The Boscaglia Vegetation Complex in Southern Somalia

- Sandro Pignatti and Ahmed Mumin Warfa' -

SUMMARY

The boscaglia vegetation complex in Southern Somalia on fossil dunes is composed by 3 associations: (a) the *Gisekio-Tephrosietum*, a xerophilous pasture with dominance of paleotropical weeds; (b) the *Acacietum tortili-bussei*, a thorny woodland with several *Acacia*-species and (c) the *Justicio-Asystasietum gangeticae* with sciaphilous species. Each of them is described in its floristical characters and dynamism.

ZUSAMMENFASSUNG

Als Boscaglia wird ein Vegetationskomplex bezeichnet, der in Süd-Somalia auf fossilen Dünen vorkommt und aus 3 Assoziationen besteht: (a) das *Gisekio-Tephrosietum*, eine xerophile Weidegesellschaft mit Dominanz von paleotropischen Krautarten; (b) das *Acacietum tortili-bussei*, ein stachliges Gebüsch mit mehreren *Acacia*-Arten und (c) das *Justicio-Asystasietum* mit einigen Schattenpflanzen. Jede Gesellschaft wird in ihren floristischen Merkmalen und ihrer Dynamik beschrieben.

INTRODUCTION

Mogadishu, the capital of Somalia, is surrounded by a system of sand dunes. This subdesertic landscape is covered by an open community with dominance of several thorny *Acacia*-species alternating with xerophilous pastures. This vegetation (locally called "boscaglia") is broadly widespread in Southern Somalia and reaches up to the suburbia of the town. During the summer semester 1981, the first of us was appointed as professor of systematic botany at the Agriculture Faculty of the Somali National University, and an investigation of this vegetation was carried out[1].

The first botanical survey of Southern Somalia was published by ROBECCHI-BRICHETTI (1899), and a more detailed study by PAOLI (1916). In these works the name "boscaglia" appears; it comes from the Italian language and was introduced by the explorers during the colonial period. CHIOVENDA (1929), summarized the informations on this vegetation (further additions in SENNI, 1935) and gave a definition of boscaglia as "the more or less dense shrub vegetation covering a broad belt of the interior plain". At the present time, boscaglia is the only word used to designate the thorny woodland in Somalia, even with derivatives (boscagliosi = the nomads living in the shrubs). The Somali language, very rich in precise denominations for the different plant species (and particularly for the Acacias, does not seem to possess an equivalent word for the thorny woodland. A survey of the (mostly physiognomic) literature on this vegetation in Southern Somalia is given in PICHI SERMOLLI (1957, p. 39-49). No phytosociological investigations have been carried out up to the present on the boscaglia. Other vegetation types of the territory are described in CIFERRI (1939) and RAIMONDO & WARFA' (1980).

The investigated area corresponds to the former Benadir in Southern Somalia, i.e. the region surrounding Mogadishu from the coast to the river Shabelle. The whole area is flat, without reliefs of any importance; the only permanent water is the river Shabelle. The area is rather densely populated, chiefly in the irriguous belt along the river; the major urban area is Mogadishu, large agricultural settlements are also Afgoy and Balad.

METHODS

The analysis of the vegetation was carried out in accord with the principles of the phytosociological method (BRAUN-BLANQUET 1964, WESTHOFF & VAN DER MAAREL 1973). In the herbaceous vegetation the usual phytosociological techniques have been used, with relevés of mostly 100 m^2 (exceptionally 50-250 m^2)

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in almost omotonous areas, largely exceeding the minimal area of the association. The woody vegetation, on the contrary, required some methodological modifications because of their general discontinuity: the relevés were begun in a single dense shrub of 50-70 m^2 area (hardly corresponding to the minimal area of this vegetation), and then continued on surrounding shrub up to a complete inventory of the woody component, i.e. 200-800 m^2; cover values have been estimated in the first area investigated, the border of shrub (mostly infiltrated with herbaceous vegetation), has been neglected.
Floristic nomenclature follows CUFODONTIS (1953-1972) with some recent additions. Ordination of phytosociological tables with the WILDI and ORLOCI software (1980). Type relevés labelled with (*).

