	30	25	30	30	30	25	

Vegetation Unit	Dominant Species	B-2																							
	Location No.	T 6	T 7	T 8	T 9	T 13	T 26	G 2	G 3	G 9	G 10	G 24	G 25	G 29	G 35	G 36	G 38	G 39	G 40	G 41	G 42	G 43	G 47	G 65	presence %
Bushland	Dombeya sp.																								
Bt	Grewia similis																								
	Panicum maximum						+																		4
	Enteropogon macrostachyus																2				3	3	3	3	22
B-1	Dobera glabra																								
	Thespesia danis			1	6	6	5																		17
	Grewia tenax	1	2	5	1						3		4		4						1		3		39
	Combretum hereroense																								
	Ecbolium striatum	3	2	1									+						3				3	2	30
	Diospyros cornii																								
	Indigofera schimperi				2	1	2																		13
	Schoenefeldia transiens																								
	Digitaria milanjiana																						2		4
B-2	Boscia coriacea							4	4	5	5	5	3	5	4	4	4	4	3	3		3		4	61
	Combretum hereroense	6	2	6	5	5	1							2											30
	Commiphora campestris											5	4	4	3	1	4	4	2	4		+			43
	Commiphora erythraea									3	3				2					3					17
	Commiphora riparia	2	5	2	3																		3		22
	Dobera glabra	5	3	3	3	2															4		3	4	35
	Cordia sinensis								3		4	4		5	3	3	3	2	3	5		5	4		52
	Hermania uhligii					2				5		2	4	5	5	4	4	5	4			4			48
	Salvadora persica			1	+	2	1				3		2		2		2	4	3	1		+	2	2	61
	Euphorbia robecchii									2		2	2		1	1	1	1		1	3	1			43
	Schoenefeldia transiens	4		5	4	5	+			5	6	6	4	6	4	5	3	3	4	4	1	3	+		83
	Sporobolus helvolus		7	6	6	6															2		5		26
	Panicum sp.						+	6	6			1			5		2					4			30
BG-1	Dobera glabra																								
	Thespesia danis			1	6	6	5																		17
	Grewia tenax	1	2	5	1						3		4		4						1		3		39
	Combretum hereroense																								
	Ecbolium striatum	3	2	1									+						3				3	2	30
	Cynodon dactylon																								
	Cenchrus ciliaris					2	1														3				13
	Schoenefeldia transiens																								
BG-2	Cordia sinensis																								
	Boscia coriacea																								
	Dobera glabra																								
	Grewia villosa								2		3					2	3	3		4	1	4		3	39
	Eragrostis superba																								
	Enteropogon macrostachyus																2				3	3	3	3	22
	Schoenefeldia transiens																								
BG-3	Acacia zanzibarica	1	+			4	2																2		22
	Sporobolus helvolus																								
Bare ground		10	10	10	15	20	15	5	15	25	25	17	28	30	28	25	40	43	39	43	50	35	30	30	
Tree cover																									
Tall shrub cover		20	20	15	15	10	20	40	20	45	40	20	10	10	15	10	35	25	25	25	15	20	15	15	
Small shrub cover		30	35	35	30	40	20					20	20	20	20	25	10	20	25	20	10	20	25	35	
Grass cover		40	35	40	40	30	50	50	50	25	35	40	40	30	35	35	10	10	10	10	25	25	25	15	

Vegetation Unit	Dominant Species	BG-1					BG-2												BG-3					
	Location No.	G 16	G 22	G 54	G 59	presence %	T 1	G 27	G 28	G 31	G 33	G 34	G 37	G 48	G 49	G 50	G 55	presence %	T 4	T 16	G 4	G 21	G 45	presence %
Bushland	Dombeya sp.																							
Bt	Grewia similis		3			25																		
	Panicum maximum																							
	Enteropogon macrostachyus																						4	20
B-1	Dobera glabra																			2		3		40
	Thespesia danis																					3		20
	Grewia tenax							1	3		+			3		2	2	55						
	Combretum hereroense																							
	Ecbolium striatum								3	4	2	3	3	2			3	64					1	20
	Diospyros cornii	3				25																		
	Indigofera schimperi		3	1		50							4	3			3	27		1				20
	Schoenefeldia transiens																						+	20
	Digitaria milanjiana	4	4			50	4		5			3	5	4				45						
B-2	Boscia coriacea			3		25																		
	Combretum hereroense																							
	Commiphora campestris			+		25											+	9						
	Commiphora erythraea																							
	Commiphora riparia				+	25									4	3		18				5		20
	Dobera glabra																			2		3		40
	Cordia sinensis																							
	Hermania uhligii							2		4		5		+		4		45					1	20
	Salvadora persica	3				25														1	2	2	+	80
	Euphorbia robecchii			1		25				1				+	+	1		36						
	Schoenefeldia transiens																						+	20
	Sporobolus helvolus				3	25							3					9						
	Panicum sp.									2				3				18				2		20
BG-1	Dobera glabra	4	3	4	1	100														2		3		40
	Thespesia danis		5	1	3	75																3		20
	Grewia tenax	5		+	2	75																		
	Combretum hereroense		5	3	3	75																		
	Ecbolium striatum		3	3	3	75			3	4	2	3	3	2			3	64					1	20
	Cynodon dactylon	4		2	2	75							2			3		18						
	Cenchrus ciliaris		3	2	+	75				3				3				18						
	Schoenefeldia transiens		5	5		50																	+	20
BG-2	Cordia sinensis							4	5		2	3	3	3	4	4	3	82						
	Boscia coriacea			3		25		3	4		2	2	3	2	2	4		73						
	Dobera glabra						5	2	3		4	2	2				4	64		2		3		40
	Grewia villosa	2				25	3	4	3	5	3		2	4	4	4	1	91						
	Eragrostis superba						6	3					3				3	36						
	Enteropogon macrostachyus						6			3				4				27					4	20
	Schoenefeldia transiens							3	4	7	5	5	5	4	6	7	3	91					+	20
BG-3	Acacia zanzibarica				3	25													6	7	6	5	5	100
	Sporobolus helvolus				3	25							3					9	7	7	7	7	5	100
Bare ground		10	7	15	10		10	25	25	15	20	29	25	25	22	10	20		10	5	25	20	15	
Tree cover																								
Tall shrub cover		40	75	5	5		20	10	10	5	15	5	3	2	2	5	5		20	15	10	10	25	
Small shrub cover			25	15	20			15	15	10	15	20	15	20	25	25	15		10	15		15	15	
Grass cover		50	60	60	60		70	45	50	70	45	45	50	50	50	60	55		60	65	60	50	45	

SUMMARY TABLE OF THE DOMINANT SPECIES USING THE MODIFIED BRAUN BLANQUET COVER-ABUNDANCE SCALE (4)

Vegetation Unit	Dominant Species / Location No.	S			G-1				G-2												G-3			G-4				
		T54	T70	presence %	G7	G8	G30	presence %	T2	T22	T24	T32	T33	T36	G26	G32	G44	G46	G56	presence %	T15	T53	presence %	T46	T50	T59	T65	presence %
Shrubland	Maytenus undatus	6	5	100																								
S	Balanites orbicularis	2	2	100																								
	Panicum infestum		6	50																								
	Cyperus articulatus	6		50																								
Bare ground		20	15																									
Tree cover																												
Tall shrub cover																												
Small shrub cover		70	45																									
Grass cover		10	40																									
Grassland																												
G-1	Schoenefeldia transiens				7	6	7	100							1	5	1		2	36						5	25	
	Cenchrus ciliaris				5	3		67								3				9								
G-2	Echinochloa haploclada								4				6	6						27								
	Echinochloa stagnina								7	4		5								27								
	Sporobolus helvolus										-	7			7	4	7	6	7	55								
	Panicum maximum												2	5						27								
	Cynodon dactylon								2			5								18								
G-3	Cyperus rotundus										4									9	4	7	100					
	Echinochloa colonum																				7		50					
G-4	Suaeda monoica																				5		50			3	4	50
	Sporobolus spicatus																							7	6	7	6	100
Bare ground					10	25	14		20	7	15	35	10	18	10	3	29	10	17		20	20		30	35	5	30	
Tree cover					0	0																					40	
Tall shrub cover					10	15	1			8			5	2		2	5	5	2			10				60	15	
Small shrub cover							5		5	10			10			5	5	20	10		5				15		5	
Grass cover					75	55	80		70	75	80	60	75	80	90	90	60	60	70		75	70		50	50	30	10	

PLANTS OF THE TANA AREA

TREES, SHRUBS AND HERBS

1. Abutilon mauritianum
2. Acacia bussei
3. " brevispica
4. " mellifera
5. " nilotica
6. " reficiens
7. " tortilis
8. " zanzibarica
9. Achyranthes sp.
10. Adansonia digitata
11. Aloe dawei
12. Albizia sp.
13. Ammocharis tinneana
14. Asparagus buchanenii
15. " racemosus
16. Avicennia marina
17. Balanites orbicularis
18. Barleria acanthoides
19. Barringtonia racemosa
20. Borassus aethiopum
21. Boscia coriacea
22. Bothriocline somalensis
23. Brachystegia sp.
24. Bruguiera gymnorrhiza
25. Cadaba ruspolii
26. " sp.
27. Cardiogyne africana
28. Cassia sp.
29. Chlorophora excelsa
30. Cissus rotundifolia
31. Combretum hereroense
32. " sp.
33. Commelina benghalensis
34. " sp.
35. Commiphora campestris
36. " riparia
37. " schimperi
38. Cordia crenata
39. " sp.

40. Croton dichogamus
41. " sp.
42. Cynometra webberi
43. Diospyros cornii
44. Dobera glabra
45. Dombeya sp.
46. Ecbolium sp.
47. " striatum
48. Euclea divinorum
49. Euphorbia candelabrum
50. " robechii
51. " sp.
52. " tirucalii
53. Ficus sp.
54. " sycomorus
55. Garcinia livingstonei
56. Gomphocarpus sp.
57. Grewia bicolor
58. " similis
59. " sp.
60. " tenax
61. " villosa
62. Harrisonia abyssinica
63. Heliotropium sp.
64. Hermania uhligii
65. Hibiscus sp.
66. Hyphaene coriacea
67. Indigofera schimperi
68. " sp.
69. Ipomoea batatas
70. " cairica
71. Lannea stuhlmannii
72. Lantana sp.
73. " trifolia
74. Lawsonia inermis
75. Maerua sp.
76. Mangifera indica
77. Manilkara sansibarensis
78. Maytenus undatus
79. Melia sp.

80. Ormocarpum sp.
81. Phoenix reclinata
82. Phyllanthus somalensis
83. Psidium guajava
84. Rhizophora mucronata
85. Rhus vulgaris
86. Salvadora persica
87. Sansevieria conspicia
88. " sp.
89. Securinega virosa
90. Sesbania sesban
91. Sida sp.
92. Sideroxylon inerma
93. Solanum incanum
94. Sphaeranthus sp.
95. Suaeda monoica
96. Syzygium cordatum
97. Tephrosia sp.
98. Terminalia brownii
99. " sp.
100. " spinosa
101. Thespesia danis
102. Tribulus sp.
103. Triumfetta flavescens
104. Vernonia sp.

GRASSES AND SEDGES

1. Bothriochloa glabra
2. " insculpta
3. Brachiaria brizantha
4. " sp.
5. Cenchrus ciliaris
6. Chloris pycnothrix
7. Chrysopogon aucheri
8. Cynodon dactylon
9. " plectostachyus
10. Cyperus articulatus
11. " sp.

12. Cyperus rotundas
13. Digitaria milanjiana
14. " sp.
15. Echinochloa colonum
16. " haploclada
17. " sp.
18. " staginina
19. Enteropogon macrostachyus
20. Eragrostis sp.
21. " superba
22. Eustachys paspaloides
23. Heteropogon contortus
24. Hyparrhenia fufa
25. Leptothrium senegalense
26. Leptochloa obtusiflora
27. Mariscus sp.
28. Panicum infestum
29. " maximum
30. " sp.
31. Pennisetum purpureum
32. Schmidtia sp.
33. Schoenefeldia transiens
34. Setaria sp.
35. " sphacelata
36. Sporobolus helvolus
37. " marginatus
38. " sp.
39. " spicatus

PLANTS OF GALANA RANCHING AREA

TREES, SHRUBS AND HERBS

1. Albizia sp.
2. Abutilon mauritianum
3. Abutilon sp.
4. Acacia brevispica
5. " bussei
6. " horrida

7. Acacia mellifera
8. " nilotica
9. " reficiens
10. " seyal
11. " sp.
12. " zanzibarica
13. Adenium obesum
14. Afzelia cuanzensis
15. Albizia sp.
16. Alocasia sp.
17. Aloe sp.
18. Anisotes parvifolius
19. Asparagus buchanenii
20. " sp.
21. Balanites sp.
22. Barleria acanthoides
23. Blepharispermum sp.
24. Borassus aethiopum
25. Boscia coriacea
26. Bothriocline somalensis
27. Brachystegia spiciformis
28. Bridelia cathartica
29. Cadaba farinosa
30. " glandulosa
31. Caesalpinia sp.
32. " trothaei
33. Canthium schimperianum
34. Carissa edulis
35. Cassia singueana
36. Cissus rotundifolia
37. Clematis sp.
38. Combretum exalatum
39. " hereroense
40. " illairii
41. " molle
42. " sp.
43. Commelina sp.
44. Commiphora africana
45. " campestris
46. " erythraea

47. Commiphora riparia
48. " schimperi
49. " sp.
50. Cordia sinensis
51. " sp.
52. Croton dichogamus
53. " sp.
54. Cucumis sp.
55. Cynometra webberi
56. Delonix elata
57. Diospyros comii
58. " sp.
59. Dobera glabra
60. Ecbolium striatum
61. Echeveria sp.
62. Elaeodendron aquifolium
63. Encephalartos hildebrandtii
64. " sp.
65. Erythrina excelsa
66. " sp.
67. Euclea divinorum
68. Euphorbia grandicornis
69. " robecchii
70. " sp.
71. " tirucalli
72. Gardenia jovis-tonantis
73. Grewia bicolor
74. " forbesii
75. " praecox
76. " similis
77. " sp.
78. " sulcata
79. " tenax
80. " villosa
81. Heinsia crinita
82. Hermania uhligii
83. Hibiscus tiliaceus
84. Indigofera schimperi
85. " sp.

86. Indigofera spinosa
87. Ipomoea cairica
88. " membassana
89. " sp.
90. " spathulata
91. Lannea sp.
92. " stuhlmannii
93. Lantana sp.
94. Leucas sp.
95. Maerua denhardtiorum
96. " sp.
97. Manilkara sulcata
98. Mariscus sp.
99. Melia volkensii
100. Millettia lasiantha .
101. " sp.
102. Nectaropetalum kaessneri
103. Ochna mossambicensis
104. Platycelyphium voense
105. Portulaca sp.
106. Psychotria amboniana
107. Pteris sp.
108. Rhizophora mucronata
109. Rhoicissus revoilii
110. Rhus natalensis
111. " sp.
112. " vulgaris
113. Salacia sp.
114. Salsola dendroides
115. Salvadora persica
116. Sansevieria conspicia
117. " cylindrica
118. " sp.
119. Securinega virosa
120. Sesbania sesban
121. Sideroxylon inerme
122. Solanum incanum
123. " sp.
124. Sonneratia alba
125. Strophanthus sp.

