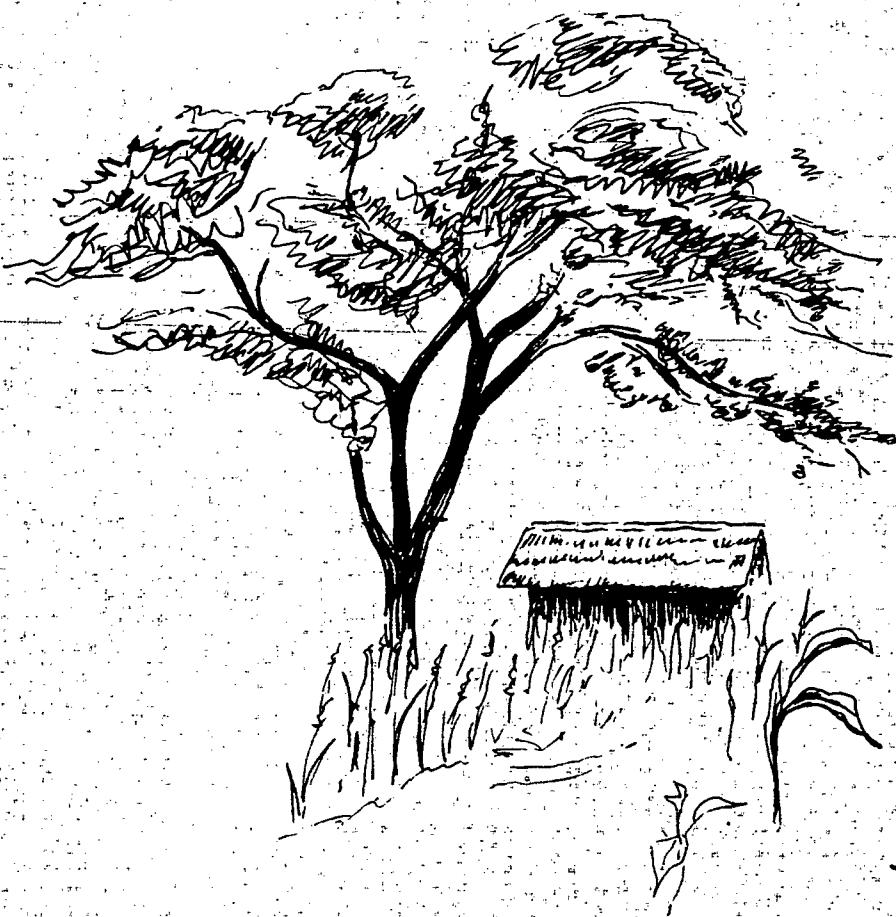


TRAINING PROJECT IN PEDOLOGY

KILIFI

- KENYA



J. V. J. M. KUIJPER

THE HUMAN INFLUENCE ON THE VEGETATION  
IN A PART OF THE KILIFI AREA

A LANDSCAPE GUIDED APPROACH

PRELIMINARY REPORT NO. 4  
(KILIFI SERIES)



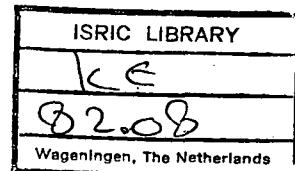
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THE HUMAN INFLUENCE ON THE VEGETATION  
IN A PART OF THE KILIFI AREA

a landscape guided approach

by

J.V.J.M. Kuyper

preliminary report no. 4  
(Kilifi series)  
Januari 1982

Training Project In Pedology, Kilifi Kenya  
Agricultural university, Wageningen - The Netherlands

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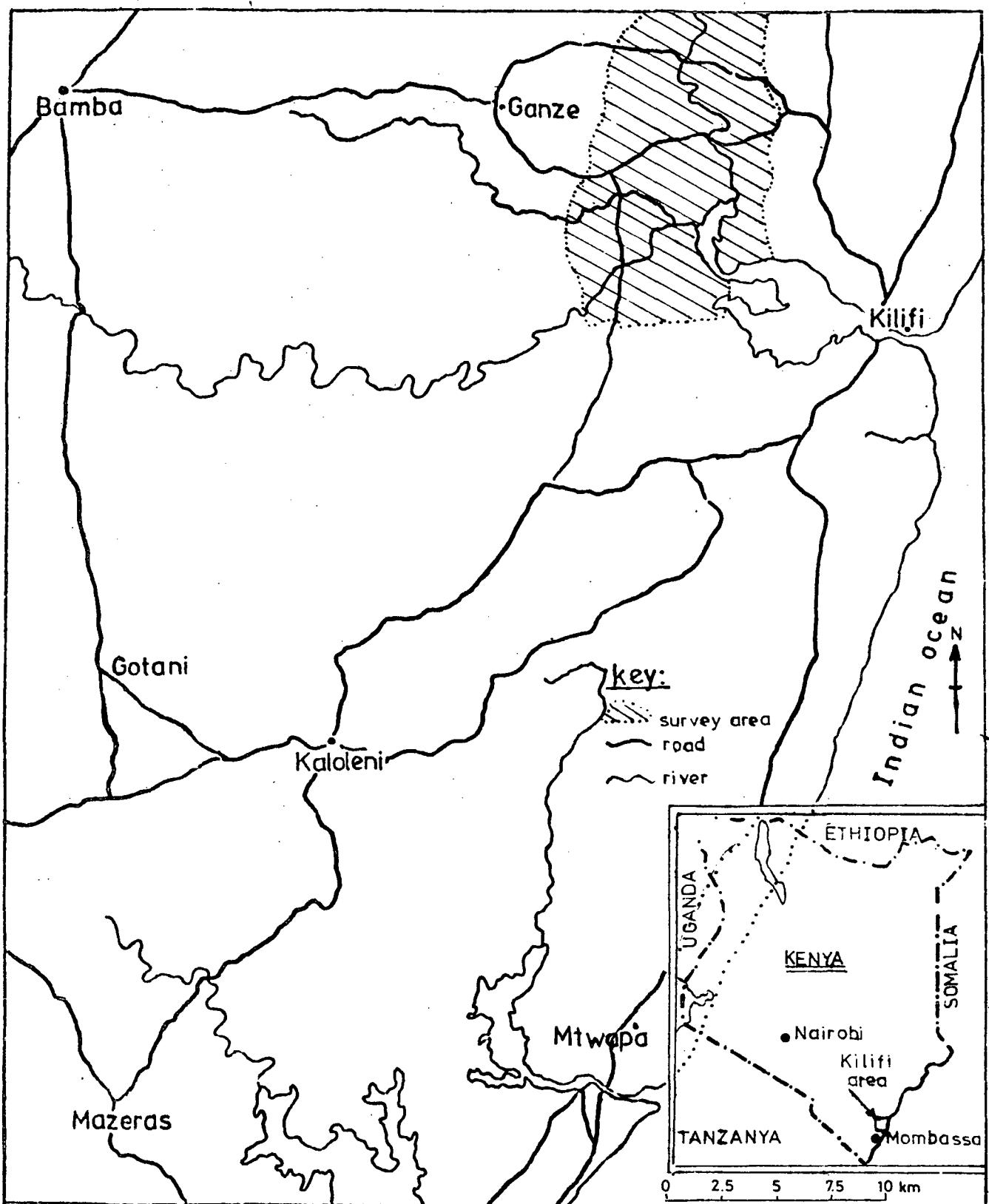
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Kilifi area (K.S.S. mapsheet 198)  
Fig.1. The studied area.

## SUMMARY - INTRODUCTION

This paper presents the second preliminary report on the vegetation in the Kilifi area at the Kenya coast (Fig. 1).

It deals with the human influence on the vegetation in the northern part of the Terminalia spinosa - Maytenus senegalensis landscape (LS 3, van Leeuwen 1982). It was carried out as a 3 months postgraduate study for vegetation science in the MSc. course Tropical Soil Science at the Agricultural University Wageningen, The Netherlands. It is a contribution to the vegetation and landuse map of the Kilifi area (Preliminary Report nr. 3), and to the land evaluation of the area. The studied landscape is situated NW of Kilifi, 10-20 km inland and covers 100 km<sup>2</sup> (Fig. 1). The rainfall distribution is bimodal and the yearly precipitation is 500-800 mm. The mean monthly air temperature varies between 22-30°C.

The area is strongly dissected and hilly. The altitude varies from 0 to 90 m. As described in Preliminary Report nr. 3, LS 3 is developed on the Mto Mkuu Shale Formation. The soils of the vegetation units (to be described subsequently) show only a slight variation. The vegetation, however, differs from shrubbed grassland to tropical monsoon forest. Landuse varies considerable as well. The population density decreases from south to north and landuse shows the same gradient.

All vegetation types were sampled by means of vegetation relevées (field descriptions of structure and floristic composition). A classification (with the Braun Blanquet tabular method) was then compiled, resulting in the recognition of several vegetation types. Subsequently, evolution of and interrelationship between these types was studied. It appears that the human influence on the vegetation is one of the main determining factors.