CLIMATE

The mean yearly temperature in Southern Somalia is lower along the coasts (from 26° to 27°C) and slowly increases in the internal plain, up to 28.7° in Bulo Burti, but the differences are feeble. Even seasonal differences are small and temperature remains remarkably constant all over the year. On the contrary, strong differences can be observed in rainfall. In the coastal region only one rainy period occurs, in correspondence with the SW-Monsun, i.e. from April to July, the completely dry period lasts 4 months, from December to March; total precipitations vary from 250 to 400 mm in the year. In the internal plain, even at only 30-40 km distance from the sea, rainfall shows an almost bimodal distribution, with two maxima, in April-May and in October-November; the dry period is mostly reduced to 3 months (January to March); total precipitation reaches 400 to 500 mm. These features correspond to a semi-arid climate of the II(III)2 type following WALTER & LIETH. With increasing distance from the coast a second period of drought (from June to September) appears, mean yearly temperature increases up to 30°, total precipitation decreases under 250 mm and the climate can be regarded as semi-desertic; further informations in PRETO (1976).
Mean values of yearly rainfall: Mogadishu 483 mm
Afgoy 534 mm
Bur Acaba 559 mm

GEOMORPHOLOGY AND SUBSTRATE

The investigated vegetation grows on the big Somali dune (cfr. PERISOTTO 1978). This is a system of dunes, parallel to the coast of the Indian Ocean, extending from Northern Somalia to the mouth of the river Juba, next to the Kenya frontier. The big Somali dune is about 1200 km long and mostly 20-30 km wide, and was built in geological times; actually this dune system may be regarded as a fossil one. The dune system mostly begins some hundred meters from the sea shore (which partly consists of sand of recent coralline origin and partly of sedimentary rocks) and reaches the maximum elevation (60 to 120 metres above sea level) some km far from the sea; more inwards, the dune is flattened and partly eroded and gently declines to the alluvial plain of the river Shabelle.
The dune is composed by a typical reddish sand rich in silicates and poor in cations. The superficial sand of the dune is completely incoherent and can be easily blown away by the Monsun wind. In places where vegetation is scarce or lacking imponent phenomena of aeolian erosion (on the coastal side), wandering dunes and overlay with sand of the agricultural land have been observed. Under the vegetation cover, the dune is almost stable, and in 50-100 cm depth, the sand appears compact and coherent (even in dry state).

BIOCLIMATICAL ZONES

According to the scheme proposed by CHEVALIER (1933) and recently reviewed by SCHNELL (1976), Southern Somalia (with yearly rainfall of 350-600 mm) can be regarded as belonging to the "Sahelian zone" of vegetation. The climate of Northern Somalia on the contrary is of the desertic type (rainfall lower than 350 mm). In the southernmost part of the Somalian Republic near to the frontier of Kenya, annual rainfall reaches up to 600-700 mm and this territory possibly belongs to the "Sudanian zone". All relevés of this study have been carried out within the Sahelian zone of Somalia. The territory is flat and therefore it is not possible to distinguish vegetation belts or any other altitudinal difference in vegetation. A vegetation map in scale 1:500 000 was carried out by DE MARCO & FAGOTTO (1978) with quite accurate cartography of the boscaglia limits in the territory between Brava and Merca.

VEGETATION

1. Pastures: Gisekio-Tephrosietum pumilae (tab. 1)

1.1 Description

The vegetation of the pastures on the dunes surrounding Mogadishu and in the neighbouring area, up to Balad (in the North) and to Afgoy (in the West) can be indicated as *Gisekio-Tephrosietum pumilae*. In general this association occurs in mosaic with the xerophilous thorny woodland, characterized by *Acacia* species.

Tephrosia pumila (Lam.) Pers. is the dominant species in these pastures. It is a small perennial herb (fam. *Papilionaceae*) with 5-15 cm long creeping branches and woody base; the root system is well developed and contributes to the consolidation of sand. Nodules with nitrifying bacteria are frequent; the herb seems to be of low pabular value. Other high-frequency species are *Ipomoea garckeana, Commelina forskahlei, Gisekia pharnacioides, Latipes senegalensis, Pedalium murex, Psilotrichum gnaphalobryum* and *Eragrostis ciliaris*.