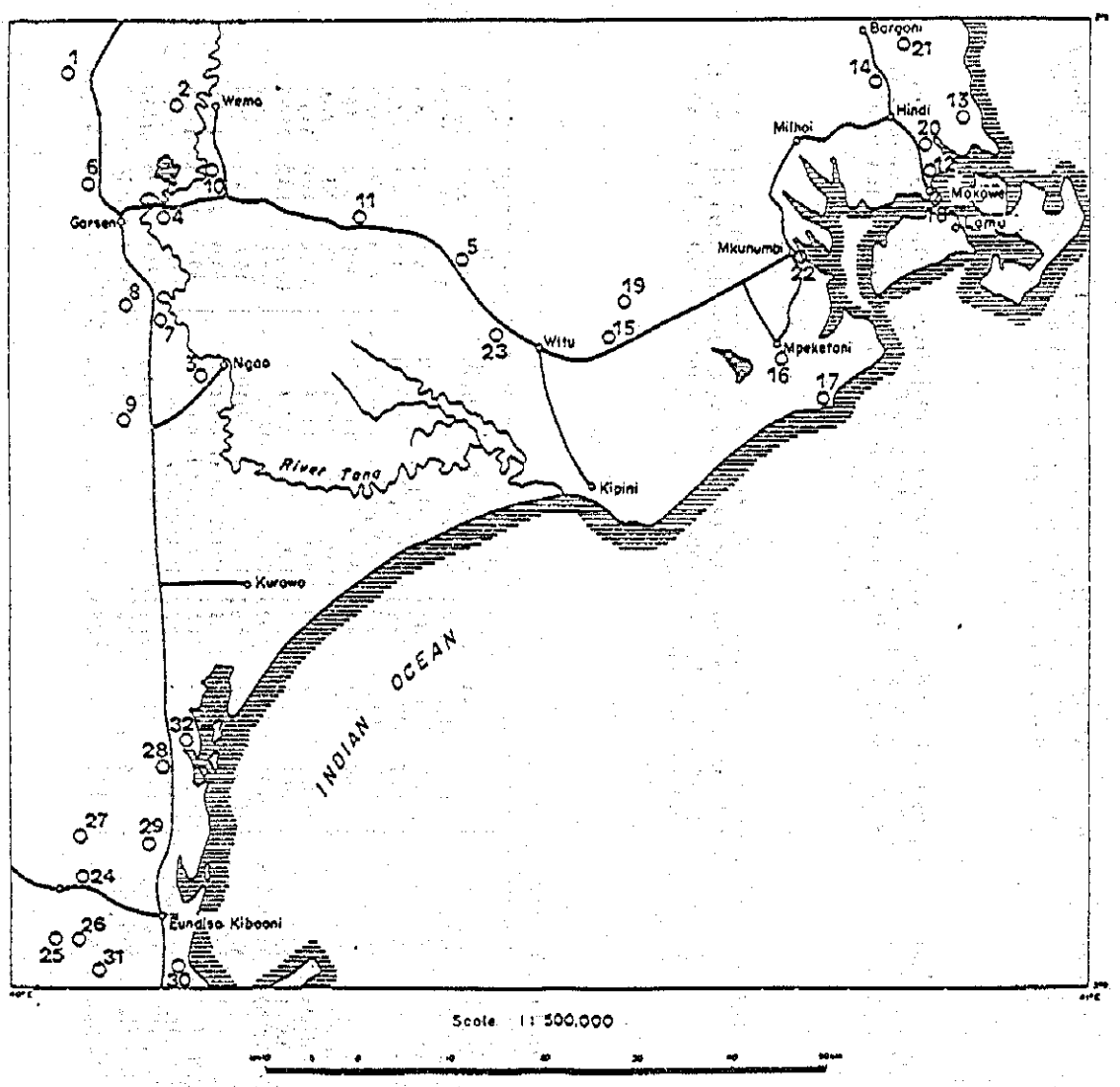
126. Strychnos sp.
127. Suregada zanzibarensis
128. Tephrosia sp.
129. Terminalia parvula
130. " prunioides
131. " sp.
132. " spinosa
133. Thespesia danis
134. Tinnea aethiopica
135. Tribulus sp.
136. Uvaria lucida
137. Ximenia americana

GRASSES AND SEDGES

1. Aristida adoensis
2. " keniensis
3. " sp.
4. Becium sp.
5. Blepharis linariifolia
6. Bothriochloa glabra
7. Brachiaria brizantha
8. " sp.
9. Cenchrus ciliaris
10. " sp.
11. Chloris sp.
12. Cynodon dactylon
13. " sp.
14. Cyperus sp.
15. Dactyloctenium sp.
16. Digitaria milanjiana
17. " sp.
18. " velutina
19. Echinocloa haploclada
20. " sp.
21. " staginina
22. Enteropogon macrostachyus
23. " sp.
24. Eragrostis ciliaris

25. Eragrostis sp.
26. " superba
27. Hyparrhenia rufa
28. Imperata cylindrica
29. Leptothrium senegalense
30. Leptochloa obtusiflora
31. Mariscus macropus
32. " sp.
33. Panicum infestum
34. " maximum
35. " sp.
36. Pennisetum sp.
37. Sacciolepis curvata
38. Schmidtia sp.
39. Schoenefeldia transiens
40. Setaria sp.
41. " sphacelata
42. Sporobolus helvolus
43. " sp.
44. " spicatus

SOIL



SURVEY POINT	SURVEY PERIOD
1 ~ 22	'81 11~'82 2
23 ~ 32	'82 7~'82 10

LOCATION MAP OF SOIL SURVEY

Unit PtJso, Profile 1

Soil classification:	orthic Solonetz
Agro-climatic zone:	VI.
Observation:	179/1; Tana River District; E. 40°3'. S. 2°4'; 37m.
Geological formation:	Lagoonal sands and clays.
Local petrography:	Sands and clays.
Physiography unit:	Middle terrace.
Relief-macro:	Flat.
Relief-meso, micro:	Sink hole.
Vegetation/Land use:	Bushed Grassland/Grazing.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	0%
Salinity/alkalinity:	Moderately sodic.
Surface crack:	Nil.
Internal drainage class:	Moderately well drained.

A 0–7cm. Dusky red (2.5YR 5/1 dry, 2.5YR 3/1 moist); silty loam; strong, medium, crumb structure; soft when dry, friable when moist, slightly sticky and plastic when wet; common fine roots:

Bn 7–35cm Dusky red (2.5YR 3/1 dry, 2.5YR 3/1 moist); silty loam, strong, very coarse, columnor structure; hard when dry, very firm when moist, sticky and very plastic when wet; few, small, spherical white concretions; few medium roots:

Btn 35–140 cm+ Dusky red (2.5Y 4/1 dry, 2.5YR 3/1 moist); clay loam; strong, very coarse, subangular blocky structure; extremely hard when dry, firm when moist, very sticky and very plastic when wet; frequent, small, spherical white concretions; few medium roots:

LABORATORY DATA SHEET

Horizon		A	Bn	Btn	Horizon		A	Bn	Btn
Depth	cm	5	30	80	Exch. Na	me/100g	0.40	3.66	10.50
Bulk density	g/cm³	1.20	1.45	1.46	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	5.2	5.1	5.3
Sand	%	36.5	29.0	24.0	SiO_2/R_2O_3	mol/mol	4.2	4.1	4.3
Silt	%	50.5	65.2	41.5	Fe_2O_3	mmol/100g	37.59	36.97	39.47
Clay	%	13.0	5.8	34.5	Available P	ppm	498	328	458
Class		SiL	SiL	CL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		8.5	8.9	8.9	HCO_3	me/l	302.8	396.0	349.4
pH–KCl (1:2.5)		7.2	7.4	7.7	SO_4	me/l	10.72	1.12	16.96
EC (1:2.5)	mmho/cm	0.25	1.10	3.90	Flocc. Index	%	34.6	–	76.8
C	%	1.2	0.7	0.6	K (25%HCl)	me/100g	32.8	29.8	29.8
N	%	0.315	0.070	0.041	Ca (25%HCl)	me/100g	93.0	210.0	164.0
C/N		3.8	10.0	14.6	Mg (25%HCl)	me/100g	89.6	121.2	132.4
CEC pH7.0	me/100g	38.0	38.0	39.8	P (25%HCl)	ppm	1017	697	771
Exch. Ca	me/100g	35.8	29,8	28.2	P (sorption)	mg/100g	1740	1870	1530
Exch. Ma	me/100g	9.56	17.34	19.3	Hp	me/100g	0.22	0.26	0.22
Exch. K	me/100g	2.84	1.10	1.25					

Unit PrAvc, Profile 2

Soil classification:	chromic Vertisols (sodic phase).
Agro-climatic zone:	VI.
Observation:	179/1, Tana River District; E. 40°13', S. 2°8'; 19m.
Geological formation:	Recent alluvial deposits.
Local petrography:	Sands, silts and clays.
Physiography unit:	Natural levees.
Relief-macro:	Gently undulating.
Relief-meso, micro:	Gilgai.
Vegetation/Land use:	Bush thicket/Grazing.
Evidence of erosion:	Non detected.
Surface stoniness:	Nil.
Slope gradient:	0 ∿ 2%.
Salinity/alkalinity:	Moderately sodic.
Surface crack:	0.5 ∿ 1 cm width.
Internal drainage class:	Moderately well drained.

A 0–15cm Dark reddish brown (5YR 4/3 dry, 5YR 3/3 moist); loam; strong, medium, crumb structure; hard when dry, firm when moist, sticky and very plastic; many fine roots;

Cn_1 15–85cm Dark brown (7.5YR 3/3 moist); common red mottles; silty clay loam; strong, coarse, prismatic structure; extremely firm when moist, very sticky and very plastic when wet; few, small, spherical, white concretions; common fine, few medium roots;

Cn_2 85–140cm+ Dark brown (7.5YR 3/3 moist); few red mottles; silty loam; strong, coarse, prismatic structure; very firm when moist, very sticky and very plastic when wet; frequent, small, spherical, white concretion; and few, small, spherical, black manganese nodules; slickenside; few medium roots;

LABORATORY DATA SHEET

Horizon		A	Cn1	Cn2	Horizon		A	Cn1	Cn2
Depth	cm	10	50	100	Exch. Na	me/100g	1.86	3.22	7.91
Bulk density	g/cm³	1.52	1.61	1.59	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	4.1	4.5	5.5
Sand	%	25.5	18.0	26.5	SiO_2/R_2O_3	mol/mol	3.3	3.6	4.5
Silt	%	49.0	54.0	67.2	Fe_2O_3	mmol/100g	5.63	52.63	46.36
Clay	%	25.5	28.0	6.3	Available P	ppm	244	269	431
Class		L	SiCL	SiL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		7.8	8.8	8.0	HCO_3	me/l	218.9	524.1	163.0
pH–KCl (1:2.5)		6.1	7.1	.2	SO_4	me/l	3,36	0.87	63.90
EC (1:2.5)	mmho/cm	0.22	0.25	7.60	Flocc. Index	%	35.3	33.9	33.3
C	%	0.6	0.4	0.3	K (25%HCl)	me/100g	20.5	20.0	20.2
N	%	0.052	0.040	0 034	Ca (25%HCl)	me/100g	35.4	47.2	82.3
C/N		11.5	10.0	8.8	Mg (25%HCl)	me/100g	77.6	83.4	88.2
CEC pH7.0	me/100g	36.0	36.0	34.8	P (25%HCl)	ppm	686	647	767
Exch. Ca	me/100g	26.58	30.55	34.8	P (sorption)	mg/100g	1140	1190	1460
Exch. Ma	me/100g	11.50	13.08	13.4	Hp	me/100g	0.16	0.25	0.14
Exch. K	me/100g	1.31	0.96	0.78					

Unit PcA_1qf, Profile 3

Soil classification:	ferralic Arenosols.
Agro-climatic zone:	V.
Observation:	179/3, Tana River District; E. 40°10'. S. 2°26'; 24m.
Geological formation:	Dune sands.
Local petrography:	Sands.
Physiography unit:	Dunes.
Relief-macro:	Rolling.
Relief-meso, micro:	Nil.
Vegetation/Land use:	Grassland/fallow.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	2 ∿ 5%.
Salinity/alkalinity:	Nil.
Surface crack:	Nil.
Internal drainage class:	Some what excessively drained.

Ap 0–15cm Yellowish red (5YR 5/6 dry, 5YR 4/6 moist); sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; many fine roots; diffuse and smooth transition to:

B 15–130cm+ Yellowish red (5YR 5/8 dry, 5YR 4/8 moist); sandy loam; single grain; loose when dry and moist, non-sticky and non-plastic when wet; many fine and few medium roots;

LABORATORY DATA SHEET

Horizon		Ap	B	B	Horizon		Ap	B	B
Depth	cm	10	50	120	Exch. Na	me/100g	0.39	0.04	0.07
Bulk density	g/cm³	1.50	1.53	1.50	Base sat	%	100+	66.2	75.0
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	21.0	21.0	17.6
Sand	%	91.8	82.0	86.8	SiO_2/R_2O_3	mol/mol	18.4	18.4	15.7
Silt	%	2.0	3.5	2.2	Fe_2O_3	mmol/100g	6.89	6.89	8.15
Clay	%	6.2	14.5	11.0	Available P	ppm	46	36	25
Class		S	SL	LS	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		6.7	5.2	5.5	HCO_3	me/l	384.3	34.9	23.3
pH-KCl (1:2.5)		5.4	3.9	3.8	SO_4	me/l	0.69	0.81	1.10
EC (1:2.5)	mmho/cm	0.08	0.04	0.04	Flocc. index	%	11.3	13.8	45.5
C	%	0.2	0.2	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.037	0.026	0.019	Ca (25%HCl)	me/100g	<3.0	<3.0	<3.0
C/N		5.4	7.7	5.3	Mg (25%HCl)	me/100g	<3.0	<3.0	<3.0
CEC pH7.0	me/100g	2.6	3.2	3.4	P (25%HCl)	ppm	133	122	122
Exch. Ca	me/100g	2.23	0.77	0.33	P (sorption)	mg/100g	< 50	<50	<50
Exch. Ma	me/100g	1.00	1.15	1.50	Hp	me/100g	0.16	0.72	0.77
Exch. K	me/100g	0.43	0.29	0.65					

Unit PrAje, Profile 4

Soil classification:	eutric Fluvisols.
Agro-climatic zone:	V.
Observation:	179/3, Tana River District; E. 40°8'. S. 2°16'; 14m.
Geological formation:	Recent alluvial deposits.
Local petrography:	Sands, silts and clays.
Physiography unit:	Natural levees.
Relief-macro:	Flat.
Relief-meso, micro:	Small depression.
Vegetation/Land use:	Grassland/Grazing.
Evidence of erosion:	Non detected.
Surface stoniness:	Nil.
Slope gradient:	0%
Salinity/alkalinity:	Nil.
Surface crack:	Nil at site, but big crack in adjacent field.
Internal drainage class:	Moderately well drained.