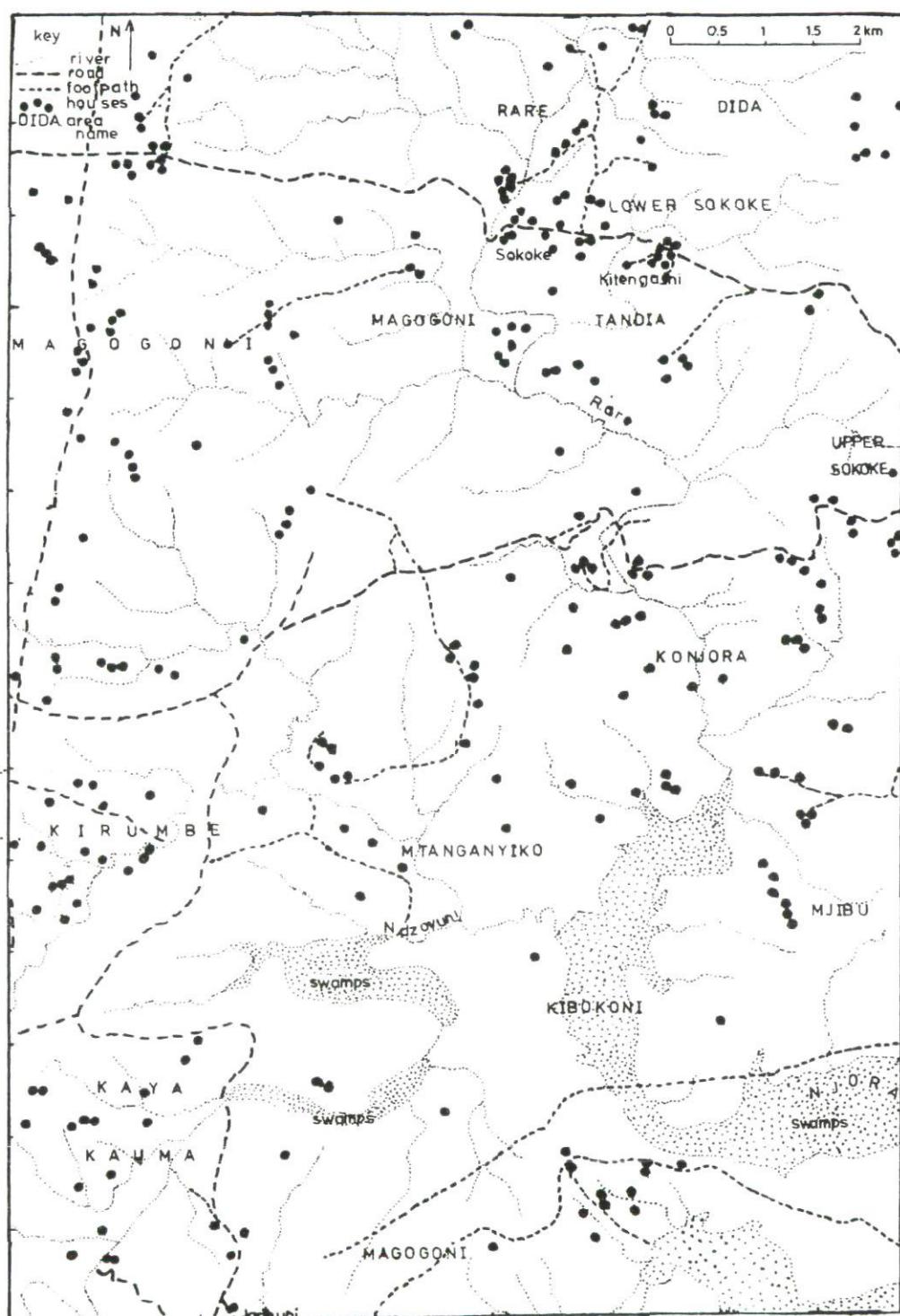
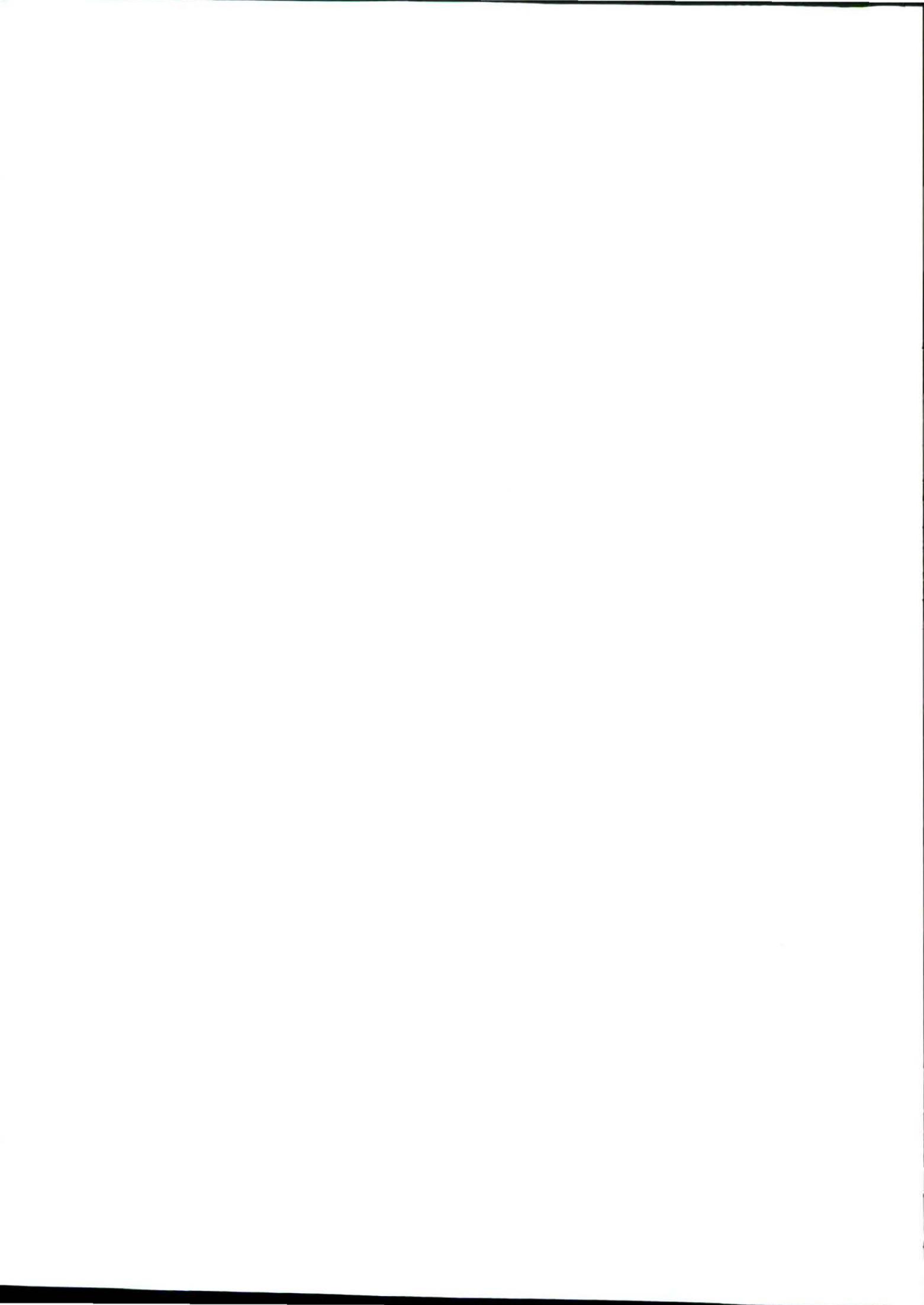


Fig.2. The distribution pattern of huts, roads and paths, rivers.



## 1 GENERAL DATA

### 1.1 Population

The people in this area originally lived in homesteads on elevated positions (hill tops) surrounded by forest in the so called 'Kayas'. The strategic position of the Kaya protected them against attacks of the Masai and Somali herdsmen. The Kayas were deserted last century; nowadays they only have a religious function. The Kaya nearest to our area is Kaya Kauma (Fig. 2). The people of Jaribuni originate from this Kaya. It is not clear whether most of the people in the area descended from Kaya Kauma or somewhere else. Clearly, the most intensively used land of our area surrounds Kauma Kaya (Fig. 4, 3.3c and d with 1/3 and 1/2 arable land).

Presently, small villages (consisting of a small number of huts) are scattered throughout the area (Fig. 2). Plots of arable land are cleared from grass-, shrub- or bushland surrounding the villages. This land is used for a number of years until the yields get too low. On the fallow land, the vegetation can restore. Vegetation along paths is regularly burned (yearly).

Much of the land is already in ownership. The population is increasing very fast. The growing demand for wood and arable land causes the vegetation to degenerate more and more, because of shorter fallow periods.

### 1.2 Climate

The mean monthly air temperature varies between 22-30 °C. The rainfall distribution shows a bimodal rainfall pattern. The average annual rainfall varies from 500 to 800 mm. (Fig. 6) The area is situated in the rainshade of the hills on the east and west side and receives less rainfall than the surrounding area.

More climatic data are given in Preliminary Report nr. 3.

### 1.3 Soils, geomorphology and geology

General information about geology and geomorphology can be found in Preliminary Report nr. 3, and the references given there.

Landscape 3 is developed on the MTO MKUU Shale Formation. The area is hilly and strongly dissected by the rivers Ndzovuni, Njora and Rare (Fig. 3, 2). The river valleys were not taken into account in this study.