Facies with dominance of *Tephrosia/Ipomoea* or with dominance of *Commelina/Latipes* occur frequently; vegetational aspects with dominance of *Pedalium* or *Gisekia* are also diffused. A quite unusual facies with abundant *Oxygonum* is widespread near Balad. In the coastal belt near the airport there is a facies with *Aristolochia rigida* (not recorded in table 1). Seedlings of woody plants

TAB. 1 - GISEKIO-TEPHROSIETUM PUMILAE

Number of relevés	1	2	3	4	5	6	7	8	9*	10	11	12	13	14	15	16	17	
Elevation in m	120	120	90	90	90	40	90	10	60	100	90	90	110	90	90	90	90	
Slope in %	–	–	–	–	–	–	–	0–5	–	–	2	–	1	–	–	–	–	
Exposure	–	–	–	–	–	–	–	W	–	–	N	–	N	–	–	–	–	
Cover in %	95	95	70	80	70	70	85	80	80	60	75	85	70	95	80	85	85	
Surface in m^2	150	150	75	70	100	50	100	50	100	250	100	100	150	100	100	100	100	
Character-species of the association																		
Tephrosia pumila (Lam.) Pers.	+	+	3.1	1.1	+	2.2	2.2	2.3	3.3	+	3.2	2.2	3.3	+	3.3	3.2	3.3	100
Gisekia pharnacioides L.		+	+	2.2	+		+	+	+	1.1	+	+	+	+	1.2	2.1	+	88
Scilla somaliensis Baker	(+)	+	+			+		+	(+)								+	41
Differential species of an East-African syntaxon																		
Ipomoea garckeana Vatke	3.3	+	1.1	2.1	1.1	1.1	1.1	+	+	+	+	+	1.1	+	1.1	1.1	1.1	100
Psilotrichum gnaphalobryum (Hochst.) Schinz	+	1.1	+	1.1	2.1	+	1.2	1.1	1.2	+	+	1.1	+	+	1.1	+	1.1	100
Indigofera ciferrii Chiov.	+	+	+	1.1		+	+					+	(+)		+	+	+	65
Cleome strigosa (Bojer) Oliver			+				1.1		-		+	+	1.1	(+)		+	1.1	1.1	53
Dignatia hirtella Stapf	+.2	1.2				+		+	+	+								35
Indigofera tanganykensis Baker		1.1												+	+	+		24
Paleotropical weeds (ch.-species of the class ?)																		
Commelina forskahlei Vahl	1.1	1.1	1.1	1.1	2.2	1.1	2.2	(+)	1.1	1.1	+	1.1	+	+	2.2	1.2	1.1	100
Pedalium murex L.	r	r	+.2	2.1	2.1	1.1	2.1	(+)	(+)	+	1.1	2.2	+	+	1.2	2.1	+	100
Latipes senegalensis Kunth	1.2	1.2	+	1.2	+	+	2.3		+	2.2	+	2.2	+	+	1.1	1.2	+.2	94
Eragrostis ciliaris (L.) R.Brown	1.1	1.1	1.1	+	+	1.1	1.1	+	+	+	+	+	1.1	1.1	+		1.1	94
Oxygonum atriplicifolium (Meissn.) Martelli	+	+	+	+			+	+	(+)	3.4	1.1	1.1	+	+	1.1	+	1.1	94
Borreria scabra (Schum. et Th.) K.Schum.	1.1	1.1	+	+		+	+	2.3	1.1		+	+	+	1.1	+	+	+	88
Digitaria milanjana Stapf	+	2.3	+			2.2	+	(+)	+	+	1.1		+	1.1	+	+	+	82
Zornia glochidiata Rchb.	+	+							+	r	1.1	+	1.1	1.1	+.2	1.1	1.2	65
Portulaca quadrifida L.		+	1.1	+	+	+		+		+	+		(+)	+		+		65
Heliotropium subulatum (DC.) Vatke	+		+	+	+	+	1.1		+		+	+						53
Hibiscus crassinervius Hochst.	+	+		+	+		+		1.1	+					+	+		53
Tephrosia subtriflora Baker	+	+	+						+				(+)		+	+	+	47
Cucumis dipsaceus Ehrenberg			+			+	+			+	+	+			+	+		47
Cenchrus ciliaris L.	2.2				+					+			+	1.1		+	+	41
Kohautia caespitosa Schnizl.	+										+	+	(+)	+	+	+		41
Indigophera schimperi Jaub. et Spach	+						+		(+)	+			+	+				35
Phyllanthus rotundifolius Klein					+								+	+	1.1	+		29
Dactyloctaenium scindicum Boissier	+	1.2	+						+		+							29
Blepharis edulis (Forsk.) Pers.	1.1	1.1						2.2	1.1									24
Urochloa panicoides P.Beauv.	+	1.2											+					18
Tephrosia quartiniana Cuf.		(+)							+	+								18
Companions																		
Aerva persica (Burm.f.) Merrill	1.1	+	+	1.1	+	+	+	+	(+)	+	+		+	1.1	+	+	+	94
Corchorus erinaceus Weimarck	+	+		+		+		+	+	1.1	+	+		+				59
Cyperus esculentus L.	+	+.2	+.2	1.1	1.2								(+)	+		+.2	+.2	53
Acacia senegal (L.) Willd. (young plants)							+	+	+	+	+		+	+	+	+°		53
Justicia flava (Vahl) Vahl		1.1	+									+	1.2			+	1.1	35
Cenchrus biflorus Roxburgh	2.2	+			+	+	+				+	+						35
Acacia tortilis (Forsk.) Hayne (young plants)	+	+	+				+						+	+				35
Dactyloctaenium aegyptium (L.) Richter		+			+	+	+					+					+	35
Pavonia sp.	+	+		+	+	+	+											35
Ocimum hadiense Forsk.	+	+	+					+	+									29
Asystasia gangetica (L.) Anderss.		1.1							+	1.1			+					24
Barleria waggana Rendle	+.2	+	+							1.2								24
Acacia bussei Harms (young plants)				+	+		+					+						24
Solanum jubae Bitter	+	+	+															18
Sporadical species (under 20 %)	4	2	2	1	3	1	3	4	6	2	1	3	2	5	–	–	–	