A 0–10cm Reddish brown (7.5YR 7/6 dry, 5YR 4/3 moist); sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; many fine roots;

C_1 10–20cm Dusky red (2.5YR 3/1 dry, 2.5YR 3/1 moist); loam; strong, coarse, prismatic structure; very hard when dry, firm when moist, very sticky and very plastic when wet; common fine roots;

C_2 20–25cm Yellowish red (5YR 6/8 dry, 5YR 4/6 moist); sand; single grain; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots:

C_3 25–40cm Dark brown (10YR 7/4 dry, 10YR 3/3 moist); sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; common fine roots;

C_4 40–125cm+ Dark reddish gray (5YR 4/2 moist); few red mottles; cracking clay loam; strong, coarse, prismatic structure; very firm when moist, very sticky and very plastic when wet; few, small, black ironstone nodules; common fine roots;

LABORATORY DATA SHEET

Horizon		A	C_1	C_3	Horizon		A	C_1	C_3
Depth	cm	5	15	30	Exch. Na	me/100g	0.07	0.28	0.08
Bulk density	g/cm³	1.35	1.21	1.34	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	14.9	4.8	9.3
Sand	%	91.0	27.0	90.5	SiO_2/R_2O_3	mol/mol	13.4	4.0	8.1
Silt	%	3.0	49.0	2.0	Fe_2O_3	mmol/100g	10.03	43.86	16.92
Clay	%	6.0	24.0	7.5	Available P	ppm	107	256	176
Class		S	L	S	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2,5)		8.7	8.4	8.8	HCO_3	me/l	186.3	198.0	232.9
pH-KCl (1:2.5)		7.7	7.1	7.8	SO_4	me/l	0.44	1.57	0.62
EC (1:2.5)	mmho/cm	0.11	0.27	0.09	Flocc. index	%	4.67	79.17	60.00
C	%	0.1	0.3	0.1	K (25%HCl)	me/100g	3.1	24.0	4.8
N	%	0.013	0.029	0.012	Ca (25%HCl)	me/100g	36.5	83.8	22.8
C/N		7.7	10.3	8.3	Mg (25%HCl)	me/100g	13.3	97.9	19.3
CEC pH7.0	me/100g	3.4	39.2	4.8	P (25%HCl)	ppm	242	538	647
Exch. Ca	me/100g	10.69	32.4	11.41	P (sorption)	mg/100g	80	1730	250
Exch. Mg	me/100g	1.66	13.0	1.91	Hp	me/100g	0.15	0.15	0.12
Exch. K	me/100g	0.35	1.01	0.22					

Unit PcA_2qf, Profile 5

Soil classification:	ferralic Arenosols
Agro-climatic zone:	V
Observation:	179/4 Tana River district; E. 40°20', S. 2°/9' ; 17m
Geological formation:	Dune sands
Local petrography:	Sands
Physiography unit:	Dunes
Relief-macro:	Undulating
Relief-meso, micro:	Nil
Vegetation/Land use:	Bushed Grassland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	1 ~ 2%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Well Drained

A 0–10cm Very dusky red (2.5YR 2/3 dry, 25YR 2/2 moist); sandy loam; single grain; loose when dry, friable when moist, non-sticky and non-plastic when wet; many fine roots; clear and smooth transition to:

BA 10–40cm Red (10R 4/8 dry, 10R 4/6 moist); sandy loam; single grain; loose when dry, friable when moist, slightly sticky and non-plastic when wet; common fine roots; gradual and smooth transition to:

Bu_1 40–230cm Dark red (10R 6/8 dry, 2.5YR 3/6 moist); loamy sand; moderate, medium, subangular structure, slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; very few medium pores; few fine routs:

(auger boring from 100cm below)

LABORATORY DATA SHEET

Horizon		A	BA	Bul	Horizon		A	BA	Bul
Depth	cm	5	30	150	Exch. Na	me/100g	0.08	0.14	0.04
Bulk density	g/cm³	1.41	1.55	1.44	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	9.9	9.0	9.7
Sand	%	83.0	78.5	81.5	SiO_2/R_2O_3	mol/mol	9.1	8.4	8.8
Silt	%	6.0	6.5	6.5	Fe_2O_3	mmol/100g	12.53	13.16	16.29
Clay	%	11.0	15.0	12.0	Available P	ppm	44	20	19
Class		SL	SL	LS	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		6.6	6.8	6.3	HCO_3	me/l	23.3	34.9	34.9
pH–KCl (1:2.5)		5.3	5.1	4.8	SO_4	me/l	0.46	0.51	0.09
EC (1:2.5)	mmho/cm	0.09	0.04	0.04	Floce. index	%	83.64	86.67	79.17
C	%	0.04	0.3	0.2	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.043	0.032	0.022	Ca (25%HCl)	me/100g	3.8	3.4	3.4
C/N		9.3	9.4	9.1	Mg (25%HCl)	me/100g	4.7	6.8	5.3
CEC pH7.0	me/100g	3.5	4.3	2.9	P (25%HCl)	ppm	182	161	157
Exch. Ca	me/100g	2.90	2.67	2.01	P (sorption)	mg/100g	<50	110	80
Exch. Ma	me/100g	1.15	1.54	1.00	Hp	me/100g	0.14	0.12	0.14
Exch. K	me/100g	0.52	0.42	0.30					

Unit PtJso, Profile 6

Soil classification:	orthic Solonetz (saline phase).
Agro-climatic zone:	VI.
Observation:	179/1, Tana River District; E. 40°4'. S. 2°14'; 28m.
Geological formation:	Lagoonal sands and clays.
Local petrography:	Sands and clays.
Physiography unit:	Lower terraces.
Relief-macro:	Flat to gently undulating.
Relief-meso, micro:	Micro depression.
Vegetation/Land use:	Bushland.
Evidence of erosion:	Non detected.
Surface stoniness:	Nil.
Slope gradient:	0 ∿ 1%.
Salinity/alkalinity:	Slightly saline and moderately sodic.
Surface crack:	Nil.
Internal drainage class:	Moderately well drained.

A 0–10cm Gray (10YR 6/1 dry, 10YR 3/1 moist); loam; weak, fine, crumb structure; loose when dry, friable when moist, very sticky and very plastic; many fine roots; clear and smooth transition to:

Btn 10–45cm Dark gray (10YR 6/1 dry, 10YR 4/1 moist); common light reddish brown mottles; loam, moderate, medium, prismatic structure; slightly hard when dry, firm when moist, very sticky and very plastic when wet; frequent, small, spherical, white concretions, and frequent, small, spherical black manganese; common fine roots; clear and irregular transition to:

Btnz 45–120cm+ Dark gray (10YR 6/1 dry, 10YR4/1 moist); few light reddish brown mottles; cracking clay; strong, very coarse, prismatic structure; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; few, small, spherical, white concretions and frequent, small, spherical black manganese; few fine roots:

LABORATORY DATA SHEET

Horizon		A	Btn	Btnz	Horizon		A	Btn	Btnz
Depth	cm	5	30	80	Exch. Na	me/100g	0.25	3.04	11.13
Bulk density	g/cm³	1.17	1.51	1.47	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	6.8	6.3	6.0
Sand	%	39.0	35.5	27.0	SiO_2/R_2O_3	mol/mol	5.7	5.3	4.9
Silt	%	47.5	47.5	32.5	Fe_2O_3	mmol/100g	31.33	31.95	33.21
Clay	%	13.5	17.0	40.5	Available P	ppm	242	220	265
Class		L	L	C	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		8.4	9.1	8.9	HCO_3	me/l	244.6	500.8	384.3
pH–KCl (1:2.5)		7.2	7.5	7.8	SO_4	me/l	1.70	0.42	60.75
EC (1:2.5)	mmho/cm	0.22	0.60	4.20	Flocc. index	%	37.04	–	81.48
C	%	0.7	0.3	0.2	K (25%HCl)	me/100g	33.8	28.2	31.7
N	%	0.100	0.037	0.030	Ca (25%HCl)	me/100g	94.9	172.5	160.0
C/N		7.0	8.1	6.7	Mg (25%HCl)	me/100g	93.6	114.7	132.4
CEC pH7.0	me/100g	29.4	31.8	34.8	P (25%HCl)	ppm	527	506	482
Exch. Ca	me/100g	34.8	28.4	23.5	P (sorption)	mg/100g	1490	1860	1460
Exch. Mg	me/100g	9.37	16.85	16.24	Hp	me/100g	0.12	0.38	0.30
Exch. K	me/100g	2.14	1.02	1.45					

Unit PrAje, Profile 7

Soil classification:	eutric Fluvisols.(sodic phase)
Agro-climatic zone:	V
Observation:	179/3 Tana River district; E. 40°7'; S. 2°23'; 18m
Geological formation:	Recent alluvial deposits
Local petrography:	Sands, silts and clays
Physiography unit:	Valley bottom lands
Relief-macro:	Flat
Relief-meso, micro	Macro relief-land and depression
Vegetation/Land use:	Glassland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	Moderately sodic
Surface crack:	Crack width 0.5 – 1cm
Internal drainage class:	Moderately well drained

A 0–13cm. Brownish black (5Y 4/1 dry, 2.5Y 3/1 moist); loam; moderate, fine, crumb structure; loose when dry, friable when moist, very stick and very plastic when wet; few fine roots; clear and smooth transition to:

C1 13–20cm. Light gray (7.5Y 8/1 dry, 7.5Y 7/1 moist); sand; single grain; loose when dry and moist, non-sticky and non-plastic; common fine roots; clear and smooth transition to:

Cck 20–60cm. Very dark gray (5Y 4/1 dry, 5Y 3/1 moist); slightly gravelly clay loam; moderate, medium, prismatic structure; very firm when moist, very sticky and plastic when wet; few, small, spherical, white concretions; common fine roots; clear and smooth transition to:

Cn 60–120cm+ Very dark gray (25Y dry, 5Y 3/1 moist); slightly gravelly sandy loam; moderate, coarse, prismatic structure; extremely firm when moist, sticky and plastic when wet; very frequently, small, spherical, white concretions; very fine roots:

LABORATORY DATA SHEET

Horizon		A	Cck	Cn	Horizon		A	Cck	Cn
Depth	cm	10	40	90	Exch. Na	me/100g	1.03	2.04	2.14
Bulk density	g/cm³	1.18	1.49	1.62	Base sat	%	100+	100+	100+
Gravel	%	ND'	ND.	ND.	SiO_2/Al_2O_3	mol/mol	8.9	12.8	16.6
Sand	%	41.5	35.0	59.5	SiO_2/R_2O_3	mol/mol	7.7	10.7	14.8
Silt	%	37.0	29.0	10.5	Fe_2O_3	mmol/100g	19.42	18.17	13.16
Clay	%	21.5	36.0	30.0	Available P	ppm	152	54	50
Class		L	CL	SCL	CO_3	me/l	ND'	ND.	ND.
pH–H_2O (1:2.5)		8.0'	8.8	9.2	HCO_3	me/l	302.8	396.0	384.3
pH–KCl (1:2.5)		6.9	7.0	7.3	SO_4	me/l	2.84	1.00	4.47
EC (1:2.5)	mmho/cm	0.39	0.20	0.42	Flocc. index	%	60.5	52.8	31.7
C	%	0.6	0.2	0.1	K (25%HCl)	me/100g	13.0	9.5	8.7
N	%	0.076	0.023	0.016	Ca (25%HCl)	me/100g	44.5	32.0	42.5
C/N		7.9	8.7	6.3	Mg (25%HCl)	me/100g	56.1	52.9	49.8
CEC pH7.0	me/100g	35.7	30.0	22.5	P (25%HCl)	ppm	281	168	161
Exch. Ca	me/100g	29.18	20.91	17.3	P (sorption)	mg/100g	1120	490	1340
Exch. Ma	me/100g	9.08	9.84	7.86	Hp	me/100g	0.11	0.12	0.24
Exch. K	me/100g	1.90	0.78	0.47					

Unit PtJxh, Profile 8

Soil classification:	calcic Xerosols (sodic phase)
Agro-climatic zone:	V
Observation:	179/3; Tana River district; E. 40°5', S. 2°22'; 22m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands and clays
Physiography unit:	Middle terraces
Relief-macro:	Flat
Relief-meso, micro:	Nil
Vegetation/Land use:	Bushland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	Slightly sodic
Surface crack:	Nil
Internal drainage class:	Moderately well drained

A 0–15cm. Dark grayish brown (7.5YR 4/2 dry, 10YR 4/2 moist); sandy clay loam; moderate, medium, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; common fine roots; clear and smooth transition to:

Bck 15–55cm Brownish gray (7.5YR 4/1 moist); few reddish yellow mottles; cracking sandy loam; strong medium, prismatic structure; very firm when moist, sticky and plastic when wet; frequent lime mycelia; common fine roots; clear and irregular transition to:

Bn 55–120cm+ Brownish gray (7.5YR 5/1 moist); few reddish yellow mottles; cracking sandy loam; strong, very coarse, prismatic structure; very firm when moist, sticky and plastic when wet; frequent lime mycelia; few fine roots:

LABORATORY DATA SHEET

Horizon		A	Bck	Bn	Horizon		A	Bck	Bn
Depth	cm	10	35	80	Exch. Na	me/100g	0.20	0.73	3.70
Bulk density	g/cm³	1.70	1.73	1.98	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	23.3	19.3	18.6
Sand	%	68.5	61.5	59.5	SiO_2/R_2O_3	mol/mol	20.0	16.9	16.3
Silt	%	10.5	22.5	28.5	Fe_2O_3	mmol/100g	14.41	10.03	10.65
Clay	%	21.0	16.0	12.0	Available P	ppm	161	97	64
Class		SCL	SL	SL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		7.1	9.1	8.7	HCO_3	me/l	163.0	302.8	279.5
pH–KCl (1:2.5)		6.0	7.5	7.7	SO_4	me/l	3.20	3.66	72.60
EC (1:2.5)	mmho/cm	0.18	0.24	2.50	Floce. index	%	71.4	34.4	75.8
C	%	0.6	0.2	0.1	K (25%HCl)	me/100g	8.1	4.2	3.3
N	%	0.072	0.022	0.013	Ca (25%HCl)	me/100g	16.0	109.5	116.8
C/N		8.3	9.1	7.7	Mg (25%HCl)	me/100g	27.3	44.7	54.7
CEC pH7.0	me/100g	16.2	19.2	20.0	P (25%HCl)	ppm	256	140	115
Exch. Ca	me/100g	14.75	27.9	27.7	P (sorption)	mg/100g	510	1360	1620
Exch. Mg	me/100g	4.19	8.11	9.25	Hp	me/100g	0.07	0.17	0.20
Exch. K	me/100g	1.07	0.34	0.32					

Unit PtJxK, Profile 9

Soil classification:	calcic Xerosols
Agro-climatic zone:	V
Observation:	179/3 Tana River district; E. 40°6', S. 2°29'; 25m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands and clays
Physiography unit:	Middle terraces
Relief-macro:	Undulating
Relief-meso, micro:	Micro depression
Vegetation/Land use:	Bushed grassland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0 ~ 2%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Moderately well drained

A 0–15cm Drownish black (10YR 2/3 moist); sandy loam; single grain; friable when moist, slightly sticky and slightly plastic when wet; many fine roots; gradual and smooth transition to:

AB 15–30cm Yellowish brown (10YR 5/4 moist); sandy loam; weak, medium, granular structure; friable when moist, slightly sticky and plastic when wet; many fine roots; clear and wave transition to:

Bck_1 30–65cm Dull grayish brown (2.5Y 4/4 dry, 2.5Y 4/2 moist); sandy loam; moderate, coarse, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; frequent lime mycelia; common fine roots; diffuse and irregular transition to:

Bck_2 65–120cm$^+$ Dull grayish brown (25Y 4/4 dry, 2.5Y 4/2 moist); sandy loam; moderate, coarse, subangular blocky structure; hard when dry, very firm when moist, sticky and plastic when wet; frequent lime mycelia; few fine roots:

LABORATORY DATA SHEET

Horizon		A	AB	Bck1	Horizon		A	AB	Bck1
Depth	cm	5	20	50	Exch. Na	me/100g	0.24	0.16	0.09
Bulk density	g/cm³	1.56	1.62	1.62	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	19.7	19.6	18.1
Sand	%	72.0	68.0	65.0	SiO_2/R_2O_3	mol/mol	17.3	17.1	15.9
Silt	%	11.0	15.0	33.5	Fe_2O_3	mmol/100g	0.03	10.03	10.03
Clay	%	17.0	17.0	1.5	Available P	ppm	976	1053	195
Class		SL	SL	SL	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		6.9	8.2	8.0	HCO_3	me/l	209.6	302.8	279.5
pH-KCl (1:2.5)		6.0	7.3	7.5	SO_4	me/l	2.60	6.76	27.00
EC (1:2.5)	mmho/cm	0.35	0.32	2.50	Flocc. index	%	86.5	85.3	—
C	%	0.6	0.5	0.2	K (25%HCl)	me/100g	11.0	10.5	9.5
N	%	0.064	0.048	0.029	Ca (25%HCl)	me/100g	20.0	43.3	210.0
C/N		9.4	10.4	6.9	Mg (25%HCl)	me/100g	27.1	35.3	39.2
CEC pH7.0	me/100g	13.8	17.0	16.2	P (25%HCl)	ppm	838	1112	231
Exch. Ca	me/100g	3.69	27.22	51.3	P (sorption)	mg/100g	870	800	2290
Exch. Ma	me/100g	3.16	3.22	2.54	Hp	me/100g	0.11	0.09	0.17
Exch. K	me/100g	1.84	2.00	2.80					