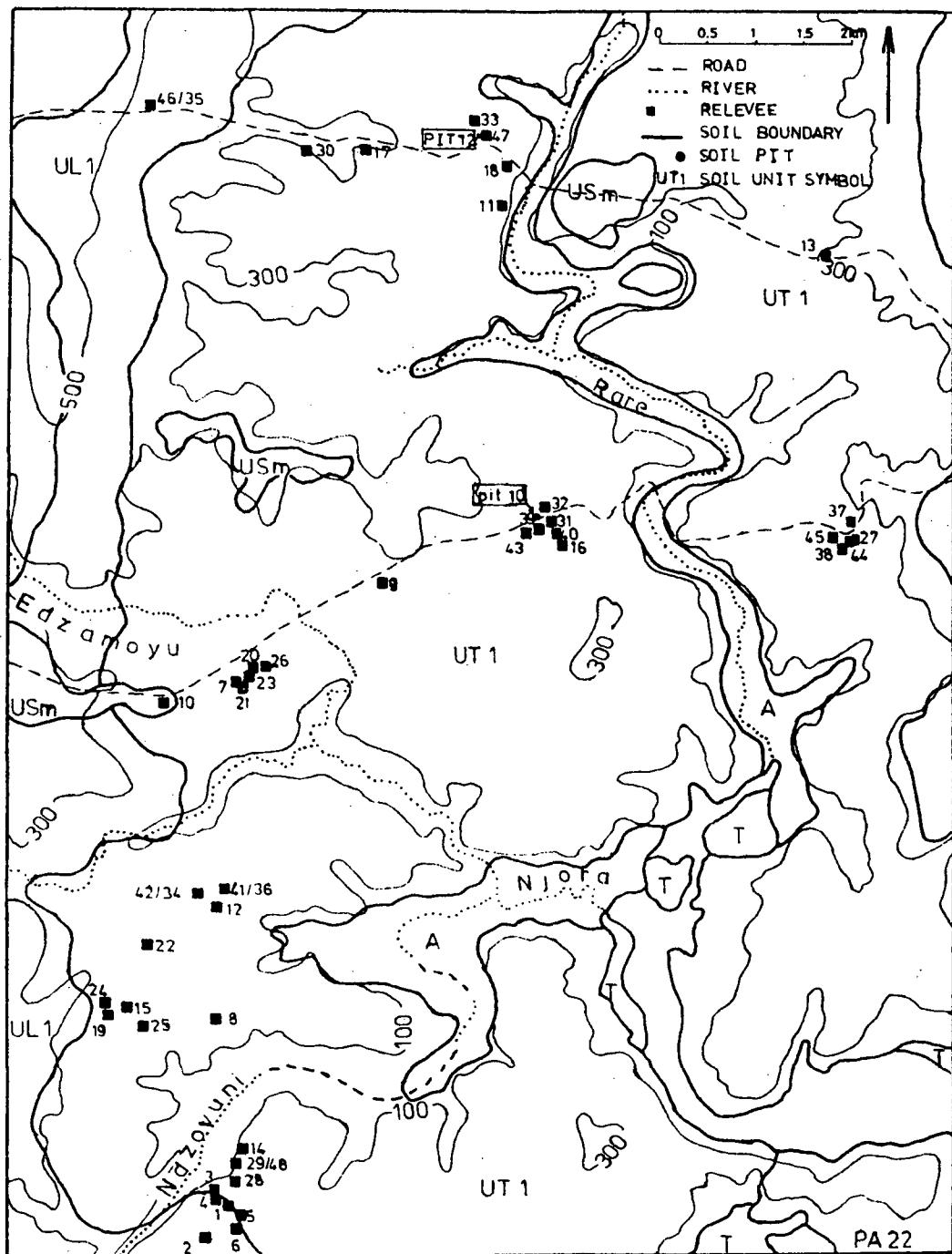


Fig.3. The soil map of the Northern Shale area, drawn on scale 1:50,000  
 (preliminary soil map of the Kilifi area, Floor et al. 1980,  
 mapsheet 198 scale 1:100,000).

In the reconnaissance soil survey 1:100,000 (Floor et al. 1980) of the Kilifi area (Fig. 3) only one unit is distinguished: UT<sub>1</sub>. The classification of the soils according to the FAO soil map of the world is: Eutric Cambisol, Chromic Luvisol, Chromic Vertisol and according to the USDA Soil Taxonomy: Udic Ustochrept, Udic Rhodustalf, Typic Chromustert.

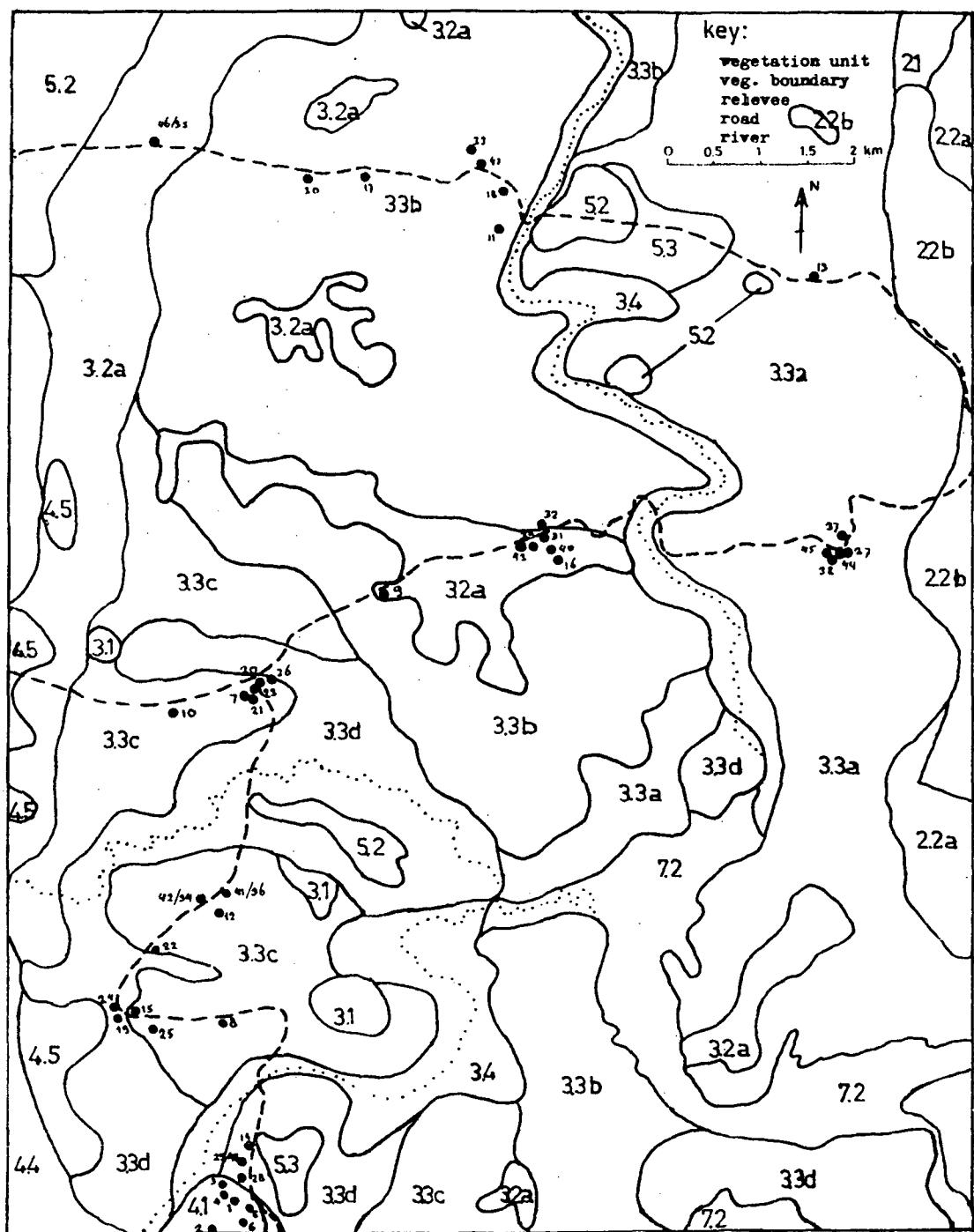


Fig.4. The vegetation and landuse map of the Northern Shale landscape (derived from the vegetation and landuse map of Kilifi, Maarten van Leeuwen 1981, scale 1:100,000; drawn on scale 1:50,000).

## 2.1 Working methods

Firstly, a rough airphoto interpretation map of landuse and vegetation (Fig.4) was studied and some field observations were made. The airphotos were taken in 1968; scale 1:49,500. The following major vegetation units were distinguished; forest, secondary bush, deserted fields, fields, grassland and burned vegetation with scattered trees and bushes. In each unit and in some of the transitions 48 vegetation descriptions were made.

In the Jaribuni-Kirumbe area (Fig.2) various unit elements are found close to each other. Many relevees could be made within short distance of each other. Later on relevees were made throughout the northern shale area to check the information derived from the Jaribuni-Kirumbe area.

The field work was carried out at the end of the long rainy season in June 1981. The relevees were made and tabulated as described in Preliminary Report nr. 3, to classify the stages of succession and degradation. The units are not mapped. The physiognomic classification is according to Pratt and Gwyne (1976).

## 2.2 Field data

The environmental data of the relevees are listed in App.2:

- 1 the relevee number
- 2 the location (Fig. 2)
- 3 the physiognomic classification
- 4 the height above sea level (feet, meter)
- 5 the topographic position (top, hill slope, plateau)
- 6 the colour of the topsoil, subsoil (Munsell colour book)
- 7 CaCO<sub>3</sub> at depth (cm)
- 8 the textural class
- 9 the surface area

The vegetation samples are listed in appendix 1. The bar diagram (Fig.5) is derived from the synoptic table (App.1).

| Sociological group    | Vegetation communities                   |  |   |   |  |
|-----------------------|--|--|---|---|--|
|                       | <u>Croton pseudopulchellus</u><br>Forest | <u>Kleinia kleindoides</u><br>bushland | <u>Dioscorea esculenta</u><br>shrubland | <u>Securinega virosa</u><br>arable land | <u>Euclytia fructuosa</u><br>wooded part of<br>Heteropogon contortus |
| Trees and shrubs      |  |  |   |   |  |
| I Croton gr.          | █  |  |   |   |  |
| II Commiphora gr.     | █  | █                                      |   |   | █  |
| III Premna gr.        | █  | █                                      |   |   | █  |
| IV Strychnos gr.      | █  | █                                      |   |   | █  |
| V Theespesia gr.      | █  | █                                      |   |   | █  |
| VI Clerodendrum gr.   |  | █                                      |   |   | █  |
| VII Manilkara gr.     |  | █                                      |   |   | █  |
| Scandent plants       |  |  |   |   |  |
| VIII Pyrenacantha gr. | █  |  |   |   |  |
| IX Uvaria gr.         |  | █                                      |   |   | █  |
| X Kleinia gr.         |  | █                                      |   |   | █  |
| XI N.S.51 gr.         |  | █                                      |   |   | █  |
| Herbs                 |  |  |   |   |  |
| XII Anchomanus gr.    |  |  |   |   |  |
| XIII N.S.72 gr.       |  |  | █                                       |   | █  |
| XIV N.S.79 gr.        |  |  |   | █                                       |  |
| XV Emilia gr.         |  |  |   | █                                       |  |
| XVI N.S.94 gr.        |  |  |   | █                                       |  |
| Grasses               |  |  |   |   |  |
| XVII Heteropogon gr.  |  |  |   |   | █  |
| XVIII Tetrapogon gr.  |  |  | █                                       |   | █  |

Fig.5 Scheme of the vegetation communities based on combination of sociological groups. The composition of the sociological groups can be derived from App. 1.