(*Acacia tortilis*, *A. bussei*, *A. senegal*) mostly 1-3 dm high are very scattered but nearly always present; they show the trend of the vegetational succession.

The majority of the more diffused species are perennial herbs with prostrate stems or rhizomes. Consequently the vegetation hardly reaches 20 cm in height. Only a few species with low cover values form an upper layer 30-60 cm high; they are small shrubs with erect habitus and woody branches (*Aerva*) or at least with woody base (*Cleome*, *Indigofera*).

The seasonal development of the *Gisekio-Tephrosietum* begins in June with the rainfall period and lasts about three months. In this short period most species accomplish their vegetative growth, produce flowers, fruits and seeds. During August or in the first decade of September leaves and other aerial parts progressively dry up and the vegetation turns in a condition of vegetative dormancy. Perennial herbs survive up to the next year chiefly with their root systems or with subterranean rhizomes. Reproduction by seeds seems relatively infrequent and only few seedlings can be observed at the beginning of the rainfall period. Even therophytes are scarce.

1.2 Minimal area

The extension of the minimal area was calculated for 6 relevés of tab. 1; the results are given in tab. 2. The number of observed species increases very steeply from the first m^2 up to 10 m^2. After that, the increase is more slow. In 10 m^2 17 species are present (mean value) i.e. nearly 70% of the complete assemblage of the association. In 20 m^2 more as 19 species are present (78%). Further broadening of the investigated area brings very few new species. The flexus of the curve seems to be near 20 m^2. Therefore, it may be assumed that relevés of 100 m^2 can retain the complete floristical information of this vegetation type.