Unit PrAvc, Profile 10

Soil classification:	chromic Vertisols
Agro-climatic zone:	VI
Observation:	179/1 Tana River district; E. 40°10', S. 2°12'; 17m
Geological formation:	Recent alluvial deposits
Local petrography:	Sands, silts and clays
Physiography unit:	Flood plains
Relief-macro:	Flat
Relief-meso, micro:	Micro depression by plowing
Vegetation/Land use:	Cropland (Rice, Maize)
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	Nil
Surface crack:	Crack 0.5 ∿ 1.0cm width
Internal drainage class:	Moderately well drained

Ap 0–30cm Dark reddish brown (5YR 3/3 moist); common orange mottles; cracking silty clay loam, moderate, medium, angular blocky structure; very firm when moist, very sticky and very plastic when wet; many fine roots; gradual and smmoth transition to:

C_1 30–70cm Dark reddish brown (5YR 3/2 moist); common orange mottles; cracking silty clay loam; moderate, coarse, prismatic structure; very firm when moist, very sticky and very plastic when wet; few, small, spherical, black manganese nodules; many fine roots; gradual and smooth transition to:

C_2 70–120cm+ Brown (7.5YR 4/3 moist); few orange mottles; cracking silty clay; moderate, very coarse, angular blocky structure; very firm when dry, very sticky and very plastic when wet; frequent, small, spherical, black manganese nodules; very few fine roots:

LABORATORY DATA SHEET

Horizon		Ap	C1	C2	Horizon		Ap	C1	C2
Depth	cm	5	50	90	Exch. Na	me/100g	0.67	1.13	1.41
Bulk density	g/cm³	1.12	1.32	1.47	Base sat	%	97.01+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	2.9	3.0	3.2
Sand	%	5.0	8.5	7.0	SiO_2/R_2O_3	mol/mol	2.3	2.3	2.5
Silt	%	61.0	54.5	52.5	Fe_2O_3	mmol/100g	74.56	75.19	73.31
Clay	%	34.0	37.0	40.5	Available P	ppm	117	64	98
Class		SiCL	SiCL	SiC	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		6.2	7.1	7.2	HCO_3	me/l	ND.	23.3	104.8
pH–KCl (1:2.5)		4.9	5.6	5.6	SO_4	me/l	1.56	2.24	2.74
EC (1:2.5)	mmho/cm	0.35	0.33	0.27	Flocc. index	%	83.2	85.1	44.4
C	%	1.7	0.6	0.6	K (25%HCl)	me/100g	29.8	28.8	27.3
N	%	0.160	0.07	0.064	Ca (25%HCl)	me/100g	40.3	35.5	34.8
C/N		10.6	8.6	9.4	Mg (25%HCl)	me/100g	100.0	99.9	96.5
CEC pH7.0	me/100g	42.8	39.8	36.8	P (25%HCl)	ppm	1126	806	929
Exch. Ca	me/100g	28.50	27.47	27.91	P (sorption)	mg/100g	1880	1600	1710
Exch. Mg	me/100g	11.01	11.34	12.02	Hp	me/100g	0.11	0.09	0.09
Exch. K	me/100g	1.34	0.90	0.68					

Unit PtJbk, Profile 11

Soil classification:	calcic Cambisols (saline-sodic phase)
Agro-climatic zone:	V
Observation:	179/4 Lamu district; E. 40°/7', S. 2°17' ; 11m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands and clays
Physiography unit:	Middle terraces
Relief-macro:	Flat to gently undulating
Relief-meso, micro:	Small depression
Vegetation/Land use:	Forest/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	1 ∿ 2%
Salinity/alkalinity:	Slightly saline and moderately sodic
Surface crack:	Nil
Internal drainage class:	Moderately well drained

A 0–25cm Dark reddish brown (5YR 2/2 moist); loam; moderate, fine, crumb structure; friable when moist, slightly sticky and very plastic when wet; many fine roots; clear and smooth transition to:

Bn 25–45cm Dark olive brown (2.5YR 3/3); cracking silty loam; moderate, medium, subangular blocky structure; very friable when moist, sticky and very plastic when wet; few, small, powdely soft lime, and very few gypsum; common medium roots; gradual and smooth transition to:

Bckn 45–80cm Brown (10YR 4/3 moist); silty loam; moderate, medium, subangular blocky structure; very friable when moist, sticky and very plastic when wet; frequent, small, powdely soft lime and few gypsum; moderate slickenside; few medium roots; gradual and irregular transition to:

By 80–120cm+ Yellowish brown (10YR 5/2 moist); silty clay; moderate, medium, subangular blocky structure, very friable when moist, sticky and very plastic when wet; few, small, powdery soft lime and few gypsum:

LABORATORY DATA SHEET

Horizon		A	Bn	Bckn	Horizon		A	Bn	Bckn
Depth	cm	5	40	60	Exch. Na	me/100g	0.92	3.06	7.77
Bulk density	g/cm³	1.15	1.57	1.38	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	7.1	6.5	5.8
Sand	%	50.5	40.5	37.0	SiO_2/R_2O_3	mol/mol	5.9	5.1	4.8
Silt	%	40.5	50.5	60.8	Fe_2O_3	mmol/100g	28.82	35.09	33.83
Clay	%	9.0	9.0	2.2	Available P	ppm	68	88	87
Class		L	SiL	SiL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		6.3	8.4	8.5	HCO_3	me/l	209.6	279.5	174.7
pH–KCl (1:2.5)		5.7	7.4	7.7	SO_4	me/l	6.40	108.0	142.2
EC (1:2.5)	mmho/cm	0.60	2.30	7.00	Floce. Index	%	55.6	55.6	–
C	%	2.5	0.5	0.1	K (25%HCl)	me/100g	13.0	11.5	11.3
N	%	0.230	0.047	0.018	Ca (25%HCl)	me/100g	38.2	180.5	171.5
C/N		10.9	10.6	5.6	Mg (25%HCl)	me/100g	51.8	90.1	97.6
CEC pH7.0	me/100g	34.8	28.0	30.6	P (25%HCl)	ppm	535	369	2741
Exch. Ca	me/100g	29.06	29.3	34.5	P (sorption)	mg/100g	1060	1740	1590
Exch. Ma	me/100g	8.16	16.79	21.80	Hp	me/100g	0.09	0.27	0.21
Exch. K	me/100g	1.35	0.90	0.71					

Unit PcA_2qa, Profile 12

Soil classification:	albic Arenosols (pesoferric phase)
Agro-climatic zone:	IV
Observation:	180/2 Lamu district; E. 40°51', S. 2°14'; 5.5m
Geological formation:	Dune sands
Local petrography:	Sands
Physiography unit:	Dunes
Relief-macro:	Flat
Relief-meso, micro:	Micro depression
Vegetation/Land use:	Grassland/Village
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Somewhat excessively drained

A 0–35cm Dark brown (2.5YR 5/1 dry, 10YR 3/3 moist); sand; weak, medium, crumb structure; loose when dry, very friable when moist, non-sticky and non-plastic when wet; many fine and medium roots; gradual and smooth transition to:

Bs_1 35–55cm Brown (10YR 4/4 dry, 7.5YR 4/3 moist); many brown mottles; sand; weak, fine, prismatic structure; soft when dry, very friable when moist, non-sticky and non-plastic when wet; frequent, small, irregular, black ironstones; few coarse pores; few fine roots; gradual and irregular transition to:

Bs_2 55–100cm Dull yellow (25Y 6/3 moist); many brown mottles; sandy loam; weak, fine, prismatic structure; firm when moist, non-sticky and non-plastic when wet; very frequent, small, irregular, black ironstones (manganes concretions); very few fine roots:

Bs_3 100–120cm+ Light brownish gray (2.5Y 6/2 moist); many brown mottles; loam; moderate, fine prismatic structure; extremely firm when moist, slightly sticky and slightly plastic when wet;

LABORATORY DATA SHEET

Horizon		A	Bs1	Bs2	Horizon		A	Bs1	Bs2
Depth	cm	10	40	80	Exch. Na	me/100g	0.05	0.08	0.26
Bulk density	g/cm³	1.37	1.49	1.52	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	13.3	13.5	10.6
Sand	%	90.0	88.0	81.0	SiO_2/R_2O_3	mol/mol	12.1	12.3	9.8
Silt	%	6.0	6.0	7.0	Fe_2O_3	mmol/100g	5.64	6.89	12.53
Clay	%	4.0	6.0	12.0	Available P	ppm	14	12	2
Class		S	S	SL	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		6.5	6.6	6.5	HCO_3	me/l	116.5	ND.	477.5
pH-KCl (1:2.5)		5.3	4.7	4.5	SO_4	me/l	1.16	0.30	0.06
EC (1:2.5)	mmho/cm	0.06	0.03	0.05	Floce. index	%	–	25.0	29.2
C	%	0.3	0.1	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.026	0.014	0.010	Ca (25%HCl)	me/100g	5.8	<3.0	7.0
C/N		11.5	7.1	10.0	Mg (25%HCl)	me/100g	<3.0	<3.0	3.6
CEC pH7.0	me/100g	2.6	1.7	3.2	P (25%HCl)	ppm	126	98	165
Exch. Ca	me/100g	2.10	1.04	1.62	P (sorption)	mg/100g	260	90	940
Exch. Ma	me/100g	0.47	0.57	1.36	Hp	me/100g	0.12	0.15	0.13
Exch. K	me/100g	0.25	0.23	0.26					

Unit PtJqc, Profile 13

Soil classification:	cambic Arenosols
Agro-climatic zone:	IV
Observation:	180/2 Lamudistrict; E 40°53', S.2°10'; 6m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands
Physiography unit:	Middle terraces
Relief-macro:	Flat
Relief-meso, micro:	Nil
Vegetation/Land use:	Bushland thicket/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Well drained

A 0–14cm Very dark grayish brown (2.5Y 6/2 dry, 2.5Y 3/2 moist); loamy sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; many fine roots; gradual and smooth transition to:

Bu_1 10–80cm Darkgrayish brown (2.5Y 7/2 dry, 2.5Y 4/2 moist); sand; weak, fine, angular blocky structure; slightly hard when dry, loose when moist, non-sticky and non-plastic when wet; few medium pores; common fine roots; clear and smooth transition to:

Bu_2 80–120cm+ Yellowish brown (10YR 6/4 dry, 10YR 5/4 wet); common brown mottles; sandy loam; moderate, fine, angular blocky; hard when dry, firm when moist, non-sticky and non-plastic when wet; very few fine roots:

LABORATORY DATA SHEET

Horizon		A	Bu1	Bu2	Horizon		A	Bu1	Bu2
Depth	cm	5	50	90	Exch. Na	me/100g	0.04	0.01	0.04
Bulk density	g/cm³	1.49	1.47	1.57	Base sat	%	100+	100+	81.4
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	17.9	14.9	12.4
Sand	%	86.5	90.5	80.5	SiO_2/R_2O_3	mol/mol	17.0	14.3	11.7
Silt	%	8.5	4.0	2.5	Fe_2O_3	mmol/100g	3.8	3.8	6.9
Clay	%	5.0	5.5	17.0	Available P	ppm	263	36	58
Class		LS	S	SL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		8.0	6.1	5.5	HCO_3	me/l	ND.	23.3	163.0
pH–KCl (1:2.5)		7.4	4.7	4.0	SO_4	me/l	0.26	0.40	0.20
EC (1:2.5)	mmho/cm	0.23	0.04	0.03	Flocc. Index	%	20.0	--	60.0
C	%	1.0	0.1	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.100	0.018	0.016	Ca (25%HCl)	me/100g	20.0	5.2	<3.0
C/N		10.0	5.6	6.3	Mg (25%HCl)	me/100g	<3.0	<3.0	<3.0
CEC pH7.0	me/100g	4.8	1.7	3.6	P (25%HCl)	ppm	239	140	256
Exch. Ca	me/100g	7.60	1.33	2.08	P (sorption)	mg/100g	550	420	750
Exch. Ma	me/100g	1.06	0.29	0.54	Hp	me/100g	0.12	0.29	0.49
Exch. K	me/100g	0.48	0.24	0.27					

Unit PtJqa, Profile 14

Soil classification:	albic Arenosols
Agro-climatic zone:	IV
Observation:	180/2 Lamu district; E. 40°48', S. 2°7'; 15m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands
Physiography unit:	Middle terraces
Relief-macro:	Flat to gently undulating
Relief-meso, micro:	Weak depressions
Vegetation/Land use:	Forest/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	1 – 2%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Well drained

A 0–18cm Brownish black (10YR 2/2 dry, 7.5YR 3/1 moist); sandy loam; weak, medium, subangular blocky; soft when dry, very friable when moist, non-sticky and non-plastic when wet; few coarse pores, many fine roots; gradual and wave transition to:

E(?) 18–40cm Dull brown (10YR 7/3 dry, 7.5YR 5/3 moist); few reddish yellow mottles; sandy loam; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, non-sticky and non-plastic when wet; common medium roots; clear and wave transition to:

B 40–120cm+ Yellow (10YR 7/6 moist); many reddish yellow mottles; sandy loam; weak, medium, angular blocky structure; firm when moist, non-sticky and non-plastic when wet; common medium roots:

LABORATORY DATA SHEET

Horizon		A	E	B	Horizon		A	E	B
Depth	cm	10	30	70	Exch. Na	me/100g	0.11	0.05	0.02
Bulk density	g/cm³	1.47	1.55	1.55	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	120.4	125.3	53.5
Sand	%	77.0	78.5	77.5	SiO_2/R_2O_3	mol/mol	92.9	96.7	44.8
Silt	%	3.5	4.5	3.5	Fe_2O_3	mmol/100g	3.8	3.8	5.6
Clay	%	19.5	17.0	19.0	Available P	ppm	16	7	1>
Class		SL	SL	SL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		6.8	6.0	6.4	HCO_3	me/l	104.8	46.6	46.6
pH–KCl (1:2.5)		5.9	4.4	5.1	SO_4	me/l	0.18	0.78	0.34
EC (1:2.5)	mmho/cm	0.11	0.04	0.03	Flocc. Index	%	74.4	82.4	90.5
C	%	0.8	0.1	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.062	0.017	0.009	Ca (25%HCl)	me/100g	7.0	15.0	<3.0
C/N		12.9	5.9	11.1	Mg (25%HCl)	me/100g	3.5	<3.0	<3.0
CEC pH7.0	me/100g	4.3	1.0	0.8	P (25%HCl)	ppm	129	87	91
Exch. Ca	me/100g	3.07	0.80	0.62	P (sorption)	mg/100g	50	<50	<50
Exch. Mg	me/100g	1.02	0.41	0.41	Hp	me/100g	0.09	0.22	0.11
Exch. K	me/100g	0.26	0.16	0.06					

Unit PtJqa, Profile 15

Soil classification:	albic Arenosols (pesoferric phase)
Agro-climatic zone:	IV
Observation:	180/3 Lamu district; E. 40°32', S. 2°22'; 20m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands
Physiography unit:	Middle terraces
Relief-macro:	Flat to gently undulating
Relief-meso, micro:	Micro depression
Vegetation/Land use:	Forest/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0 – 1%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Well drained

A 0–20cm Black (7.5Y 4/1 dry, 7.5Y 2/1 moist); loamy sand; moderate, fine, crumb structure; soft when dry, loose when moist, non-sticky and non-plastic when wet; few coarse pores; common fine roots; gradual and smooth transition to:

E(?) 20–50cm Olive brown (5Y 7/3 dry, 2.5Y 4/6 moist); sand; weak, medium, subangular blocky structure; soft when dry, loose when moist, non-sticky and non-plastic when wet; common medium roots; diffuse and wave transition to:

Bs_1 50–90cm Light yellowish brown (2.5Y 5/4 dry, 10YR 6/4 moist); many reddish yellow mottles; loamy sand; moderate, medium, angular blocky structure; hard when dry, loose when moist, non-sticky and non-plastic when wet; few coarse pores, common medium roots; gradual and smooth transition to:

Bs_2 90–120cm+ Reddish yellow (7.5YR 6/6 moist); few reddish yellow mottles; loamy sand; moderate, medium, angular blocky structure; hard when dry, loose when moist, non-sticky and non-plastic when wet; few coarse pores;