Continuous bar: must occur, interrupted bar: may occur, no bar: should not occur.

### 3 THE VEGETATION UNITS

#### 3.1 A description of the Plant Communities

Five structural vegetation types were distinguished on beforehand: Primary forest, secundairy bush, fallow arable land, arable land and a unit subject to seasonal burning (a grassland with scattered trees and bushmounds). After the field research it appeared that these structural types represent 5 floristic classification categories: Croton pseudopulchellus forest, Kleinia kleiniooides bushland, Thespesia danis shrubland, Securinega virosa arable land, Euclia fructuosa wooded grassland and Heteropogon contortus grassland part of wooded grassland.

All vegetation types are scattered throughout the area, except the forest. The soils of the relevees differ in calcium carbonate content, colour and texture, but these differences seem not to be specific for a vegetation unit (App. 2 and Fig. 5). Characteristic vegetation structure diagrams of the vegetation units are presented in Fig. 7.

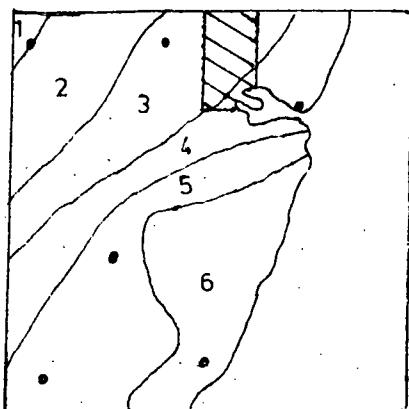
#### Croton pseudopulchellus forest

The use of this forest is extensive exploitation of wood, for charcoal production or building construction. The forest of Kauma has a religious function and is therefore protected against intensive exploitation.

The forest is found only in the western half of the area. A physical gradient (rainfall, soil) from west to east might be the cause.

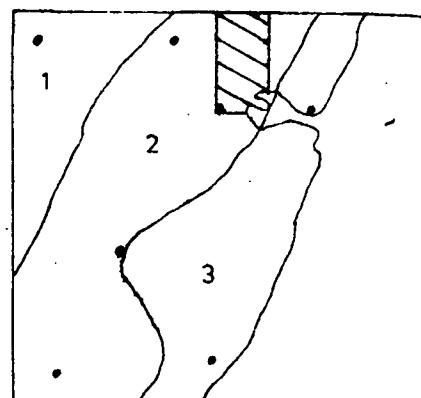
The relevees 1-6 (see App. 1) all stem from the Kauma Kaya forest. They differ from numbers 7, 8 and 9. The sociological groups VIII and XII are only found in the first six relevees. The soils of these six samples are more brown. Interaction with the vegetation on the Magarini sands east of the forest and/or the one on the limestones west of the forest might be the cause.

It is remarkable that relevee nr. 5, of the most disturbed part of the forest has the highest number of tree and shrub species in common with those of small remnants of forest surrounded by more intensively used sites (7, 8 and 9). The relevees 5, 7, 8, and 9 are composed of many species of the groups II, III and IX. These three groups appear to be specific for recovering vegetations like the bushland and the wooded part of wooded grassland (to be described subsequently). In these samples (5, 7, 8, 9) many trees were cut, which is the first degradation-step. They can be seen as the transition between the forest and the bushland or wooded grassland.



|                            |           |                            |             |
|----------------------------|-----------|----------------------------|-------------|
| <input type="checkbox"/> 1 | 600 - 700 | <input type="checkbox"/> 4 | 900 - 1000  |
| <input type="checkbox"/> 2 | 700 - 800 | <input type="checkbox"/> 5 | 1000 - 1100 |
| <input type="checkbox"/> 3 | 800 - 900 | <input type="checkbox"/> 6 | 1100 - 1200 |

Fig. 6 average annual rainfall (mm)  
(from T.P.I.P preliminary report no 1)



|                            |           |
|----------------------------|-----------|
| <input type="checkbox"/> 1 | 2200-2300 |
| <input type="checkbox"/> 2 | 2100-2200 |
| <input type="checkbox"/> 3 | 2000-2100 |

Fig.6 average annual evaporation

### Kleinia kleinioides bushland

This vegetation unit occurs on arable land which is deserted since many years, on former wooded grassland and on areas which give problems with cultivation, (slopes to erosion gullies e.g.).

Extensive exploitation for firewood and building material is practiced. The vegetation is too dense for ranging, consequently this landuse is hardly observed. This bushland has nearly all sociological groups in common with the Euclia fructuosa wooded part of the grassland, but differs through the presence of group IX and Kleinia kleinioides and the absence of group VII.

Both types seem to be on the same level of succession towards the climax vegetation.

### Thespesia danis shrubland

These shrublands were cultivated a few years ago, sample 23 even one year ago. Presently they serve as rangeland for cows and goats. Especially herbs are important cattlefood.

These shrublands develop into a bushland, unless they are cleared and used again, or burned.

### Securinega virosa arable land

Most of the arable land is found surrounding (often temporary) huts or villages. The fallow and cultivation periods show a large variation. The longer the distance from the hut the shorter the cultivation period. In the fallow period, the fields with maize, cassave and beans change into shrubland or grassland.

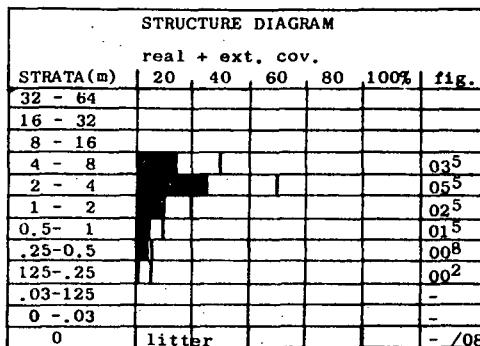
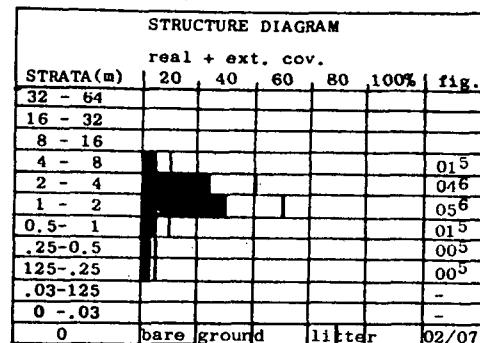
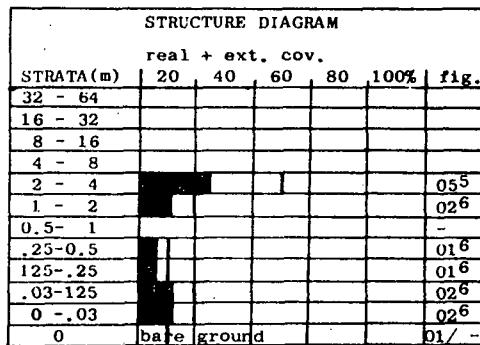
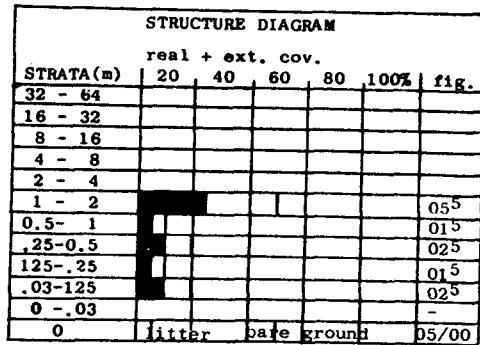
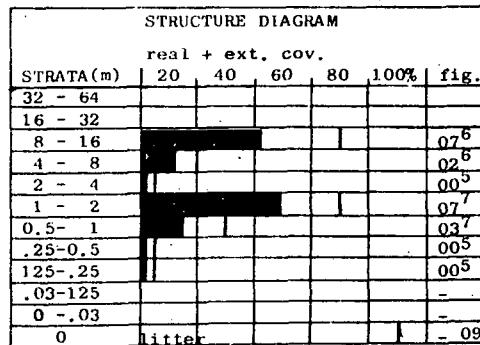
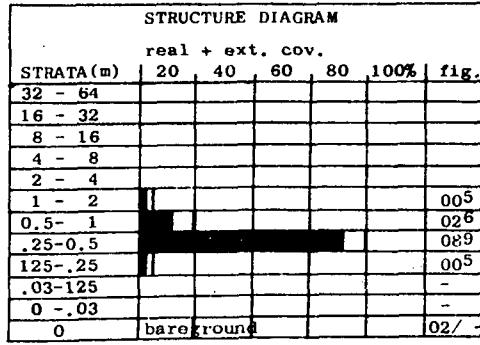
### Wooded grassland

Most of the wooded grasslands has been arable land or might be a relict of the influence of the larger mammals and herdsmen who inhabited the area a century ago. In the fallow period the vegetation is burned down regularly. The high trees are able to survive the fire, while the young ones in the grass are killed. The wooded part of the wooded grassland grows often on a former termite mound or around a former shade tree ('bushmounds').

The grassland part and wooded part of wooded grassland were sampled separately and appear separately in the table.

The soils of nrs. 35 and 46 are developed from a different parent material.