TAB. 2 - Minimal area

relevés	1	2	3	4	5	6	observations (total)	mean	sum
1 m^2	8	8	11	9	8	8	52	8.66	8.66
2	3	1	1	2	2	3	12	2.0	10.66
5	5	3	5	3	1	1	18	3.0	13.66
10	2	4	4	3	4	3	20	3.33	17.00
20	1	4	1		5	2	13	2.16	19.16
30	1	1	2	1	1	1	7	1.16	20.32
40	1			3	1	1	6	1.00	21.32
50	1			1		1	3	0.50	21.82
100	3		3	2	2	5	15	2.50	24.32
200				1			1	0.16	24.48

1.3 Human activity

The pastures of the *Gisekio-Tephrosietum pumilae* type are submitted to intense grazing by goat, camels, zebu and sheep. The available biomass is of 100-250 g/m^2 of dry fodder (average value of 7 determitations), i.e. very low. The main fodder species seem to be *Commelina*, *Borreria*, *Psilotrichum* and the grasses; *Tephrosia* on the contrary, seems to be avoided by the cattle. Poisonous plants (*Euphorbia*, *Solanum*) occur in single individuals and with very low frequency. Spiny plants are almost absent from the herbaceous layer (on the contrary, they dominate the woody vegetation). The discontinuous vegetation prevents the expansion of fire and consequently burning does not seem to have a significant importance for this vegetation type.

The traditional agricultural exploitment is based on the conversion of open pastures into closed fields (shambas). Small depressions between the dunes are fenced with branches of spiny *Acacia*, the woody vegetation is cut and burned and the herbaceous layer can massively develop because of the higher humidity, the presence of ash in the soil and even of a weak manuring. In this way soil conditions improve and the herbaceous vegetation can reach a cover of nearly 100%, with height of 2-4 dm and biomass of 500 g/m^2 and more. The fodder is harvested in July-September and sold in the town. After harvesting, cattle is introduced in the shamba with some restrictions as far as grazing is concer-

ned. Unreglemented grazing is almost avoided. A single surface can be used as shamba for many years (up to 50 years and more) and after exhaustion of the residual fertility is abandoned again. Differential species of the shambas aspects are *Blepharis edulis*, *Dactyloctaenium scindicum*, *Dignatia* and others.

1.4 Syntaxonomy

The *Gisekio-Tephrosietum* shows close relationships to the anthropogenous vegetation of the neighborhood of Mogadishu described by RAIMONDO & WARFA' (1980). The floristic affinity is particularly high with the *Aristolochia rigida* community, which is surely a distinct association, but possibly belonging together with the *Gisekio-Tephrosietum* to a single alliance. Unfortunately RAIMONDO & WARFA' do not indicate which higher syntaxa their associations can be referred to.

An association with *Tephrosia pumila* as a character species is described by JENIK & HALL (1976) from the pastures of the Accra Plains (Ghana); this community belongs to the class *Vetiverietea*. No other species are in common with the *Gisekio-Tephrosietum* of Somalia and even the bioclimatic features of the Accra Plains are quite different (rainfall of 700-1100 mm, i.e. typical for the Sudanian zone). Consequently it is impossible to include the *Gisekio-Tephrosietum* into the *Vetiverietea*.

Some pasture communities from the Sahara described by QUEZEL (1965) seem to be related to the *Gisekio-Tephrosietum*, namely the ass. of *Lotus glinoides* and *Matthiola livida* (from the Hoggar in 1000-1500 m altitude), the ass. of *Ruellia patula* and *Cadaba farinosa* and the ass. of *Aristida funiculata* and *Indigofera sessiliflora* (both from the Emi Koussi in 1260-1550 m and 500-1200 m altitude respectively). These associations have a group of species in common with the *Gisekio-Tephrosietum* (*Aerva persica*, *Grewia tenax*, *Gisekia pharnacioides*, *Blepharis edulis*, *Cenchrus biflorus*) but the saharo-sindian and submediterranean species are dominating. Consequently it is not clear, if these associations belong to the same class as the *Gisekio-Tephrosietum*. Anyway, they represent the extreme penetration in northern direction of equatorial elements, living in the middle of the Saharian zone. They are limited to the montane habitats (extrazonal) and therefore they cannot be regarded as particularly significant.