LABORATORY DATA SHEET

Horizon		A	E	Bsl	Horizon		A	E	Bsl
Depth	cm	5	30	60	Exch. Na	me/100g	0.03	0.04	0.05
Bulk density	g/cm³	1.50	1.61	1.54	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	51.5	75.6	40.4
Sand	%	85.0	90.5	88.0	SiO_2/R_2O_3	mol/mol	43.2	57.9	32.7
Silt	%	10.0	2.5	1.5	Fe_2O_3	mmol/100g	5.6	6.3	8.8
Clay	%	5.0	7.0	10.5	Available P	ppm	33	4	1
Class		LS	S	LS	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		7.4	7.1	6.7	HCO_3	me/l	279.5	116.5	81.5
pH-KCl (1:2.5)		6.7	5.8	5.3	SO_4	me/l	0.50	0.38	0.38
EC (1:2.5)	mmho/cm	0.07	0.04	0.04	Flocc. index	%	64.0	28.6	38.1
C	%	1.1	0.2	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.076	0.020	0.017	Ca (25%HCl)	me/100g	9.5	<3.0	<3.0
C/N		14.5	10.0	5.9	Mg (25%HCl)	me/100g	3.1	<3.0	3.7
CEC pH7.0	me/100g	7.8	1.7	2.4	P (25%HCl)	ppm	101	76	108
Exch. Ca	me/100g	8.08	1.11	1.09	P (sorption)	mg/100g	220	<50	<50
Exch. Mg	me/100g	1.85	1.05	1.50	Hp	me/100g	0.11	0.12	0.14
Exch. K	me/100g	0.27	0.22	0.23					

Unit PtJ'lc, Profile 16

Soil classification:	chromic Luvisols
Agro-climatic zone:	IV
Observation:	180/3 Lamu district; E. 40°43', S. 2°24'; 11m
Geological formation:	Calcareous lagoonal sands and clays
Local petrography:	Calcareous sands and clays
Physiography unit:	Middle terraces
Relief-macro:	Flat
Relief-meso, micro:	Nil
Vegetation/Land use:	Cropland (Bananas, Mangos)
Evidence of erosion:	Non detected
Surface stoniness:	Very few stone
Slope gradient:	0%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Well drained

Ap 0–10cm Black (5YR 2/3 dry, 5YR 2/1 moist); sandy loam; weak, fine, crumb structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; few medium pores; many fine roots; gradual and smooth transition to:

AB 10–35cm Dusky red (2.5YR 3/4 dry, 2.5YR 3/2 moist); sandy loam; moderate, medium, subangular blocky structure; hard when dry, firm when friable, slightly sticky and plastic when wet; few medium pores; few fine roots, gradual and smooth transition to:

Bt 35–50/80cm Red (2.5YR 4/6 moist); sandy clay loam; moderate, medium, subangular blocky structure; firm when moist, sticky and very plastic when wet; few medium pores, few fine roots; abrupt and irregular transition to:

IIC 50/80–80cm^{+} Hard coral limestone

LABORATORY DATA SHEET

Horizon		Ap	AB	Bt	Horizon		Ap	AB	Bt
Depth	cm	5	25	50	Exch. Na	me/100g	0.09	0.03	0.07
Bulk density	g/cm^3	1.15	1.34	1.36	Base sat	%	100+	100+	97.0
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	12.7	7.6	6.8
Sand	%	68.0	61.0	55.5	SiO_2/R_2O_3	mol/mol	10.6	6.6	5.9
Silt	%	20.0	21.0	17.0	Fe_2O_3	mmol/100g	19.4	25.1	26.9
Clay	%	12.0	18.0	27.5	Available P	ppm	256	141	68
Class		SL	SL	SCL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		7.2	7.8	6.6	HCO_3	me/l	116.5	163.0	58.2
pH–KCl (1:2.5)		6.2	6.5	5.1	SO_4	me/l	0.06	ND.	0.12
EC (1:2.5)	mmho/cm	0.08	0.05	0.05	Floce. index	%	79.2	58.3	78.2
C	%	1.6	0.6	0.3	K (25%HCl)	me/100g	6.7	7.6	6.8
N	%	0.130	0.072	0.054	Ca (25%HCl)	me/100g	22.8	25.8	11.1
C/N		12.3	8.3	5.6	Mg (25%HCl)	me/100g	8.8	9.8	9.3
CEC pH7.0	me/100g	15.6	11.6	12.8	P (25%HCl)	ppm	1021	975	1000
Exch. Ca	me/100g	14.54	12.25	9.61	P (sorption)	mg/100g	260	170	400
Exch. Ma	me/100g	2.78	1.95	2.03	Hp	me/100g	0.11	0.09	0.09
Exch. K	me/100g	0.83	0.70	0.70					

Unit PcA_2qc, Profile 17

Soil classification:	cambic Arenosols
Agro-climatic zone:	IV
Observation:	180/3 Lamu district; E. 40°44', S. 2°27'; 26m
Geological formation:	Dune sands
Local petrography:	Sands
Physiography unit:	Dunes
Relief-macro:	Rolling
Relief-meso, micro:	Nil
Vegetation/Land use:	Shrubland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	7 – 8%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Somewhat excessively drained

A 0–10cm Very dark grayish brown (2.5Y 4/2 dry, 2.5Y 3/2 moist); loamy sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; many fine and common medium roots; clear and smooth transition to:

B 10–140cm+ Brownish yellow (10YR 8/6 dry, 10YR6/6 moist); loamy sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; many fine and common medium roots:

LABORATORY DATA SHEET

Horizon		A	B	B	Horizon		A	B	B
Depth	cm	5	40	80	Exch. Na	me/100g	0.06	0.03	0.09
Bulk density	g/cm³	1.33	1.35	1.33	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	11.3	11.1	12.3
Sand	%	85.5	82.0	99.0	SiO_2/R_2O_3	mol/mol	9.8	9.8	11.0
Silt	%	0.7	13.0	0.4	Fe_2O_3	mmol/100g	15.0	12.5	10.0
Clay	%	13.8	5.0	0.6	Available P	ppm	182	78	68
Class		LS	LS	S	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		8.5	8.6	8.9	HCO_3	me/l	442.5	267.9	256.2
pH–KCl (1:2.5)		8.0	8.4	8.7	SO_4	me/l	0.10	0.07	0.03
EC (1:2.5)	mmho/cm	0.16	0.13	0.10	Flocc. index	%	81.9	–	–
C	%	0.6	0.2	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.052	0.022	0.009	Ca (25%HCl)	me/100g	335.0	413.5	490.0
C/N		11.5	9.1	11.1	Mg (25%HCl)	me/100g	17.0	20.6	29.6
CEC pH7.0	me/100g	2.3	0.7	0.4	P (25%HCl)	ppm	485	358	274
Exch. Ca	me/100g	14.5	q5.4	16.78	P (sorption)	mg/100g	< 50	510	280
Exch. Ma	me/100g	1.62	1.72	1.44	Hp	me/100g	0.14	0.13	0.10
Exch. K	me/100g	0.10	0.04	0.03					

Unit TA_1ge, Profile 18

Soil classification:	eutric Gleysols (saline phase).
Agro-climatic zone:	IV.
Observation:	180/2 Lamu District; E. 40°53', S. 2°15'; 2m.
Geological formation:	Beach sands and muds of coastal creeks.
Local petrography:	Sands.
Physiography unit:	Sand flats
Relief-macro:	Flat.
Relief-meso, micro:	Nil.
Vegetation/Land use:	Bush land.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	0%
Salinity/alkalinity:	Moderately saline.
Surface crack:	Nil.
Internal drainage class:	Poorly drained.

Az 0–10cm Dark brown (7.5YR 4/4 moist); many dark brown mottles; sandy clay loam; massive; loose when moist, non-sticky and non-plastic when wet; many fine roots; gradual and smooth transition to:

Bz 10–30cm Dark brown (7.5YR 4/4 moist); many dark brown mottles; loamy sand; massive; loose when moist; non-sticky and non-plastic, when wet; few, small, black, manganese nodules; many fine roots; gradual and smooth transition to:

Bgz 30–80cm+ Dark brown (7.5YR 4/4 moist); many yellow orange and many pell yellow mottles; many olive black humus substance; massive; loose when moist, non-sticky and non-plastic when wet; few, small, black, manganese nodules:

LABORATORY DATA SHEET

Horizon		Az	Bz	Bgz	Horizon		Az	Bz	Bgz
Depth	cm	5	20	80	Exch. Na	me/100g	0.59	1.16	0.89
Bulk density	g/cm³	1.50	1.61	1.54	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	16.4	14.3	14.6
Sand	%	74.5	82.5	80.5	SiO_2/R_2O_3	mol/mol	15.4	13.3	13.7
Silt	%	2.5	4.0	8.5	Fe_2O_3	mmol/100g	5.6	6.9	6.3
Clay	%	23.0	13.5	11.0	Available P	ppm	12	17	11
Class		SCL	LS	SL	CO_2	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		8.0	7.7	7.7	HCO_3	me/l	279.5	81.5	116.5
pH-KCl (1:2.5)		7.8	7.4	7.3	SO_4	me/l	9.00	51.00	46.80
EC (1:2.5)	mmho/cm	6.50	9.60	9.70	Floce. index	%	37.0	22.2	61.8
C	%	0.3	0.2	0.1	K (25%HCl)	me/100g	<3.0	3.5	3.1
N	%	0.024	0.018	0.010	Ca (25%HCl)	me/100g	<3.0	3.2	<3.0
C/N		12.5	11.1	10.0	Mg (25%HCl)	me/100g	5.1	8.5	7.5
CEC pH7.0	me/100g	1.8	2.7	2.1	P (25%HCl)	ppm	119	175	172
Exch. Ca	me/100g	0.8	0.88	0.75	P (sorption)	mg/100g	<50	<50	<50
Exch. Ma	me/100g	1.69	1.91	1.46	Hp	me/100g	0.08	0.11	0.09
Exch. K	me/100g	0.40	0.76	.61					

Unit BAvp, Profile 19

Soil classification:	pellic Vertisols.
Agro-climatic zone:	IV.
Observation:	180/3 Lamu District; E. 40°33', S. 2°19'; 14m.
Geological formation:	Recent alluvial deposits.
Local petrography:	Sands, silts and clays.
Physiography unit:	Bottomland.
Relief-macro:	Flat.
Relief-meso, micro:	Gilgai.
Vegetation/Land use:	Grassland/Grazing.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	0%
Salinity/alkalinity:	Nil.
Surface crack:	Crack 10cm width.
Internal drainage class:	Imperfectly drained.

A 0–20cm Balck (7.5YR 1.7/1 moist); cracking clay; strong, coarse, prismatic structure; very hard when dry, extremely firm when moist, very sticky and very plastic when wet; few, big, irregular, white concretions; many fine roots; gradual and wave transition to:

C_1 20–50cm Black (7.5YR 1.7/1, moist); common brownish yellow mottles; cracking clay; strong, coarse, angular blocky structure; very hard when dry, extremely firm when moist, very sticky and very plastic when wet; few, big, irregular, white concretions; moderate slickenside; few medium roots; gradual and wave transition to:

C_2 50–120cm+ Very dark gray (N 3/0 moist); many browish yellow mottles; cracking clay; strong, coarse, prismatic structure, very hard when dry, extremely firm when moist, very sticky and very plastic when wet; few, big, irregular, white concretions, moderate slickenside, few fine roots:

LABORATORY DATA SHEET

Horizon		A	C1	C2	Horizon		A	C1	C2
Depth	cm	15	30	80	Exch. Na	me/100g	0.88	0.78	0.73
Bulk density	g/cm³	1.03	1.62	1.82	Base sat	%	90.7	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	4.3	4.8	6.1
Sand	%	29.0	6.0	17.5	SiO_2/R_2O_3	mol/mol	4.0	4.2	5.3
Silt	%	21.5	17.0	16.0	Fe_2O_3	mmol/100g	19.4	31.3	28.8
Clay	%	49.5	77.0	66.5	Available P	ppm	14	3	24
Class		C	C	C	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		5.9	6.4	7.2	HCO_3	me/l	58.2	46.6	139.8
pH–KCl (1:2.5)		4.4	5.1	5.6	SO_4	me/l	0.41	0.14	1,92
EC (1:2.5)	mmho/cm	0.14	0.16	0.16	Flocc. index	%	91.9	79.2	45.1
C	%	2.2	0.5	0.3	K (25%HCl)	me/100g	4.1	3.5	<3.0
N	%	0.270	0.070	0.034	Ca (25%HCl)	me/100g	19.5	13.7	14.7
C/N		8.1	7.1	8.8	Mg (25%HCl)	me/100g	12.9	14.4	15.5
CEC pH7.0	me/100g	30.6	19.6	16.8	P (25%HCl)	ppm	140	122	119
Exch. Ca	me/100g	17.52	13.01	12.25	P (sorption)	mg/100g	900	790	180
Exch. Ma	me/100g	7.98	7.10	5.86	Hp	me/100g	0.36	0.13	0.09
Exch. K	me/100g	1.36	0.75	0.27					

Unit PcA_2qa, Profile 20

Soil classification:	alabic Arenosols.
Agro-climatic zone:	IV.
Observation:	180/2 Lamu District; E. 40°51', S. 2°11'; 7m.
Geological formation:	Dune sands.
Local petrography:	Sands.
Physiography unit:	Interlevee lowland.
Relief-macro:	Flat to very gently undulating.
Relief-meso, micro:	Nil.
Vegetation/Land use:	Bushed grasland/Grazing.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	1 ∿ 2%.
Salinity/alkalinity:	Nil.
Surface crack:	Nil.
Internal drainage class:	Some what excessively drained.

A 0–20cm Dark grayish brown (10YR 6/2 dry, 10YR 4/2 moist); sandy loam; moderate, fine to medium, subangular blocky structure; slightly hard when dry, very friable when moist, non-sticky and non-plastic when wet; few, fine pores; many very fine roots; clear and smooth transition to:

Bu_1 20–60cm Grayish brown (10YR 7/2 dry, 10YR 5/2 moist); sandy loam; moderate, medium, sub-angular blocky structure; slightly hard when hard, loose when moist; non-sticky and non-plastic when wet; very few fine pores; common very fine, few medium roots; gradual and smooth transition to:

Bu_2 60–110cm+ Light gray (10YR 8/1 dry, 10YR 7/2 moist); few strong brown mottles; sandy loam; weak, medium, sub-angular blocky; loose when dry and moist, non-sticky and non-plastic when wet; many fine pores; very few fine and medium roots:

LABORATORY DATA SHEET

Horizon		A	Bu1	Bu2	Horizon		A	Bu1	Bu2
Depth	cm	5	55	100	Exch. Na	me/100g	0.01>	0.01>	0.01
Bulk density	g/cm³	1.45	1.56	1.52	Base sat	%	100+	100+	96.7
Gravel	%	ND	ND.	ND.	SiO_2/Al_2O_3	mol/mol	39.0	32.0	32.9
Sand	%	75.5	81.0	83.0	SiO_2/R_2O_3	mol/mol	36.7	30.4	31.2
Silt	%	2.5	2.0	2.0	Fe_2O_3	mmol/100g	2.5	2.5	2.5
Clay	%	19.0	17.0	15.0	Available P	ppm	6	7	8
Class		SL	SL	SL	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		6.0	6.4	6.4	HCO_3	me/l	23.3	11.6	ND.
pH-KCl (1:2.5)		4.7	5.2	5.0	SO_4	me/l	0.36	0.63	0.18
EC (1:2.5)	mmho/cm	0.04	0.02	0.02	Floce. index	%	89.5	88.2	–
C	%	0.2	0.1	0.04	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.024	0.009	0.005	Ca (25%HCl)	me/100g	<3.0	<3.0	<3.0
C/N		8.3	11.1	8.0	Mg (25%HCl)	me/100g	<3.0	<3.0	<3.0
CEC pH7.0	me/100g	0.8	0.5	0.3	P (25%HCl)	ppm	76	59	69
Exch. Ca	me/100g	0.46	0.32	0.14	P (sorption)	mg/100g	<50	<50	<50
Exch. Mg	me/100g	0.45	0.16	0.09	Hp	me/100g	0.27	0.15	0.12
Exch. K	me/100g	0.06	0.04	0.05					

Unit PrAqa, Profile 21

Soil classification:	albic Arenosols.
Agro-climatic zone:	V.
Observation:	180/2 Lamu District; E. 40°49', S. 2°1'; 7m.
Geological formation:	Recent alluvial deposits.
Local petrography:	Sands, silts and clays.
Physiography unit:	Valley bottom lowlands.
Relief-macro:	Undulating.
Relief-meso, micro:	Nil.
Vegetation/Land use:	Wooded bush land.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	1 ∼ 2%.
Salinity/alkalinity:	Nil.
Surface crack:	Nil.
Internal drainage class:	Somewhat excessively drained.