Fig.7. Characteristic structure diagrams of the plant communities :

Croton pseudopulchellus forest  
(relevee 2)Kleinia kleiniooides bushland  
(relevee 12)Thespesia danis shrubland (21)  
(rel. 21)Securinega virosa arable land  
(rel. 26)Euclia fructuosa wooded part  
of wooded grassland (rel. 38)Heteropogon contortus grassland  
part of wooded grassland (44)

*Euclia fructuosa* wooded part of wooded grassland

The wooded part is used extensively for firewood and construction wood. This type is rather similar in structure and floristic composition to the *Kleinia kleinio-ides* bushlands. They might have changed into each other with in- and decreasing wild animal populations or herds in earlier days.

*Heteropogon contortus* grassland part of wooded grassland

The grassland is in extensive use as rangeland. With decreasing fire frequency the wooded grasslands develop towards shrub- or bushland. This unit has many species in common with the bush, shrub and arable land and the wooded part of wooded grassland.

3.2 The correlation of the plant communities described in Preliminary Reports 3 and 4

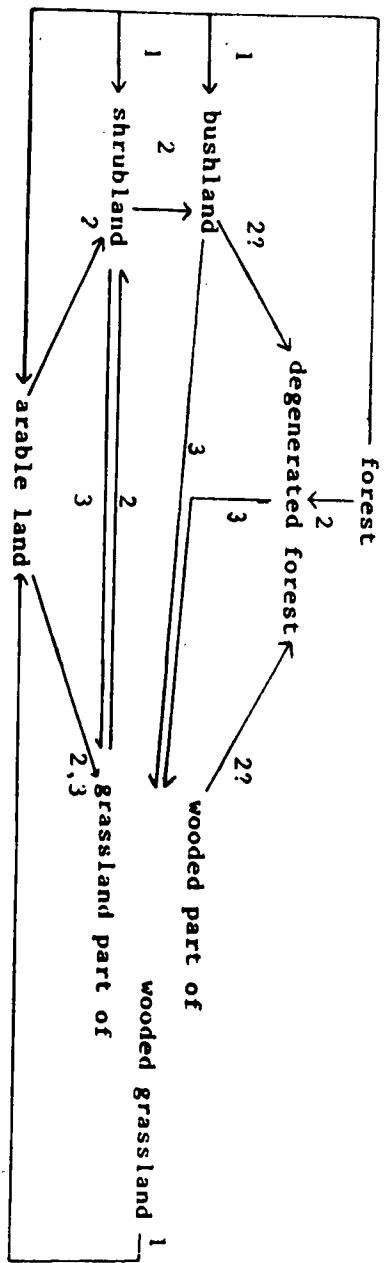
The vegetation of the northern part of the *Terminalia spinosa - Maytenus senegalensis* landscape is in Preliminary Report nr. 3 (M. van Leeuwen) described with 3 plant communities (F1, F2 and I, see bar diagram in Preliminary Report nr. 3) and in Preliminary Report nr. 3 with 5 plant communities (see bar diagram in Fig. 6).

Apart from the difference in scale (of study) this difference is caused by the fact that in Preliminary Report nr. 3 the seemingly least unnatural vegetation formations were studied, while here descriptions are made of various stages of human influence on the vegetation.

The least disturbed plant communities of this study show a high correlation with F1, F2, and I: the *Croton pseudopulchellus* forest with I, the *Kleinia kleinio-ides* bushland and *Euclia fructuosa* wooded part of wooded grassland with F1 and *Heteropogon contortus* grassland part of the wooded grassland with F2.

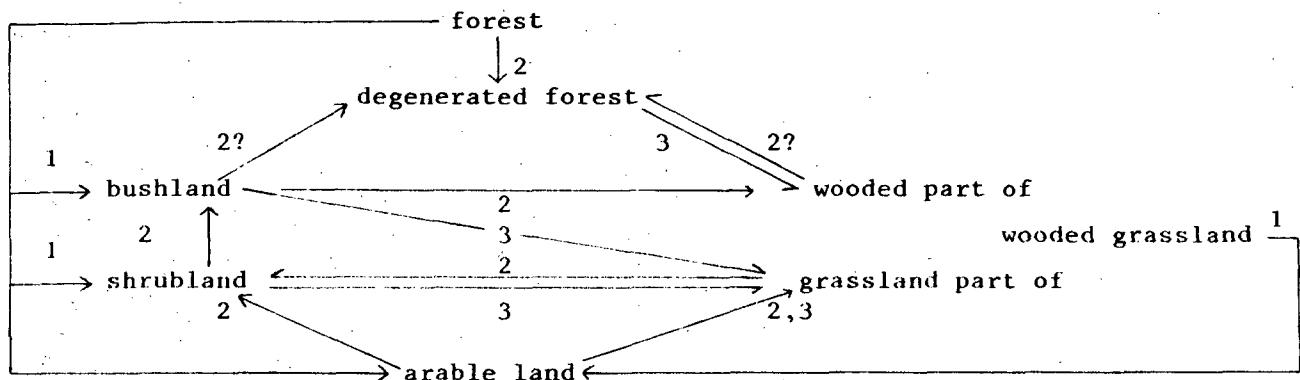
The *Securinega virosa* arable land and *Thespesia danis* shrubland show some correlation with the plant communities F1 and F2, but have many species which can be found on arable land in the whole Kilifi area.

Eratum: page 15



## 4 CONCLUSION

The relation between landuse and the vegetation types:



1. intensive exploitation (clearing)
2. extensive exploitation (gathering and cutting of wood, or ranging)
3. burning

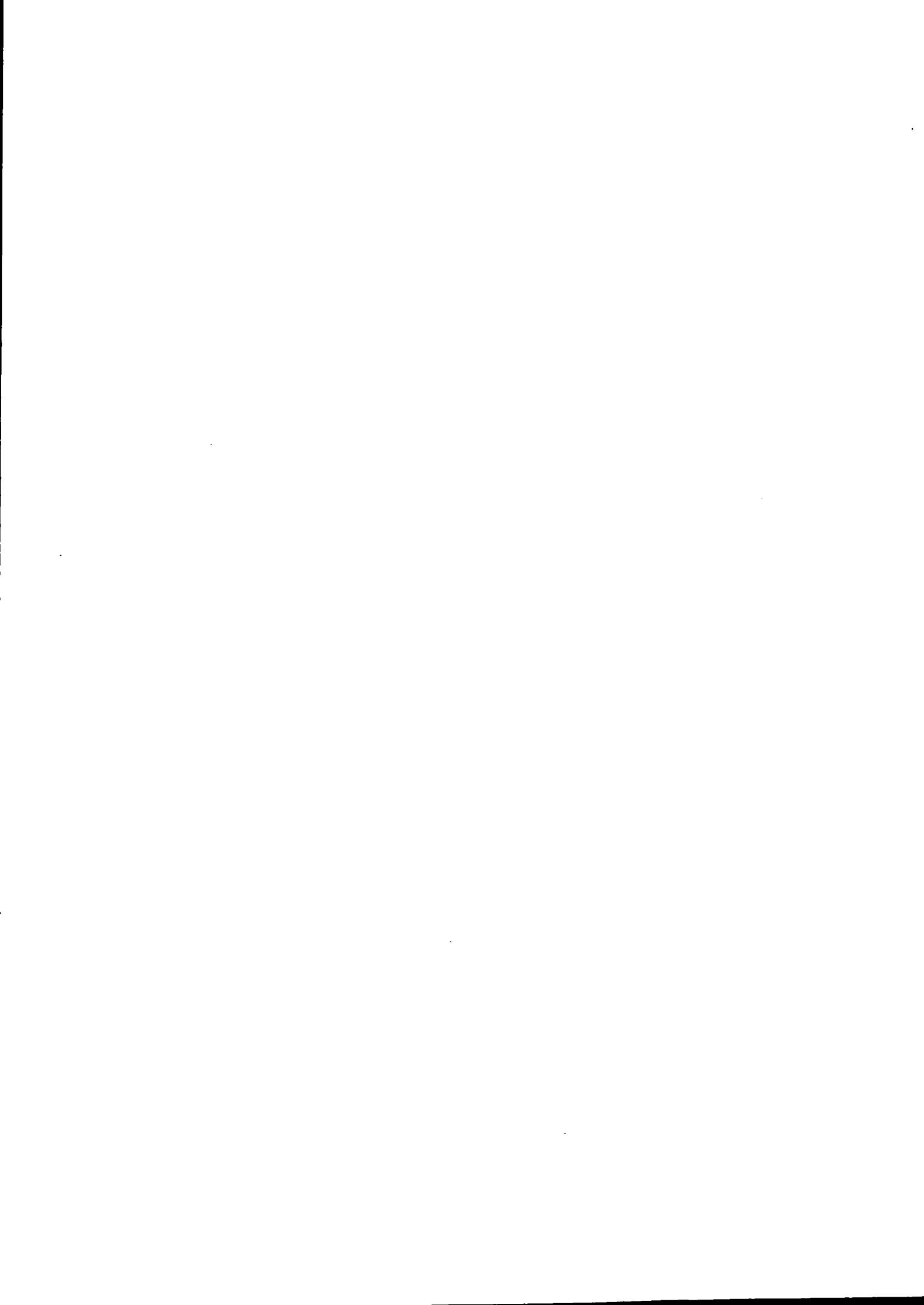
The human influence on the vegetation is one of the main determining factors. With a change in this influence the vegetation types would develop in a different way with different relations. Before the occupation for arable land started, herdsmen and large wild mammals must have determined the vegetation of this area, also with clearing (elephants) and burning (natural and induced fires).