Closer floristic affinity shows the community of *Schmittia pappophoroides* and *Panicum turgidum* described by QUEZEL (1969) in the Darfur area (Sudan Republic). Species in common with the *Gisekio-Tephrosietum* are *Cenchrus biflorus*, *Gisekia pharnacioides*, *Zornia glochidiata*, *Latipes senegalensis*, *Dactyloctaenium aegyptium*, *Aerva persica*, *Oxygonum atriplicifolium*. This community has been observed on sandy soils at 750-1100 m altutude in a territory with 300-350 mm rainfall (i.e. probably belonging to the Sahelian zone). The higher syntaxonomical units for this vegetation are not indicated.

In conclusion, it seems likely, that at least the *Gisekio-Tephrosietum*, the vegetation described by RAIMONDO & WARFA' near Mogadishu and the Darfur community belong to a unique vegetation class. As character species for this class several paleotropical weeds with sahelian distribution (from West Africa to Arabia and Sindh) could be proposed. Consequently, the class seems to have a broad distributional range. Otherwise, the communities described in Somalia (both by RAIMONDO & WARFA' and by us) are characterized by several East African species, not occurring elsewhere; they may probably belong to a particular syntaxon. The species in Tab. 1 have been ordered following these assumptions, but we think that the present knowledge of this vegetation types is too fragmentary and not sufficient for proposing a new syntaxonomical scheme.

2. The open thorny woodland: Acacietum tortili-bussei (tab. 3)

2.1 Description

The *Acacia* community is widespread on the sand-dune near Afgoy, between Mogadishu and Afgoy and up to Gesira and Balad. A similar community has been physiognomically recognized also along the dune system from Gandersh to Merca and Brava. Therefore, this association is spread at least over 200 km along the coast.

The dominating element of this association is given by the *Acacia* species:

A. tortilis subsp. *spirocarpa* - small tree or gregarious shrub
A. senegal - gregarious shrub
A. bussei - gregarious shrub
A. misera - scattered shrub
A. nilotica - shrub, ± accidental
A. mellifera - shrub, ± accidental

Other widespread shrubs are *Solanum jubae*, many *Capparidaceae* (*Courbonia*, *Cadaba*, *Maerua*, *Boscia*), *Commiphora*, *Uvaria dehnhartiana*, *Anisotes involucratus* etc.

The following vegetation strata can be identified:

A_2 - Umbrelliform trees-layer (5-8 m high) chiefly composed by *Acacia tortilis* and single individuals of other *Acacia* species, *Balanites* and *Dobera*. The arboreal *Acacia* species cover a very small surface (mostly not more than 5-20%).

B_1 - Higher shrubs-layer (2-6 m height) a compact shrub of different *Acacia* species, in association with other shrubs. This vegetation covers about 80-95% of the surface.

B_2 - Lower shrubs-layer (5-20 dm); sporadically occurs at the edges of *Acacia* thickets covering no more than 5%.

C - Herbs-layer (5-80 cm), particularly abundant under the shrubs, composed by species of the pasture like *Commelina forskahlei* and *Ipomoea garckeana* or by shadow elements like *Justicia flava*. This layer covers about 20-40%.

D - Climbers, very scattered and with low cover (1% or less).

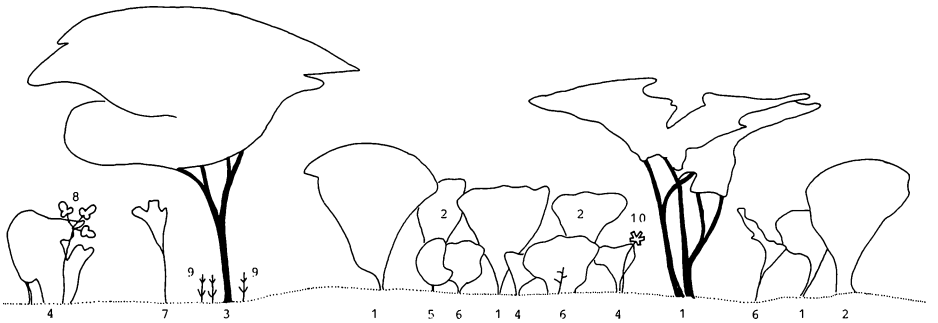

Fig. 1: Vegetation profile of the *Acacietum tortili-bussei*.