A 0–10cm Grayish brown (2.5Y 7/3 dry, 2.5Y 5/2 moist); common reddish yellow mottles; sand; massive; hard when dry, friable when moist; non-sticky and non-plastic when wet; few medium pores; gradual and smooth transition to:

BA 10–60cm Light yellow (2.5Y 8/3 dry, 2.5Y 7/3 moist), common reddish yellow mottles; sand; massive; hard when dry, friable when moist, non-sticky and non-plastic when wet; few medium pores; common fine roots; gradual and smooth transition to:

Bu 60–120cm White (2.5Y 8/2 moist); common reddish yellow mottles; loamy sand; moderate, fine, sub-angular blocky structure; friable when moist, non-sticky and non-plastic when wet; common medium roots; clear and smooth transition to:

Bg 120–140cm‡ Light gray (5Y 7/2 moist); common yellowish red mottles; loamy sand; moderate, medium, sub-angular blocky structure; non-sticky and non-plastic when wet; few medium roots:

LABORATORY DATA SHEET

Horizon		A	Bu	Bg	Horizon		A	Bu	Bg
Depth	cm	5	90	130	Exch. Na	me/100g	0.06	0.05	1.29
Bulk density	g/cm³	1.63	1.37	1.72	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	25.0	26.9	10.4
Sand	%	93.0	84.5	83.0	SiO_2/R_2O_3	mol/mol	23.2	25.2	9.5
Silt	%	2.0	2.5	4.0	Fe_2O_3	mmol/100g	4.4	3.8	11.9
Clay	%	5.0	13.0	13.0	Available P	ppm	4	1	3
Class		S	LS	LS	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		5.8	6.4	5.0	HCO_3	me/l	ND.	93.2	23.3
pH-KCl (1:2.5)		4.4	5.0	3.7	SO_4	me/l	3.56	0.84	1.78
EC (1:2.5)	mmho/cm	0.04	0.03	0.29	Flocc. Index	%	14.0	4.6	11.5
C	%	0.2	0.04	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.015	0.005	0.082	Ca (25%HCl)	me/100g	<3.0	<3.0	<3.0
C/N		13.3	8.0	1.2	Mg (25%HCl)	me/100g	<3.0	<3.0	5.4
CEC pH7.0	me/100g	1.0	0.2	4.8	P (25%HCl)	ppm	87	50	76
Exch. Ca	me/100g	0.73	0.13	1.46	P (sorption)	mg/100g	<50	<50	<50
Exch. Mg	me/100g	0.43	0.07	2.50	Hp	me/100g	0.21	0.12	0.37
Exch. K	me/100g	0.06	0.01	0.05					

Unit PtJqa, Profile 22

Soil classification:	albic Arenosols (pesoferric phase)
Agro-climatic zone:	IV.
Observation:	180/3 Lamu District; E. 40°44', S. 2°19'; 8m.
Geological formation:	Lagoonal sands and clays.
Local petrography:	Sands.
Physiography unit:	Lower terraces.
Relief-macro:	Flat.
Relief-meso, micro:	Nil.
Vegetation/Land use:	Bushed grassland.
Evidence of erosion:	None detected.
Surface stoniness:	Nil.
Slope gradient:	0%
Salinity/alkalinity:	Nil.
Surface crack:	Nil.
Internal drainage class:	Moderately well.

A 0–20cm Black (7.5YR 4/1 dry, 7.5YR2/1 moist); loamly sand; moderate, coarse, sub-angular blocky structure; soft when dry, very friable when moist, non-sticky and non-plastic when wet; few medium pores; many fine, common big roots; clear and smooth transition to:

AB 20–35cm Dark brown (7.5YR 6/2 dry, 7.5YR 4/2 moist); common, very dark brown mottles; sand; massive, slightly hard when dry, very friable when moist; non-sticky and non-plastic when wet; frequent, small, spherical, black manganese nodules; few fine pores; common fine, common big roots; gradual and irregular transition to:

E(?) 35–60cm Dull brown (7.5YR 8/2 dry, 7.5YR 5/3 moist); many very dark brown mottles; sand; massive; slightly hard when dry, very friable when moist, non-sticky and non-plastic when wet; very few, big, spherical, black manganese nodules; common medium pores, few fine and common medium roots; gradual and smooth.

Bs 60–120cm+ Light brown (7.5YR 6/4 moist); many brownish yellow mottles; sandy loam; moderate, coarse, angular blocky structure, firm when moist, non-sticky and non-plastic when wet; frequent, big, spherical, black, manganese nodules; common medium pores; few fine, common medium roots:

LABORATORY DATA SHEET

Horizon		A	E	Bs	Horizon		A	E	Bs
Depth	cm	5	45	90	Exch. Na	me/100g	0.08	0.11	1.24
Bulk density	g/cm³	1.32	1.48	1.58	Base sat	%	100+	100+	94.9
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	10.7	16.2	14.9
Sand	%	83.5	90.5	77.0	SiO_2/R_2O_3	mol/mol	10.2	15.0	12.5
Silt	%	5.5	2.5	3.5	Fe_2O_3	mmol/100g	6.3	6.9	16.9
Clay	%	11.0	7.0	19.5	Available P	ppm	24	3	3
Class		LS	S	SL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		7.2	6.9	5.4	HCO_3	me/l	165.8	349.4	23.3
pH–KCl (1:2.5)		6.5	5.3	4.2	SO_4	me/l	0.08	1.35	0.44
EC (1:2.5)	mmho/cm	0.14	0.05	0.41	Flocc. Index	%	72.7	35.7	64.1
C	%	1.2	0.2	0.1	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.092	0.019	0.018	Ca (25%HCl)	me/100g	5.5	<3.0	12.2
C/N		13.0	10.5	5.6	Mg (25%HCl)	me/100g	3.9	<3.0	4.1
CEC pH7.0	me/100g	5.3	1.3	4.3	P (25%HCl)	ppm	112	94	105
Exch. Ca	me/100g	4.20	0.71	1.40	P (sorption)	mg/100g	80	<50	450
Exch. Mg	me/100g	2.45	0.76	2.36	Hp	me/100g	0.11	0.13	0.22
Exch. K	me/100g	0.33	0.23	0.08					

Unit PcA_2 be, Profile 23

Soil classification:	eutric Cambisols
Agro-climatic zone:	IV
Observation:	179/4 Lamu district; E. 40°13', S. 2°23'; 12m
Geological formation:	Dune sands
Local petrography:	Sands
Physiography unit:	Dunes
Relief-macro:	Very gently undulating
Relief-meso, micro:	Nil
Vegetation/Land use:	Wooded bushland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0 – 2%
Salinity/alkalinity:	Nil
Surface crack:	Nil
Internal drainage class:	Well drained

A 0–10cm Black (10YR 3/1 dry, 10YR 1.7/1 moist); sand; moderate, fine, crumb structure; soft when dry, very friable when moist, non-sticky and non-plastic when wet; many fine roots; clear and smooth transition to:

AB 10–30cm Very dark brown (10YR 3/2 dry, 10YR 2/2 moist); sand; moderate, fine, angular blocky structure; soft when dry, very friable when moist, non-sticky and non-plastic when wet; many fine roots; clear and smooth transition to:

Bu 30–90cm Dark yellowish brown (10YR 3/4 moist); loamy sand; moderate, medium, subangular blocky structure; very friable when moist, non-sticky and non-plastic when wet; few, small, spherical manganese nodules; common medium roots; clear and smooth transition to:

Bg 90–120cm+ Reddish yellow (7.5YR moist); very many grayish mottles; sandy clay loam; moderate, medium, subangular blocky structure; friable when moist, non-sticky and non-plastic when wet; few fine roots:

LABORATORY DATA SHEET

Horizon		A	Bu	Bg	Horizon		A	Bu	Bg
Depth	cm	5	70	110	Exch. Na	me/100g	0.17	0.18	2.09
Bulk density	g/cm³	1.50	1.57	1.73	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	11.21	11.05	8.26
Sand	%	87.5	85.5	67.8	SiO_2/R_2O_3	mol/mol	10.39	10.17	7.31
Silt	%	7.3	5.5	8.2	Fe_2O_3	mmol/100g	9.08	10.02	18.47
Clay	%	5.2	9.0	24.0	Available P	ppm	77	6	12
Class		S	LS	SCL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		6.6	6.1	6.6	HCO_3	me/l	144.0	52.4	333.9
pH–KCl (1:2.5)		5.9	4.4	5.0	SO_4	me/l	0.76	0.26	11.3
EC (1:2.5)	mmho/cm	0.10	0.04	0.15	Flocc. index	%	3.8	22.2	0
C	%	1.2	0.2	0.2	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.076	0.023	0.026	Ca (25%HCl)	me/100g	6.0	<3.0	4.7
C/N		15.8	8.7	7.7	Mg (25%HCl)	me/100g	4.0	3.0	8.0
CEC pH7.0	me/100g	7.0	3.7	9.3	P (25%HCl)	ppm	178	113	127
Exch. Ca	me/100g	6.40	1.32	3.50	P (sorption)	mg/100g	650	530	575
Exch. Ma	me/100g	2.35	1.64	4.27	Hp	me/100g	0.07	0.39	0.09
Exch. K	me/100g	0.40	0.21	0.20					

Unit HObc, Profile 24

Soil classification:	chromic Cambisols
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°2', S. 2°54'; 135m
Geological formation:	Pliocene sediments
Local petrography:	Sandy clays and bright red sands
Physiography unit:	Hill
Relief-macro:	Rolling
Relief-meso, micro:	Nil
Vegetation/Land use:	Crop land (Maize)
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	5%
Salinity/alkalinity:	
Surface crack:	Nil
Internal drainage class:	Well drained

Ap 0–15cm Dusky red (10R 4/6 dry, 10R 3/4 moist); silty loadm, moderate, medium, crumb structure; soft when dry, very friable when moist, very sticky and very plastic when wet; many fine roots; gradual and smooth transition to:

B 15–120cm+ Red (10R 4/8 moist); silt; weak, coarse, subangular blocky structure; very friable when moist, very plastic and sticky when wet; common medium roots:

LABORATORY DATA SHEET

Horizon		Ap	B	B	Horizon		Ap	B	B
Depth	cm	10	50	100	Exch. Na	me/100g	0.12	0.23	0.21
Bulk density	g/cm³	0.92	0.90	1.19	Base sat	%	100+	100+	100+
Gravel	%	9.0	1.4	11.8	SiO_2/Al_2O_3	mol/mol	2.64	2.48	2.51
Sand	%	27.0	10.2	19.0	SiO_2/R_2O_3	mol/mol	2.13	2.01	2.02
Silt	%	66.8	84.1	75.5	Fe_2O_3	mmol/100g	61.99	68.26	68.26
Clay	%	6.2	5.7	5.5	Available P	ppm	84	56	30
Class		SiL	Si	SiL	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		7.9	8.1	8.2	HCO_3	me/l	163.7	130.9	130.9
pH-KCl (1:2.5)		7.3	7.4	7.6	SO_4	me/l	0.28	2.24	2.09
EC (1:2.5)	mmho/cm	0.25	0.20	0.25	Flocc. index	%	35.5	100	100
C	%	3.4	0.8	0.8	K (25%HCl)	me/100g	4.0	<3.0	<3.0
N	%	0.340	0.089	0.085	Ca (25%HCl)	me/100g	40.3	31.0	56.6
C/N		10.0	9.0	9.4	Mg (25%HCl)	me/100g	8.6	7.4	8.3
CEC pH7.0	me/100g	28.0	15.0	13.4	P (25%HCl)	ppm	262	207	185
Exch. Ca	me/100g	27.33	22.11	28.38	P (sorption)	mg/100g	1,322	1,131	1,211
Exch. Ma	me/100g	3.41	2.96	3.92	Hp	me/100g	0.07	0.07	0.08
Exch. K	me/100g	1.60	0.45	1.04					

Unit IIDbk, Profile 25

Soil classification:	calcic Cambisols (sodic phase)
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district E. 40°1', S. 2°56'; 130m
Geological formation:	Pliocene sediments
Local petrography:	Sandy clays and bright red sands
Physiography unit:	Hill
Relief-macro:	Undulating
Relief-meso, micro:	Nil
Vegetation/Land use:	Bushed glassland
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	2%
Salinity/alkalinity:	
Surface crack:	Crack 0.5 – 1cm width
Internal drainage class:	Moderately well drained

A 0–10cm Black (10YR 2/1 moist); loam; moderate, medium, crumb structure; friable when moist, sticky and very plastic when wet; many fine roots; clear and smooth transition to:

Bk 10–55cm Black (2.5Y 2/1 moist); few gravelly sandy loam, moderate, medium, sub-angular blocky structure; friable when moist, very sticky and very plastic when wet; few big and common medium roots; gradual and smooth transition to:

Bn 55–110cm+ Black (2.5Y 2/1 moist); few gravelly loam; strong, coarse, angular blocky structure; firm when moist, very sticky and very plastic when wet; few, medium, powdery, white concretions; moderate slickenside; few big roots:

LABORATORY DATA SHEET

Horizon		A	Bk	Bn	Horizon		A	Bk	Bn
Depth	cm	5	40	80	Exch. Na	me/100g	0.34	2.23	5.54
Bulk density	g/cm³	1.33	1.52	1.54	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	8.73	7.97	7.82
Sand	%	51.0	56.5	51.0	SiO_2/R_2O_3	mol/mol	7.43	6.73	6.66
Silt	%	34.0	32.0	27.5	Fe_2O_3	mmol/100g	22.54	25.67	24.74
Clay	%	15.0	11.5	21.5	Available P	ppm	64	62	30
Class		L	SL	L	CO_3	me/l	ND	ND	ND
pH–H_2O (1:2.5)		7.7	8.5	8.2	HCO_3	me/l	242.2	202.9	314.2
pH–KCl (1:2.5)		7.0	7.3	7.3	SO_4	me/l	2.65	5.54	16.83
EC (1:2.5)	mmho/cm	0.30	0.40	1.9	Flocc. index	%	66.7	52.2	90.7
C	%	2.0	0.8	0.6	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.130	0.044	0.027	Ca (25%HCl)	me/100g	34.0	86.3	63.3
C/N		15.4	18.2	22.2	Mg (25%HCl)	me/100g	14.4	17.8	16.2
CEC pH7.0	me/100g	30.3	30.0	31.0	P (25%HCl)	ppm	129	147	104
Exch. Ca	me/100g	23.82	36.11	27.96	P (sorption)	mg/100g	1,412	1,469	1,322
Exch. Mg	me/100g	6.48	7.18	7.09	Hp	me/100g	0.04	0.11	0.05
Exch. K	me/100g	1.02	0.29	0.24					

Unit Hoic, Profile 26

Soil classification:	chromic Luvisols
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E.40°3', S. 2°57'; 45m
Geological formation:	Pliocene sediments
Local petrography:	Sandy clays and bright red sands
Physiography unit:	Hill
Relief-macro:	Undulating
Relief-meso, micro:	Small depression
Vegetation/Land use:	Cropland (Maise, Cassava)
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0 ∿ 2%
Salinity/alkalinity:	
Surface crack:	Nil
Internal drainage class:	Well drained

Ap 0–5cm Dark reddish brown (5YR 3/3 dry, 5YR 2/3 moist); sandy loam; strong, coarse, crumb structure; hard when dry, firm when moist, very sticky and plastic when wet; many fine roots; clear and smooth transition to:

Au 5–25cm Reddish brown (5YR 4/4 moist); sandy loam; strong, medium, angular blocky structure; firm when moist, very sticky and plastic when wet; common fine roots; clear and smooth transition to:

Bt_1 25–45cm Reddish yellow (5YR 6/8 moist); loam; moderate, medium, angular blocky structure; friable when moist, sticky and plastic when wet; few medium roots; gradual and smooth transition to:

Bt_2 45–120cm$^+$ Yellowish red (5YR 5/8 moist); sandy clay loam; moderate, medium, angular blocky structure; very friable when moist, sticky and plastic when wet; few, small pores; few big, common fine roots:

LABORATORY DATA SHEET

Horizon		Ap	Au	Bt2	Horizon		Ap	Au	Bt2
Depth	cm	5	15	80	Exch. Na	me/100g	0.12	0.08	0.18
Bulk density	g/cm^3	1.16	1.49	1.51	Base sat	%	100+	100+	100+
Gravel	%	6.1	16.0	6.2	SiO_2/Al_2O_3	mol/mol	8.11	7.26	6.43
Sand	%	60.0	53.0	50.2	SiO_2/R_2O_3	mol/mol	7.09	6.62	5.60
Silt	%	33.0	35.5	26.3	Fe_2O_3	mmol/100g	20.35	22.54	25.67
Clay	%	7.0	11.5	23.5	Available P	ppm	129	42	19
Class		SL	SL	SCL	CO_3	me/l	ND	ND	ND
pH-H_2O (1:2.5)		8.0	8.1	8.1	HCO_3	me/l	425.5	425.5	148.4
pH-KCl (1:2.5)		7.5	7.3	7.1	SO_4	me/l	2.68	2.96	3.07
EC (1:2.5)	mmho/cm	0.33	0.24	0.18	Flocc. Index	%	78.6	73.9	93.6
C	%	2.1	1.4	0.3	K (25%HCl)	me/100g	3.9	4.0	<3.0
N	%	0.200	0.140	0.032	Ca (25%HCl)	me/100g	33.4	21.0	11.4
C/N		10.5	10.0	9.4	Mg (25%HCl)	me/100g	8.0	6.3	5.0
CEC pH7.0	me/100g	20.0	17.0	11.0	P (25%HCl)	ppm	258	192	138
Exch. Ca	me/100g	24.20	17.72	12.07	P (sorption)	mg/100g	1,097	272	811
Exch. Ma	me/100g	3.19	2.72	2.86	Hp	me/100g	0.09	0.07	0.07
Exch. K	me/100g	1.98	2.31	0.71					

Unit PrA_3bk, Profile 27

Soil classification:	calcic Cambisols (saline-sodic phase)
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°3', S. 2°53'; 29m
Geological formation:	Fan deposits
Local petrography:	Clays, sands and gravels
Physiography unit:	Fans
Relief-macro:	Flat to very gently undulating
Relief-meso, micro:	Nil
Vegetation/Land use:	Forest/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0 ∿ 2%
Salinity/alkalinity:	
Surface crack:	Crack 0.5 ∿ 1.0cm width
Internal drainage class:	Well drained

A 0–8cm Very dark grayish borwn (2.5Y 4/2 dry, 2.5Y 3/2 moist); few gravelly loam; strong, coarse, crumb structure; hard when dry, friable when moist, sticky and very plastic when wet; many fine roots; clear and smooth transition to:

Bn 8–35cm Dark grayish brown (2.5Y 4/2 moist); few red mottles; few gravelly loam; strong, medium, angular blocky structure; very friable when moist, sticky and very plastic when wet; many fine, few medium roots; clear and irregular transition to:

Bck 35–70cm Olive gray (5Y 4/2 moist); few gravelly silty loam; moderate, medium, angular blocky structure; friable when moist, very sticky and very plastic when wet; few big roots; gradual and smooth transition to:

Bnz 70–110cm+ Olive gray (5Y 4/2 moist); common gravelly silty loam; moderate, medium, angular blocky structure; friable when moist, very sticky and very plastic when wet, few fine roots:

LABORATORY DATA SHEET

Horizon		A	Bu	Bnz	Horizon		A	Bu	Bnz
Depth	cm	5	30	80	Exch. Na	me/100g	0.17	1.38	7.40
Bulk density	g/cm³	1.24	1.54	1.49	Base sat	%	100+	100+	100+
Gravel	%	3.6	26.0	ND.	SiO_2/Al_2O_3	mol/mol	5.83	5.20	5.01
Sand	%	48.0	41.0	39.0	SiO_2/R_2O_3	mol/mol	5.05	4.48	4.29
Silt	%	39.8	47.0	55.0	Fe_2O_3	mmol/100g	25.67	26.61	28.81
Clay	%	12.5	12.0	6.0	Available P	ppm	106	77	136
Class		L	L	SiL	CO_3	me/l	ND	ND	ND
pH–H_2O (1:2.5)		8.2	8.3	8.0	HCO_3	me/l	275.0	461.5	166.9
pH–KCl (1:2.5)		7.3	7.4	7.3	SO_4	me/l	0.17	2.38	34.86
EC (1:2.5)	mmho/cm	0.30	0.46	4.2	Flocc. Index	%	96.0	75.0	100
C	%	2.3	1.2	0.7	K (25%HCl)	me/100g	6.2	3.4	<3.0
N	%	0.180	0.096	0.038	Ca (25%HCl)	me/100g	118.5	275.5	228.5
C/N		12.8	12.5	18.4	Mg (25%HCl)	me/100g	25.5	20.0	27.8
CEC pH7.0	me/100g	31.0	28.0	30.0	P (25%HCl)	ppm	219	226	299
Exch. Ca	me/100g	39.04	44.05	32.88	P (sorption)	mg/100g	1,642	1,544	1,797
Exch. Ma	me/100g	6.99	8.56	9.58	Hp	me/100g	0.12	0.11	0.13
Exch. K	me/100g	1.56	0.50	0.29					

Unit BAge, Profile 28

Soil classification:	eutric Gleysols (sodic phase)
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°5', S. 2°50' ; 6m
Geological formation:	Alluvial deposits
Local petrography:	Sands, silts and clays
Physiography unit:	Bottom land
Relief-macro:	Flat
Relief-meso, micro:	Nil
Vegetation/Land use:	Bushland/Grazing
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	
Surface crack:	Weak crack
Internal drainage class:	Poorly drained

A 0–10cm Light olive brown (2.5Y moist); many orange mottles; sandy clay loam; massive; sticky and very plastic when wet; many fine roots; clear and smooth transition to:

Bg 10–90cm+ Gray (N 5/0 moist); many orange mottles; clay; massive; very sticky and very plastic when wet; few, small, spherical, black manganese nodules; common medium roots:

LABORATORY DATA SHEET

Horizon		A	Bg	Bg	Horizon		A	Bg	Bg
Depth	cm	5	30	80	Exch. Na	me/100g	0.35	2.62	5.05
Bulk density	g/cm³	1.39	1.58	1.61	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	7.03	5.29	5.02
Sand	%	54.5	36.0	37.0	SiO_2/R_2O_3	mol/mol	6.19	4.66	4.42
Silt	%	11.5	14.0	11.0	Fe_2O_3	mmol/100g	21.60	26.61	27.87
Clay	%	34.0	50.0	52.0	Available P	ppm	17	15	21
Class		SCL	C	C	CO_3	me/l	ND	ND	ND
pH–H_2O (1:2.5)		8.0	8.1	6.6	HCO_3	me/l	255.3	375.6	58.9
pH–KCl (1:2.5)		6.8	6.4	5.0	SO_4	me/l	1.31	7.8	0.39
EC (1:2.5)	mmho/cm	0.2	0.16	1.35	Flocc. index	%	86.8	28.0	5.8
C	%	0.7	0.3	0.2	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.045	0.024	0.019	Ca (25%HCl)	me/100g	15.6	15.7	10.3
C/N		15.6	12.5	10.5	Mg (25%HCl)	me/100g	5.1	9.7	8.8
CEC pH7.0	me/100g	12.4	16.7	16.0	P (25%HCl)	ppm	143	159	217
Exch. Ca	me/100g	12.70	10.76	10.06	P (sorption)	mg/100g	987	1,008	1,097
Exch. Mg	me/100g	2.27	5.74	4.92	Hp	me/100g	0.06	0.04	0.07
Exch. K	me/100g	0.41	0.24	0.20					

Unit PcSe, Profile 29

Soil classification:	Rendzinas
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°4', S. 2°53'; 18m
Geological formation:	Lagoonal calcareous sandstones
Local petrography:	
Physiography unit:	Raised coral reef
Relief-macro:	Undulating
Relief-meso, micro:	Nil
Vegetation/Land use:	Wooded bushland
Evidence of erosion:	None detected
Surface stoniness:	Fairy rocky
Slope gradient:	0 ∿ 2%
Salinity/alkalinity:	
Surface crack:	Nil
Internal drainage class:	Well drained

A 0–10cm Red (2.5YR 5/8 dry, 2.5YR 4/6 moist); sandy loam; weak, medium, crumb structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; clear and smooth transition to:

B 10–20cm Red (2.5YR 5/8 dry, 2.5YR 4/6 moist); sandy loam; moderate, medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; clear and smooth transition to:

C 20–110cm+ Calcareous sandstone with some pockets of soil:

LABORATORY DATA SHEET

Horizon		A	B	C	Horizon		A	B	C
Depth	cm	5	15	80	Exch. Na	me/100g	0.18	0.14	0.18
Bulk density	g/cm³	1.27	1.37	1.37	Base sat	%	100+	100+	100+
Gravel	%	1.2	16.7	55.7	SiO_2/Al_2O_3	mol/mol	6.93	6.59	6.35
Sand	%	62.0	66.0	70.0	SiO_2/R_2O_3	mol/mol	6.29	6.00	5.70
Silt	%	33.0	26.0	25.0	Fe_2O_3	mmol/100g	16.28	16.28	16.28
Clay	%	5.0	8.0	5.0	Available P	ppm	52	50	39
Class		SL	SL	SL	CO_2	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		8.2	8.3	8.3	HCO_3	me/l	383.0	284.8	58.9
pH–KCl (1:2.5)		7.5	7.6	7.6	SO_4	me/l	0.11	0.03	<0.02
EC (1:2.5)	mmho/cm	0.21	0.20	0.20	Flocc. index	%	90.0	56.3	80.0
C	%	1.0	0.6	0.5	K (25%HCl)	me/100g	3.4	3.0	<3.0
N	%	0.086	0.078	0.044	Ca (25%HCl)	me/100g	20.2	60.6	366.0
C/N		11.6	7.7	11.4	Mg (25%HCl)	me/100g	7.1	8.3	11.1
CEC pH7.0	me/100g	11.0	8.3	7.4	P (25%HCl)	ppm	217	214	226
Exch. Ca	me/100g	18.55	28.00	33.81	P (sorption)	mg/100g	875	782	1,063
Exch. Ma	me/100g	1.98	2.04	1.83	Hp	me/100g	0.06	0.07	0.18
Exch. K	me/100g	0.97	0.63	0.42					

Unit TA_1 oe, Profile 30

Soil classification:	eutric Histosols (saline-sodic phase)
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°5', S. 2°59'; 1m
Geological formation:	Beach sands and muds of the coastal creeks
Local petrography:	Sands
Physiography unit:	Mangrove swamps
Relief-macro:	Flat
Relief-meso, micro:	Nil
Vegetation/Land use:	Forest/Salt work
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	
Surface crack:	Nil
Internal drainage class:	Very poorly

sandy top 0–5cm Very pale brown (10YR 7/4 moist); sand; massive; no roots; clear and smooth transition to:

Anz 5–10cm Very pale brown (10YR 7/4 moist); many reddish yellow mottles; sandy loam; massive; slightly sticky and non-plastic when wet; many fine and many medium roots; clear and smooth transition to:

Hnz 10–60cm Grayish brown (2.5Y 5/2 moist); common reddish yellow mottles; silty loam; many humic material; massive; many fine, common medium and common big roots:

LABORATORY DATA SHEET

Horizon		Sandy	Anz	Hnz	Horizon		Sandy	Anz	Hnz
Depth	cm	top 5	10	40	Exch. Na	me/100g	1.54	6.57	13.62
Bulk density	g/cm³	1.55	1.04	0.65	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	15.52	8.18	4.34
Sand	%	91.0	59.0	17.5	SiO_2/R_2O_3	mol/mol	14.88	7.11	3.64
Silt	%	5.0	34.5	63.5	Fe_2O_3	mmol/100g	3.76	20.35	36.95
Clay	%	4.0	6.5	19.0	Available P	ppm	40	192	376
Class		S	SL	SiL	CO_3	me/l	ND.	ND.	ND.
pH-H_2O (1:2.5)		8.7	8.1	8.2	HCO_3	me/l	353.5	353.5	235.7
pH-KCl (1:2.5)		8.7	8.1	8.0	SO_4	me/l	102.80	61.00	102.16
EC (1:2.5)	mmho/cm	8.20	12.10	19.50	Flocc. index	%	67.5	12.3	0
C	%	0.3	1.2	2.5	K (25%HCl)	me/100g	<3.0	8.2	18.0
N	%	0.018	0.068	0.135	Ca (25%HCl)	me/100g	11.0	13.6	9.8
C/N		16.7	17.6	18.5	Mg (25%HCl)	me/100g	8.2	29.2	56.3
CEC pH7.0	me/100g	2.1	3.8	25.0	P (25%HCl)	ppm	138	424	608
Exch. Ca	me/100g	4.04	5.47	5.03	P (sorption)	mg/100g	530	1,015	1,469
Exch. Mg	me/100g	2.14	6.60	14.93	Hp	me/100g	0.07	0.08	0.04
Exch. K	me/100g	0.59	2.48	5.20					

Unit PtJso, Profile 31

Soil classification:	orthic Solonetz
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°3', S. 2°59' ; 35m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands and clays
Physiography unit:	Higher terrace
Relief-macro:	Gently undulating
Relief-meso, micro:	Nil
Vegetation/Land use:	Cropland (Maize)
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0 ∿ 2%
Salinity/alkalinity:	
Surface crack:	Nil
Internal drainage class:	Moderately well

Ap 0–10cm Very dark brown (10YR 3/2 dry, 10YR 2/2 wet); loamy sand; strong, medium, crumb structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; clear and smooth transition to:

AB 10–20cm Dark brown (10YR 4/3 dry, 10YR 3/3 moist); sand; moderate, medium, prismatic structure; loose when dry and moist, non-plastic and non-sticky when wet; many fine roots; clear and wave transition to:

Btn_1 20–80cm Brown (10YR 5/3 moist); many brown mottles; sandy clay loam; strong, medium, prismatic structure; firm when moist, sticky and plastic when wet; few, small, spherical, black manganese nodules; common medium and few fine roots; gradual and smooth transition to:

Btn_2 80–110cm+ Olive yellow (2.5Y 6/6 moist); few gray mottles; sandy clay loam; moterate, medium, prismatic structure; friable when moist, sticky and strong plastic when wet; few, small, spherical, black, manganese nodules:

LABORATORY DATA SHEET

Horizon		Ap	Btn1	Btn2	Horizon		Ap	Btn1	Btn2
Depth	cm	5	50	100	Exch. Na	me/100g	0.07	0.85	3.07
Bulk density	g/cm³	1.31	1.84	1.87	Base sat	%	100+	100+	100+
Gravel	%	ND.	ND.	2.3	SiO_2/Al_2O_3	mol/mol	18.57	11.69	10.39
Sand	%	85.0	68.0	64.0	SiO_2/R_2O_3	mol/mol	16.75	10.18	9.08
Silt	%	9.0	7.0	10.5	Fe_2O_3	mmol/100g	8.14	16.28	17.22
Clay	%	6.0	25.0	25.5	Available P	ppm	101	15	35
Class		LS	SCL	SCL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		8.2	6.2	8.6	HCO_3	me/l	255.3	147.3	294.6
pH–KCl (1:2.5)		7.4	4.7	7.3	SO_4	me/l	0.08	1.72	25.70
EC (1:2.5)	mmho/cm	0.12	0.20	0.8	Flocc. index	%	68.3	28.0	25.5
C	%	0.7	0.3	1.3	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.054	0.017	0.012	Ca (25%HCl)	me/100g	8.0	7.8	19.8
C/N		13.0	17.6	108.3	Mg (25%HCl)	me/100g	<3.0	65.0	116.0
CEC pH7.0	me/100g	6.2	11.7	12.0	P (25%HCl)	ppm	182	68	96
Exch. Ca	me/100g	7.10	7.62	13.20	P (sorption)	mg/100g	650	598	980
Exch. Mg	me/100g	0.98	4.27	5.58	Hp	me/100g	0.03	0.12	0.08
Exch. K	me/100g	0.31	0.38	0.24					

Unit PtJlf, Profile 32

Soil classification:	ferric Luvisols (sodic phase)
Agro-climatic zone:	IV
Observation:	187/3 Kilifi district; E. 40°5', S. 2°49' ; 9m
Geological formation:	Lagoonal sands and clays
Local petrography:	Sands and clays
Physiography unit:	Lower terraces
Relief-macro:	Flat
Relief-meso, micro:	Nil
Vegetation/Land use:	Cropland (Maize, Beans)
Evidence of erosion:	None detected
Surface stoniness:	Nil
Slope gradient:	0%
Salinity/alkalinity:	
Surface crack:	Nil
Internal drainage class:	Some what excessively drained

Ap 0–3cm Red (5YR 7/6 dry, 2.5YR 4/6 moist); sand; single grain; loose when dry and moist, non-sticky and non-plastic when wet; clear and smooth transition to:

ABp 3–20cm Reddish yellow (5YR 6/8 moist); sand weak, medium, subangular blocky structure; very friable when moist, slightly sticky and non-plastic when wet; many fine roots; clear and smooth transition to:

Bn 20–120cm+ Light red (2.5YR 6/8 moist); loamy sand to sandy clay loam; weak, medium, subangular blocky structure; very friable when moist, slightly sticky and non-plastic when wet; common medium roots:

LABORATORY DATA SHEET

Horizon		AB	B	B	Horizon		AB	B	B
Depth	cm	10	30	80	Exch. Na	me/100g	0.05	0.18	0.42
Bulk density	g/cm³	1.44	1.54	1.53	Base sat	%	100+	100+	89.79
Gravel	%	ND.	ND.	ND.	SiO_2/Al_2O_3	mol/mol	11.86	10.93	8.90
Sand	%	89.0	84.5	70.0	SiO_2/R_2O_3	mol/mol	10.77	9.91	7.98
Silt	%	4.8	2.5	7.5	Fe_2O_3	mmol/100g	11.27	12.12	16.28
Clay	%	6.2	13.0	22.5	Available P	ppm	17	5	4
Class		S	LS	SCL	CO_3	me/l	ND.	ND.	ND.
pH–H_2O (1:2.5)		7.0	6.6	6.0	HCO_3	me/l	68.7	67.8	78.6
pH–KCl (1:2.5)		5.1	4.4	4.0	SO_4	me/l	0.16	0.83	0.30
EC (1:2.5)	mmho/cm	0.04	0.03	0.05	Flocc. Index	%	35.5	38.5	28.9
C	%	0.2	0.1	0.2	K (25%HCl)	me/100g	<3.0	<3.0	<3.0
N	%	0.013	0.015	0.018	Ca (25%HCl)	me/100g	<3.0	<3.0	<3.0
C/N		15.4	6.7	11.1	Mg (25%HCl)	me/100g	<3.0	<3.0	3.8
CEC pH7.0	me/100g	2.2	3.1	4.7	P (25%HCl)	ppm	108	99	90
Exch. Ca	me/100g	1.39	1.08	1.41	P (sorption)	mg/100g	272	118	560
Exch. Ma	me/100g	0.54	1.72	1.94	Hp	me/100g	0.10	0.20	0.71
Exch. K	me/100g	0.20	0.18	0.45					

Pit number of data used for evaluation

Legend	Pit No.	Legend	Pit No.
HLSqf	3	PcA_1qc	17
HLSbk	25	PcA_2qf	3, 5
HOlc	26	PcA_2qc	13, 17
HObk	25	PcA_2be	23
HObc	24	PcA_2bk	11
PtJqf	3	PcA_2C_1	20, 28
PtJqa	14, 15, 22	PcLqf	3
PtJqc	13	PcLe	29
PtJso	1, 6, 31	PcLlc	16
PtJxk	8, 9	PcSqf	3
PtJlc	16	PcSe	29
PtJbk	11	PcJge	18
$PtJC_1$	13, 14, 15, 28	PcJso	6
PtJ'lc	16	$PcJC_1$	15, 28
PrAvp	19	TA_1oe	30
PrAvc	2, 10	TA_1ge	18
PrAj(e-v)	4	BAvp	19
PrAqa	21	BAso	6
PrAso	6	BAge	28
$PrAC_1$	4, 10	BAC_1	14, 28
PrA_3bk	27	BAC_2	19, 28
PcAge	28	SAge	28

Converted data for evaluation (1)

Laboratory data / Soil unit	CEC me/100g	Hp me/100g	Exch.-K me/100g	Avail P ppm	P sorp. %	C %
eutric Histosols	18	0.05	4.0	289	46	1.9
pellic Vertisols	27	0.28	1.2	10	32	1.6
chromic Vertisols	36∿43	0.1∿0.2	1.1∿1.3	117∿257	43∿70	0.5∿1.7
eutric-vertic Fluvisols	16	0.14	0.53	180	26	0.2
eutric Gleysols	2∿15	0.1	0.3∿0.6	15∿16	var.	0.3∿0.4
albic Arenosols	1∿6	0.1∿0.2	0.1∿0.3	4∿24	1∿3	0.2∿1.2
ferralic Arenosols	3∿4	0.1∿0.4	0.4∿0.5	28∿41	2∿4	0.2∿0.3
cambic Arenosols	1∿3	0.1∿0.2	0.1∿0.3	113	13∿17	0.3∿0.4
Rendzinas	9	0.1	0.7	51	30	0.7
orthic Solonetz	8∿38	0.1∿0.3	0.3∿1.5	72∿368	24∿68	0.6∿2.1
calcic Xerosols	18∿34	0.1	0.6∿1.5	119	31∿40	0.3∿0.5
chromic Luvisols	13∿17	0.1	0.7∿2.0	53∿179	10∿19	0.9∿1.3
calcic Cambisols	29∿34	0.1	0.5∿1.3	63∿85	44∿58	1.5∿2.2
chromic Cambisols	22	0.1	1.0	70	46	2.1
eutric Cambisols	7	0.1	0.4	77	24	1.2

Converted data for evaluation (2)

Laboratory data / Soil unit	Ca me/100g	Mg me/100g	K me/100g	P ppm	U.S. Soil Taxonany Classification
eutric Histosols	11	44	8	499	Tropofibrists
pellic Vertisols	18	13	4	134	Pellusterts
chromic Vertisols	40 41	81 100	20 30	var.	Chromusterts
eutric-vertic Fluvisols	48	44	11	476	Tropofluvents
eutric Gleysols	3∿16	7∿8	<3	153∿156	Tropaquents
albic Arenosols	3∿7	3∿4	<3	87∿112	Ustipsamments
ferralic Arenosols	3∿4	3∿6	<3	128∿168	Quartzipsamments
cambic Arenosols	var.	3∿19	<3	173∿400	Quartzipsamments
Rendzinas	47	7.9	<3	215	Rendolls
orthic Solonetz	var.	23∿114	var.	144∿772	Natrargids
calcic Xerosols	36∿78	33∿39	6∿11	var.	Calcixeroll
chromic Luvisols	22∿25	6∿10	3∿7	194∿990	Paleustalfs
calcic Cambisols	62∿234	17∿58	3∿13	141∿425	Ustropepts
chromic Cambisols	36	8.0	<3	235	Eutropepts
eutric Cambisols	6.0	4.0	<3	178	Eutropepts

Notes

Analysis data is converted into this data as the layer from top to 30 cm to be used for evaluation.

var .... variable

Areas of soil erosion resistance class by soil (km^2)

Class / Soil	Very High Resistance	High Resistance	Moderate Resistance	Slight Resistance	Very Slight Resistance	Total
HLSqf	0	0	0	6.4	0	6.4
HLSbk	0	0.1	176.1	0	0	176.2
HOlc	0	10.5	105.7	0	0	116.2
HObk	0	0	59.5	0	0	59.5
HObc	0	0	5.7	0	0	5.7
PtJqf	0	0	187.3	0	0	187.3
PtJqa	0	52.9	8.0	0	0	60.9
PtJqc	0	0	816.6	0	0	816.6
PtJso	0	0	340.2	0	0	340.2
PtJxk	0	0	137.4	0	0	137.4
PtJlc	0	48.6	0	0	0	48.6
PtJbk	0	204.2	0.1	0	0	204.3
PtJC$_1$	0	0	145.1	0	0	145.1
PtJlc	0	92.0	0	0	0	92.0
PrAvp	0	4.9	0	0	0	4.9
PrAvc	0	463.7	0.2	0	0	463.9
PrAj(e-v)	0	0.2	119.9	0	0	120.1
PrAqa	0	0	3.6	0	0	3.6
PrAso	0	0	24.1	0	0	24.1
PrAC$_1$	0	0	23.9	0	0	23.9
PrA$_3$bk	0	143.2	27.2	0	0	170.4
PcAge	0	0	11.3	0	0	11.3
PcA$_1$qc	0	22.2	0	0	0	22.2
PcA$_2$qf	0	0	219.1	36.1	0	255.2
PcA$_2$qc	0	56.0	282.5	6.2	0	344.7
PcA$_2$be	0	0	136.5	0	0	136.5
PcA$_2$bk	0	8.3	0	0	0	8.3
PcA$_2$C$_1$	0	0	11.9	0	0	11.9
PcLqf	0	0	6.6	1.2	0	7.8
PcLe	0	0	56.1	0	0	56.1
PcLlc	0	14.8	0	0	0	14.8
PcSqf	0	0	0	0.3	0	0.3
PcSe	0	0	0.2	0	0	0.2
PcJso	0	0	10.2	0	0	10.2
PcJge	0	0	23.9	0	0	23.9
PcJC$_1$	0	0	13.8	0	0	13.8
TA$_1$oe	0	0	236.0	0	0	236.0
TA$_1$ge	0	0	95.9	0	0	95.9
BAvp	0	19.8	0	0	0	19.8
BAso	0	0	0.6	0	0	0.6
BAge	0	0	2.6	0	0	2.6
BAC$_1$	0	0	10.9	0	0	10.9
BAC$_2$	0	0	73.4	0	0	73.4
SAge	0	0	59.1	0	0	59.1
TOTAL	0	1,141.4	3,431.2	50.2	0	4,622.8

(Water 17.2 km^2)

Areas of rainfed agriculture suitability class by soil (km^2)

Soil \ Class	Highly Suitable	Moderately Suitable	Marginally Suitable	Unsuitable	TOTAL
HLSqf	0	0	6.4	0	6.4
HLSbk	0	0	176.2	0	176.2
HOlc	0	0	116.2	0	116.2
HObk	0	0	59.5	0	59.5
HObc	0	0	5.7	0	5.7
PtJqf	0	0	187.3	0	187.3
PtJqa	0	0	60.9	0	60.9
PtJqc	0	0	815.9	0.7	816.6
PtJso	0	51.4	156.8	132.0	340.2
PtJxk	0	0	117.2	20.2	137.4
PtJlc	0	0	48.6	0	48.6
PtJbk	0	20.9	183.3	0.1	204.3
$PtJC_1$	0	0	145.1	0	145.1
PtJ'lc	0	0	92.0	0	92.0
PrAvp	0	0	4.7	0.2	4.9
PrAvc	0	0.2	461.8	1.9	463.9
PrAj(e-v)	0	54.6	64.4	1.1	120.1
PrAqa	0	0	3.6	0	3.6
PrAso	0	0	21.6	2.5	24.1
$PrAC_2$	0	0	23.5	0.4	23.9
PrA_2bk	0	0	170.4	0	170.4
PcAge	0	0	0	11.3	11.3
PcA_1qc	0	0	22.2	0	22.2
PcA_2qf	0	0	245.8	9.4	255.2
PcA_2qc	0	0	321.3	23.4	344.7
PcA_2be	0	0.3	136.2	0	136.5
PcA_2bk	0	5.9	2.4	0	8.3
PcA_2C_1	0	0	0	11.9	11.9
PcLqf	0	0	7.8	0	7.8
PcLe	0	0	0	56.1	56.1
PcLlc	0	0	14.8	0	14.8
PcSqf	0	0	0.3	0	0.3
PcSe	0	0	0	0.2	0.2
PcJso	0	0	10.2	0	10.2
PcJge	0	0	0	23.9	23.9
$PcJC_1$	0	0	0	13.8	13.8
TA_1oe	0	0	0	236.0	236.0
TA_1ge	0	0	0	95.9	95.9
BAvp	0	0	19.8	0	19.8
BAso	0	0.6	0	0	0.6
BAge	0	0	0	2.6	2.6
BAC_1	0	0	0	10.9	10.9
BAC_2	0	0	0	73.4	73.4
SAge	0	0	0	59.1	59.1
TOTAL	0	133.9	3,701.9	787.0	4,622.8

(Water 17.2 km^2)

Areas of irrigated agriculture suitability class by soil (km^2)

	Highly Suitable	Moderately Suitable	Marginally Suitable	Unsuitable	TOTAL
HLSqf	0	0	0	6.4	6.4
HLSbk	0	0	24.6	151.6	176.2
HOlc	0	0	9.1	107.1	116.2
HObk	0	0	7.0	52.5	59.5
HObc	0	0	0.7	5.0	5.7
PtJqf	0	0	0	187.3	187.3
PtJqa	0	0	50.1	10.8	60.9
PtJqc	0	0	0	816.6	816.6
PtJso	0	0	16.6	323.6	340.2
PtJxk	0	0	136.8	0.6	137.4
PtJlc	0	0	48.6	0	48.6
PtJbk	0	111.3	0.1	92.9	204.3
$PtJC_1$	0	0	0	145.1	145.1
PtJ'lc	0	0	72.4	19.6	92.0
PrAvp	0.3	4.6	0	0	4.9
PrAvc	0	459.5	1.0	3.4	463.9
PrAj(e-v)	0	0	110.6	9.5	120.1
PrAqa	0	0	0	3.6	3.6
PrAso	0	0	0	24.1	24.1
$PrAC_1$	0	23.7	0	0.2	23.9
PrA_3bk	0	38.3	82.4	49.7	170.4
PcAge	0	0	0	11.3	11.3
PcA_1qc	0	0	0	22.2	22.2
PcA_2qf	0	0	4.8	250.4	255.2
PcA_2qc	0	0	0	344.7	344.7
PcA_2be	0	0	0	136.5	136.5
PcA_2bk	0	7.4	0	0.9	8.3
PcA_2C_1	0	0	0	11.9	11.9
PcLqf	0	0	0	7.8	7.8
PcLe	0	0	52.1	4.0	56.1
PcLlc	0	0	14.5	0.3	14.8
PcSqf	0	0	0	0.3	0.3
PcSe	0	0	0	0.2	0.2
PcJso	0	0	0	10.2	10.2
PcJge	0	0	0	23.9	23.9
$PcJC_1$	0	0	0	13.8	13.8
TA_1oe	0	0	0	236.0	236.0
TA_1ge	0	0	0	95.9	95.9
BAvp	18.6	1.2	0	0	19.8
BAso	0	0	0	0.6	0.6
BAge	0	0	0	2.6	2.6
BAC_1	0	0	0	10.9	10.9
BAC_3	0	0	0	73.4	73.4
SAge	0	0	0	59.1	59.1
TOTAL	18.9	646.0	631.4	3,326.5	4,622.8

(Water 17.2 km^2)