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Appendix 2. Environmental data of the relevées.

| 1  | 2                | 3               | 4Ft (m)       | 5    | 6                     | 7(cm) | 8               | 9(m <sup>2</sup> ) |
|----|------------------|-----------------|---------------|------|-----------------------|-------|-----------------|--------------------|
| 1  | Jaribuni         | forest          | 210 (63)      | HS   | 7,5Y 1/4/4            | 0     | clay            | 150                |
| 2  | Jaribuni         | forest          | 210 (63)      | HS   | 2,5Y 2,5/4            | -     | silty clay      | 200                |
| 3  | Jaribuni         | forest          | 190 (45)      | HS   | 10YR4/4 (2,5Y7/4)     |       | silty clay      | 200                |
| 4  | Jaribuni         | forest          | 190 (57)      | HS   | 7,5YR4/6 7,5YR4/6     |       | silty clay      | 200                |
| 5  | Jaribuni         | bushland        | 250 (75)      | HS   | 10YR4/4 (2,5Y 7/3)    |       | silty clay      | 200                |
| 6  | Jaribuni         | forest          | 200 (60)      | HS   | 10YR4/4 7,5YR6/4      |       | silty clay      | 200                |
| 7  | Kirumbe          | bushland        | 190 (57)      | T/HS | 10YR3/2 2,5YR5/4      |       | silty clay      | 100                |
| 8  | Jaribuni/Kirumbe | bushland        | 150 (45)      | T/P  | 10YR3/3               |       | silty clay      | 200                |
| 9  | Kirumbe/Kenjera  | forest          | 250 (75)      | T/HS | 10YR4/2               |       | clay            | 400                |
| 10 | Kirumbe          | shrubland       | 250 (75)      | T/P  | 10YR3/3 2,5Y4/2 50    |       | clay            | 300                |
| 11 | Lower Sekeke     | bushland        | 150 (95)      | T/HS | 2,5YR5/4 2,5Y5/4 50   |       | silty clay      | 100                |
| 12 | Jaribuni         | bushland        | 250 (75)      | T/HS | 10YR4/3 2,5Y7/4       |       | silty clay      | 200                |
| 13 | Lower Sekeke     | bushland        |               | HS   | 10YR4/2 10YR5/3 30    |       | clay            | 150                |
| 14 | Jaribuni         | shrubland       | 250 (45)      | T/HS | 10YR5/3               |       | silty clay      | 200                |
| 15 | Jaribuni         | woodland        | 270 (72)      | HS   | 2,8Y4/4               | 0     | silty clay      | 100                |
| 16 | Konjera          | forest          |               | T    | 10YR3/3 10YR3/4       |       | clay            | 200                |
| 17 | Magogoni         | woodland        |               | T/HS | 10YR4/4               |       | clay            | 150                |
| 18 | Lower Sekeke     | bushland        |               | HS   | 10YR5/4               | 0     | clay            | 75                 |
| 19 | Jaribuni         | shrubland       | 250 (75)      | T/HS | 10YR3/3 2,5Y5/1 0     |       | silty clay      | 100                |
| 20 | Kirumbe          | bushland        | 180 (64)      | T/HS | 10YR3/2               |       | clay            | 150                |
| 21 | Kirumbe          | shrubland       | 100 (64)      | T/HS | 10YR3/8               | 0     | clay            | 150                |
| 22 | Jaribuni         | shrubland       | 260 (178)     | HS   | 10YR4/3 10YR4/4       |       | clay            | 400                |
| 23 | Kirumbe          | shrubland       | 190 (57)      | T/P  | 10YR3/4 10YR3/4 0     |       | clay            | 100                |
| 24 | Jaribuni         | arableland      | 250 (75)      | T/HS | 10YR3/3 2,5Y4/4       |       | silty clay      | 150                |
| 25 | Jaribuni         | arableland      | 200 (60)      | T/HS | 10YR3/4 2,5Y4/4       |       | silty clay      | 100                |
| 26 | Kirumbe          | arableland      | 180 (57)      | T/HS | 2,5Y3/2 2,5Y3/2       |       | clay            | 200                |
| 27 | Upper Sekeke     | arableland      | 290 (57)      | T/HS | 10YR3/3 2,5Y3/4 70    |       | silty clay      | 100                |
| 28 | Jaribuni         | arableland      | 150 (45)      | HS   | 10YR4/4 7,5YR4/6      |       | clay            | 100                |
| 29 | Jaribuni         | arableland      | 150 (45)      | HS   | 10YR4/4 7,5YR4/6      |       | sandy clay      | 100                |
| 30 | Magegeni         | shrub grassland | 310/93T/HS    |      | 7,5YR4/42,5Y5/4 0     |       | clay            | 200                |
| 31 | Konjera          | grassland       | 250 (75)      | T/HS | 7,5YR4/6              |       | sandyclay       | 100                |
| 32 | Konjera          | arableland      |               | T    | 7,5YR4/6 7,5YR4/6     |       | clay            | 150                |
| 33 | Lower Sekeke     | shrub (G.L.)    | 250 (75)      | T    | 7,5Y4/4, 2,5Y4/4 0    |       | clay            | 200                |
| 34 | Jaribuni         | wooded (G.L.)   | 250 (75)      | T    | 10YR3/3               |       | silty clay      | 100                |
| 35 | Magegeni         | wooded (G.L.)   | 150 (25)      | T/HS | 10YR4/4 7,5YR5/8      |       | sandy clay L.50 |                    |
| 36 | Jaribuni         | wooded (G.L.)   | 250 (75)      | T    | 10YR3/2 10YR3/4       |       | silty clay      | 50                 |
| 37 | Upper Sekeke     | wooded (G.L.)   | 280 (81)      | HS   | 10YR4/8               |       | clay            | 400                |
| 38 | Upper Sekeke     | wooded (G.L.)   | 300 (90)      | HS   | 2,5Y 7/8              |       | clay            | 200                |
| 39 | Xenjera          | wooded (G.L.)   |               | TP   | 10YR3/3 10YR 4/6 60   |       | clay            | 200                |
| 40 | Kenjera          | shrubland       | 230 (69) HS   |      | 10YR3/3 10YR 3/6      |       | clay            | 200                |
| 41 | Jaribuni         | wooded (G.L.)   | 250 (75) T    |      | 10YR3/2 10YR 3/4      |       | silty clay      | 200                |
| 42 | Jaribuni         | wooded (G.L.)   | 250 (75) T    |      | 10YR3/3               |       | silty clay      | 100                |
| 43 | Xenjera          | wooded (G.L.)   | 225 (67) T/HS |      | 7,5YR 4/6             |       | sandyclay       | 200                |
| 44 | Upper Sekeke     | shrub (G.L.)    | 290 (87) T/HS |      | 10YR3/3 5Y4/3 60      |       | clay            | 100                |
| 45 | Upper Sekeke     | grassland       |               |      | T/HS 10YR3/3 2,5Y7/8  |       | clay            | 100                |
| 46 | Magegeni         | wooded (G.L.)   |               |      | T/HS 10YR4/4 7,5YR5/8 |       | sandyclay L. 25 |                    |
| 47 | Lower Sekeke     | wooded (G.L.)   |               |      | T/HS 10YR3/3 2,5Y 5/4 |       | clay            | 100                |
| 48 | Jaribuni         | shrub (G.L.)    | 250 (HS) HS   |      | 10YR4/4 7,5YR4/4      |       | clay            | 50                 |





**Appendix I : The vegetation-table of the northern shale Region of the Kilifi area**

### Physiognomic table

Wageningen, The Netherlands

## APP. III SYNOPTIC VEGETATION TABLE

| PLANT SPECIES                      | PLANT COMMUNITY | 1<br>(9) | 2<br>(8) | 3<br>(6) | 4<br>(9) | 5<br>(6) | 6<br>(10) |
|------------------------------------|-----------------|----------|----------|----------|----------|----------|-----------|
| <b>TREES &amp; SHRUBS:</b>         |                 |          |          |          |          |          |           |
| <i>Encephalartos hildebrandtii</i> |                 | 9        | 1        | 2        | 1        | 2        | 1         |
| <i>Euphorbia candolaebrum</i>      |                 | 10       | 8        | 3        | 2        | 2        | 2         |
| <i>Croton pseudopulchellus</i>     |                 | 10       | 9        |          |          |          |           |
| <i>Cynometra suahelicensis</i>     |                 | 6        | 23       |          |          |          |           |
| <i>Jubbernardia magnistipulata</i> |                 | 4        | 17       |          |          |          |           |
| NS 1                               |                 | 4        | 3        |          |          |          |           |
| <i>Adenium obesum</i>              |                 | 4        | 1        | 2        | 1        |          |           |
| NS 2                               |                 | 3        | 2        |          |          |          |           |
| NS 3                               |                 | 3        | 4        |          |          |          |           |
| <i>Manilkara sulcata</i>           |                 | 7        | 5        |          |          |          |           |
| NS 4                               |                 | 5        | 2        |          |          |          |           |
| NS 5                               |                 | 4        | 6        | 2        | 1        |          |           |
| <i>Heeria mucronata</i>            |                 | 4        | 6        | 4        | 2        |          |           |
| <i>Grewia stuhlmannii</i>          |                 | 5        | 1        | 2        | 1        |          |           |
| <i>Commiphora africana</i>         |                 | 5        | 14       | 3        | 6        |          |           |
| NS 6                               |                 | 5        | 2        | 9        | 3        |          |           |
| <i>Diospyros cornii</i>            |                 | 4        | 14       | 5        | 6        |          |           |
| <i>Polysphaeria parvifolia</i>     |                 | 5        | 2        | 3        | 2        |          |           |
| <i>Allophylus</i> sp.              |                 | 3        | 2        | 7        | 6        |          |           |
| <i>Maytenus senegalensis</i>       |                 | 3        | 8        | 4        | 3        |          |           |
| NS 7                               |                 | 3        | 3        | 5        | 3        |          |           |
| NS 8                               |                 | 4        | 2        | 3        | 1        |          |           |
| NS 9                               |                 | 3        | 6        | 4        | 14       |          |           |
| <i>Premna chrysoclada</i>          |                 | 3        | 1        | 7        | 2        |          |           |
| <i>Fragaria holtziana</i>          |                 |          |          | 2        | 1        |          |           |
| <i>Lantana camara/viburnoides</i>  |                 | 2        | 1        | 5        | 3        |          |           |
| NS 10                              |                 | 3        | 2        | 5        | 3        |          |           |
| <i>Ehretia petiolaris</i>          |                 | 2        | 1        | 3        | 2        |          |           |
| <i>Lannea stuhlmannii</i>          |                 |          |          | 4        | 1        |          |           |
| NS 11                              |                 | 2        | 2        | 4        | 1        |          |           |
| NS 12                              |                 |          |          | 3        | 1        |          |           |
| NS 13                              |                 | 2        | 6        | 2        | 2        |          |           |
| <i>Vitellariopsis kirkii</i>       |                 | 3        | 9        | 5        | 14       |          |           |
| NS 14                              |                 | 3        | 1        |          |          |          |           |
| NS 15                              |                 | 2        | 1        | 3        | 4        |          |           |
| <i>Cordia ovalis</i>               |                 | 2        | 5        | 2        | 2        |          |           |
| <i>Afzelia cuanensis</i>           |                 | 2        | 5        | 2        | 1        |          |           |
| NS 16                              |                 | 2        | 1        |          |          |          |           |
| <i>Terminalia prunioides</i>       |                 | 2        | 12       | 5        | 4        |          |           |
| <i>Euclea fructuosa</i>            |                 | 2        | 6        | 4        | 2        |          |           |
| <i>Grewia ectasicarpa</i>          |                 | 2        | 5        | 5        | 7        |          |           |
| <i>Ziziphus mucronata</i>          |                 |          |          | 3        | 4        |          |           |
| <i>Dalbergia vaccinifolia</i>      |                 | 2        | 1        | 3        | 5        |          |           |
| <i>Strychnos dysophylla</i>        |                 | 3        | 2        | 3        | 4        |          |           |
| <i>Grewia villosa</i>              |                 |          |          | 7        | 1        |          |           |
| NS 17                              |                 |          |          | 4        | 2        |          |           |
| <i>Thespesia danie</i>             |                 | 2        | 2        | 5        | 3        |          |           |
| NS 18                              |                 | 2        | 5        | 2        | 1        |          |           |
| <i>Acacia nilotica</i>             |                 |          |          | 2        | 5        |          |           |
| <i>Vernonia homalanthus</i>        |                 |          |          | 5        | 9        |          |           |
| <i>Ormoscarpum kirkii</i>          |                 | 3        | 2        | 3        | 4        |          |           |
| <i>Dichrostachys cinerea</i>       |                 |          |          | 2        | 2        |          |           |
| <i>Phyllanthus reticulatus</i>     |                 |          |          | 5        | 14       |          |           |
| <i>Indigofera garckeana</i>        |                 |          |          | 3        | 1        |          |           |
| <i>Securinega virosa</i>           |                 |          |          | 2        | 10       |          |           |
| <i>Clerodendrum glabrum</i>        |                 | 2        | 1        |          | 6        |          |           |
| NS 20                              |                 |          |          |          | 8        |          |           |
| NS 21                              |                 |          |          |          | 4        |          |           |
| <i>Ochna thomasiana</i>            |                 | 3        | 2        | 3        | 2        |          |           |
| NS 22                              |                 | 3        | 2        | 4        | 4        |          |           |
| <i>Grewia bicolor</i>              |                 | 2        | 1        | 3        | 2        |          |           |
| <i>Hosplundia opposita</i>         |                 | 3        | 2        | 2        | 1        |          |           |
| <i>Deinbollia borbonica</i>        |                 | 2        | 14       | 4        | 1        |          |           |
| <i>Commiphora boiviana</i>         |                 |          |          | 3        | 2        |          |           |
| <i>Manilkara zanzibarica</i>       |                 | 2        | 1        | 3        | 1        |          |           |
| <i>Cassia sanguinea</i>            |                 |          |          | 2        | 2        |          |           |
| <i>Acacia mollifera</i>            |                 |          |          | 2        | 5        |          |           |
| <i>Acacia senegal</i>              |                 |          |          | 2        | 1        |          |           |
| NS 23                              |                 |          |          | 3        | 5        |          |           |
| NS 24                              |                 | 2        | 2        | 2        | 1        |          |           |
| <i>Ehretia bakeri</i>              |                 |          |          | 3        | 1        |          |           |
| NS 25                              |                 |          |          | 2        | 2        |          |           |
| NS 26                              |                 |          |          | 2        | 2        |          |           |
| NS 27                              |                 | 2        | 1        |          |          |          |           |
| NS 28                              |                 | 2        | 1        |          |          |          |           |
| NS 29                              |                 | 2        | 1        |          |          |          |           |
| NS 30                              |                 |          |          | 2        | 1        |          |           |
| <i>Ziziphus mauritania</i>         |                 |          |          | 2        | 2        |          |           |
| <i>Lamprothamnus zanguebaricus</i> |                 |          |          | 2        | 1        |          |           |
| <i>Fernandesia magnifica</i>       |                 | 2        | 2        | 3        | 4        |          |           |
| NS 31                              |                 |          |          | 2        | 1        |          |           |
| NS 32                              |                 | 2        | 2        | 2        | 1        |          |           |
| <i>Salvadora persica</i>           |                 | 2        | 1        | 2        | 2        |          |           |
| NS 33                              |                 |          |          | 5        | 1        |          |           |
| NS 34                              |                 |          |          | 2        | 2        |          |           |
| <i>Harrysonia abyssinica</i>       |                 | 2        | 1        | 2        | 1        |          |           |
| NS 35                              |                 |          |          | 2        | 1        |          |           |
| <i>Adansonia digitata</i>          |                 |          |          |          |          | 2        |           |
| NS 36                              |                 |          |          |          |          | 1        |           |
| <b>SCANDENT PLANTS:</b>            |                 |          |          |          |          |          |           |
| NS 37                              |                 | 3        | 1        |          |          |          |           |
| NS 38                              |                 | 3        | 2        |          |          |          |           |
| <i>Combretum butyrosum</i>         |                 | 5        | 4        |          |          |          |           |
| <i>Pyrenacantha malivifolia</i>    |                 | 5        | 8        |          |          |          |           |
| NS 39                              |                 | 7        | 3        | 2        | 1        |          |           |
| NS 40                              |                 | 6        | 4        | 2        | 1        |          |           |
| <i>Enneastemon formicatus</i>      |                 | 6        | 8        | 5        | 2        |          |           |
| <i>Cissus quadrangularis</i>       |                 | 6        | 4        | 9        | 3        |          |           |
| <i>Uvaria acuminata</i>            |                 | 4        | 5        | 5        | 8        |          |           |
| <i>Euphorbia tirucalli</i>         |                 | 4        | 3        | 5        | 2        |          |           |
| <i>Capparis stuhlmannii</i>        |                 | 3        | 1        | 3        | 1        |          |           |
| <i>Adenium globosa</i>             |                 | 4        | 2        | 3        | 3        |          |           |
| NS 41                              |                 | 3        | 2        | 8        | 3        |          |           |
| <i>Asparagus racemosus</i>         |                 | 2        | 1        | 4        | 1        |          |           |
| <i>Kleinia kleinioidea</i>         |                 | 2        | 1        | 5        | 2        |          |           |
| <i>Cissus rotundifolius</i>        |                 | 2        | 1        | 8        | 2        |          |           |
| NS 42                              |                 |          |          | 2        | 2        |          |           |
| NS 43                              |                 |          |          | 3        | 1        |          |           |
| NS 44                              |                 | 3        | 1        |          |          | 2        |           |
| NS 45                              |                 | 3        | 1        |          |          | 1        |           |
| NS 46                              |                 | 2        | 1        | 3        | 1        |          |           |
| NS 47                              |                 |          |          | 2        | 1        |          |           |
| NS 48                              |                 |          |          | 2        | 1        |          |           |
| <i>Cissampelos truncata</i>        |                 |          |          | 5        | 3        |          |           |
| NS 49                              |                 | 2        | 1        | 2        | 8        |          |           |
| NS 50                              |                 |          |          | 3        | 1        |          |           |
| NS 51                              |                 |          |          | 5        | 2        |          |           |
| NS 52                              |                 |          |          | 4        | 2        |          |           |
| NS 53                              |                 |          |          | 4        | 2        |          |           |
| NS 54                              |                 |          |          | 3        | 1        |          |           |
| NS 55                              |                 | 2        | 1        |          |          | 2        |           |
| NS 56                              |                 | 3        | 2        | 4        | 2        |          |           |
| NS 57                              |                 |          |          | 2        | 1        |          |           |
| NS 58                              |                 |          |          | 5        | 1        |          |           |
| NS 59                              |                 |          |          | 2        | 1        |          |           |
| NS 60                              |                 |          |          | 3        | 2        |          |           |
| NS 61                              |                 |          |          | 2        | 1        |          |           |
| NS 62                              |                 |          |          | 2        | 1        |          |           |
| NS 63                              |                 |          |          | 4        | 1        |          |           |
| NS 64                              |                 | 2        | 2        |          |          | 2        |           |
| NS 65                              |                 |          |          | 2        | 1        |          |           |
| NS 66                              |                 |          |          | 2        | 1        |          |           |
| NS 67                              |                 |          |          | 2        | 1        |          |           |
| <b>HERBS:</b>                      |                 |          |          |          |          |          |           |
| <i>Anchomanus dubium</i>           |                 | 4        | 1        |          |          |          |           |
| NS 68                              |                 | 4        | 1        |          |          |          |           |

| NS                       | 69  | 2 | 1 | 2 | 1               |   |     |   |     | 1 | 1    |
|--------------------------|-----|---|---|---|-----------------|---|-----|---|-----|---|------|
| NS                       | 70  | 2 | 1 | 2 | 1               |   |     |   |     | 7 | 3    |
| NS                       | 71  | 2 | 1 | 3 | 1               | 7 | 2   | 6 | 8   | 1 | 2    |
| NS                       | 72  |   |   | 4 | 1               | 5 | 1   | 5 | 1   | 8 | 2    |
| NS                       | 73  |   |   |   |                 | 4 | 6   | 3 | 2   |   |      |
| NS                       | 74  |   |   |   |                 | 4 | 2   | 4 | 1   |   |      |
| NS                       | 75  |   |   |   |                 | 4 | 1   | 4 | 1   | 3 | 4    |
| NS                       | 76  |   |   |   |                 | 2 | 5   | 5 | 1   | 1 | 1    |
| NS                       | 77  |   |   |   |                 |   |     | 7 | 1   | 2 | 2    |
| NS                       | 78  |   |   |   |                 |   |     | 6 | 1   |   |      |
| NS                       | 79  |   |   |   |                 |   |     | 6 | 1   | 2 | 1    |
| NS                       | 80  |   |   |   |                 |   |     | 4 | 1   | 2 | 1    |
| NS                       | 81  |   |   |   |                 |   |     | 5 | 1   | 1 | 1    |
| NS                       | 82  |   |   |   |                 |   |     | 6 | 1   | 2 | 1    |
| NS                       | 83  |   |   |   |                 |   |     | 4 | 1   | 2 | 1    |
| NS                       | 84  |   |   |   |                 |   |     | 4 | 2   | 1 | 1    |
| Emilia javanica          |     |   |   |   |                 |   |     | 3 | 1   |   |      |
| NS                       | 85  |   |   |   |                 |   |     | 3 | 1   | 1 | 1    |
| NS                       | 86  |   |   |   |                 |   |     | 5 | 1   | 1 | 1    |
| NS                       | 87  |   |   |   |                 |   |     | 5 | 1   | 1 | 1    |
| NS                       | 88  |   |   |   |                 |   |     | 4 | 1   | 1 | 1    |
| Solanum incanum          |     |   |   |   |                 | 2 | 1   | 6 | 2   | 3 | 1    |
| NS                       | 89  |   |   |   |                 |   |     | 4 | 3   | 1 | 1    |
| Tridax procumbens        |     |   |   |   |                 |   |     | 5 | 1   | 1 | 1    |
| Leucas oligocephala      |     |   |   |   |                 |   |     | 3 | 2   | 4 | 1    |
| Guizotia scabra          |     |   |   |   |                 | 4 | 5   | 4 | 1   | 5 | 3    |
| NS                       | 90  |   |   |   |                 |   |     | 5 | 2   | 5 | 3    |
| NS                       | 91  |   |   |   |                 |   |     | 4 | 1   | 6 | 1    |
| NS                       | 92  |   |   |   |                 |   |     | 2 | 1   | 2 | 1    |
| NS                       | 93  |   |   |   |                 |   |     | 3 | 1   | 3 | 1    |
| NS                       | 94  |   |   | 3 | 1               |   |     | 2 | 1   | 4 | 1    |
| NS                       | 95  |   |   |   |                 |   |     | 2 | 1   | 2 | 1    |
| NS                       | 96  |   |   |   |                 |   |     | 2 | 1   | 2 | 2    |
| Jatropha spicata         |     |   |   |   |                 |   |     | 2 | 1   | 2 | 1    |
| NS                       | 97  |   |   |   |                 |   |     | 2 | 1   | 2 | 2    |
| NS                       | 98  |   |   |   |                 |   |     | 4 | 1   | 2 | 3    |
| NS                       | 99  |   |   |   |                 | 2 | 1   | 2 | 1   | 2 | 2    |
| NS                       | 100 |   |   |   |                 |   |     | 2 | 1   | 2 | 1    |
| NS                       | 101 |   |   |   |                 |   |     | 2 | 1   | 1 | 1    |
| NS                       | 102 |   |   |   |                 |   |     | 3 | 2   | 1 | 1    |
| NS                       | 103 |   |   | 2 | 1               |   |     | 5 | 6   | 3 | 2    |
| NS                       | 104 |   |   |   |                 |   |     | 2 | 1   | 2 | 2    |
| NS                       | 105 |   |   |   |                 |   |     | 2 | 1   | 1 | 2    |
| NS                       | 106 |   |   |   |                 |   |     | 3 | 2   | 1 | 1    |
| Blaebaris pratensis      |     |   |   | 3 | 2               |   |     | 3 | 2   |   |      |
| NS                       | 107 |   |   | 2 | 1               | 2 | 1   | 3 | 1   |   |      |
| NS                       | 108 |   |   |   |                 |   |     | 2 | 1   | 1 | 1    |
| NS                       | 109 |   |   | 2 | 2               | 2 | 1   | 2 | 1   | 1 | 1    |
| NS                       | 110 |   |   |   |                 | 2 | 1   | 5 | 3   | 1 | 1    |
| NS                       | 111 |   |   |   |                 |   |     | 2 | 1   | 1 | 1    |
| NS                       | 112 |   |   |   |                 |   |     | 3 | 1   |   |      |
| NS                       | 113 |   |   | 2 | 2               |   |     | 4 | 2   | 2 |      |
| NS                       | 114 |   |   |   |                 |   |     | 4 | 1   |   |      |
| NS                       | 115 |   |   |   |                 |   |     | 2 | 1   | 1 | 1    |
| Achyranthes aspera       |     |   |   | 2 | 1               |   |     | 2 | 1   |   |      |
| NS                       | 116 |   |   |   |                 |   |     | 2 | 1   |   |      |
| NS                       | 117 |   |   |   |                 |   |     | 3 | 1   |   |      |
| NS                       | 118 |   |   |   |                 |   |     | 4 | 1   |   |      |
| NS                       | 119 |   |   |   |                 |   |     | 3 | 2   | 1 | 1    |
| NS                       | 120 |   |   |   |                 |   |     | 2 | 1   | 1 | 1    |
| NS                       | 121 |   |   |   |                 |   |     | 3 | 1   |   |      |
| NS                       | 122 |   |   |   |                 |   |     | 3 | 1   | 2 | 1    |
| NS                       | 123 |   |   |   |                 |   |     | 2 | 1   |   |      |
| NS                       | 124 |   |   |   |                 | 2 | 1   |   |     |   |      |
| <b>GRASSES:</b>          |     |   |   |   |                 |   |     |   |     |   |      |
| NS                       | 125 |   |   | 5 | 1               |   |     | 2 | 1   | 5 | 1    |
| Heteropogon contortus    |     |   |   |   |                 |   |     |   |     | 8 | 12   |
| Panicum maximum          |     |   |   | 2 | 1               | 2 | 2   |   |     | 5 | 11   |
| Themeda triandra         |     |   |   |   |                 |   |     |   |     | 4 | 10   |
| Chloris pilosa           |     |   |   |   |                 |   |     |   |     | 4 | 12   |
| Dichanthium radicans     |     |   |   | 2 | 2               |   |     | 2 | 1   | 2 | 14   |
| Brachiaria lachnantha    |     |   |   | 2 | 5               | 3 | 2   | 8 | 3   | 1 | 9    |
| Chloris roxburiana       |     |   |   | 2 | 2               | 4 | 2   | 2 | 5   | 2 | 3    |
| Aristida aduncosius      |     |   |   |   |                 | 4 | 9   | 2 | 5   | 2 | 9    |
| Zea mays                 |     |   |   |   |                 | 2 | 1   | 4 | 10  | 2 | 16   |
| NS                       | 126 |   |   |   |                 |   |     | 6 | 15  | 2 | 10   |
| NS                       | 127 |   |   |   |                 |   |     | 4 | 6   | 2 | 1    |
| Tetrapogon villosa       |     |   |   | 2 | 2               | 5 | 8   | 5 | 4   |   |      |
| NS                       | 128 |   |   | 2 | 5               |   |     | 3 | 6   | 4 | 1    |
| NS                       | 129 |   |   |   |                 |   |     | 4 | 4   | 2 | 1    |
| NS                       | 130 |   |   |   |                 |   |     | 4 | 1   |   | 3    |
| NS                       | 131 |   |   |   |                 |   |     | 2 | 5   |   | 1    |
| NS                       | 132 |   |   |   |                 |   |     | 3 | 2   |   | 2    |
| Dactyloctenium aegyptium |     |   |   |   |                 |   |     | 3 | 2   | 1 | 2    |
| NS                       | 133 |   |   |   |                 |   |     | 2 | 2   | 1 | 5    |
| NS                       | 134 |   |   |   |                 |   |     | 2 | 2   | 1 | 2    |
| NS                       | 135 |   |   |   |                 |   |     | 2 | 2   | 1 | 5    |
| PLANT SPECIES            |     |   |   | 1 |                 | 2 | (8) | 3 | (8) | 4 | (9)  |
|                          |     |   |   |   | PLANT COMMUNITY |   |     |   |     | 5 | (6)  |
|                          |     |   |   |   |                 |   |     |   |     | 6 | (10) |

NOTES: - adapted from vegetation table (Appendix II).

- first figure per column: presence/ absence class: 1 -- occurs in 1 to 10 % of the relevée's
- 2 -- occurs in 11 to 20 % of the relevée's
- 3 -- occurs in 21 to 30 % of the relevée's
- 4 ... etc...

- second figure per column: mean coverage of the occurring species in percent.

- between brackets: number of vegetation relevée's per plant community.

- PLANT COMMUNITIES: 1 -- Croton pseudopulchellus forest  
 2 -- Kleinia kleiniooides bushland  
 3 -- Thespesia danis shrubland  
 4 -- Securinega virosa arable land  
 5 -- Euclea fructuosa wooded part of wooded grassland  
 6 -- Heteropogon contortus grassland part of wooded grassland

FROM: J. Kuyper : Human Influence on the Vegetation of Maytenus senegalensis Landscape (IS 3) 1981