1: *Acacia tortilis*
2: *Acacia senegal*
3: *Acacia misera*
4: *Solanum jubae*
5: *Maerua angolensis*
6: *Uvaria denhardtiana*
7: *Grewia tenax*
8: *Cucumis dipsaceus*
9: *Justicia flava*
10: *Momordica balsamina*

The photosynthetic activity in the thorny woodland lasts for the whole year, with maxima in the humid periods but without a complete interruption in the dry season. The single species seem to produce leaves and flowers independently from one another and even single individuals of the same species show quite different phenology. In general, plants produce leaves and flowers during a short period (sometimes only 2-3 weeks). We observed leaves and flowers in *Acacia tortilis* (in VII), in *A. bussei* and *A. senegal* (in VIII), in *Courbonia* and *Cadaba* (in IX) and in several *Commiphora* (in X). The wood of *Acacia* shows irregular growth rings, which may be assumed to be annual.

The minimal area of the *Acacietum tortili-bussei* was not directly investigated, but seems to reach some 100 m^2.

2.2 Syntaxonomy

Communities of thorny woodland with *Acacia* (*A. tortilis* and other species), *Boscia*, *Balanites*, *Dobera*, *Cadaba*, *Courbonia* etc. are widespread all over the Sahelian zone from Senegal to Eastern Africa and even to Arabia and SW Asia.

TAB. 3 - ACACIETUM TORTILI-BUSSEI

Number of relevés	18	19	20	21	22	23*	24	25	26	
Elevation in m	120	120	90	90	90	120	90	90	90	
Slope in %	–	–	–	–	–	2	–	–	–	
Exposure	–	–	–	–	–	W	–	–	–	
Surface in m^2	400	500	300	600	500	800	200	300	400	
A_2 - Umbrelliform trees (5-8 m) %	5	20	15	30	2	5	20	5	1	
Acacia tortilis (Forsk.) Hayne	1.1	1.1	1.1	2.3	+	(+)	1.2	1.1	(+)	100
Balanites aegyptiaca (L.) Del.	+	(+)				1.1				33
Acacia misera Vatke				1.1	+					22
Acacia senegal (L.) Willd.		+							(+)	22
Dobera glabra (Forsk.) Juss.						1.1				11
Acacia bussei Harms								1.1		11
B_1 - Higher shrubs (2-6 m) %	80	98	80	80	85	80	90	70	95	
I - thorny *Acacia*										
Acacia tortilis (Forsk.) Hayne	3.3	2.2	4.5	2.3	2.2	1.1	3.4	+	1.1	100
Acacia senegal (L.) Willd.	3.3	2.2	1.1	1.1	2.2	3.4	2.1	2.2	1.1	100
Acacia bussei Harms	+	1.1	1.1	1.1	2.2	+	1.1	2.2	4.4	100
Acacia misera Vatke	+		+		+	3.4		+	(+)	66
Acacia nilotica (L.) Del.							1.1	+		33
Acacia mellifera (Vahl) Benth.		1.1								11
II - others										
Solanum jubae Bitter	1.1	+	+	1.1	+	+	+	1.1	+	100
Uvaria denhartiana Engl. et Diels	+		1.1	1.1	+	1.1	+	1.1		77
Anisotes involucratus Fiori	+	(+)	+	2.3		(+)		+	1.1	77
Commiphora ellenbeckii Engler		(+)	+	+	+	(+)	+	+		77
Maerua angolensis DC.			1.1		2.2	1.1	+	1.1	1.1	66
Courbonia nummularifolia Mattei		2.2	+	(+)		(+)	1.1		+	66
Balanites aegyptiaca (L.) Del.	1.1	+		(+)				+	(+)	55
Solanum cfr. *somalense* Franchet	1.1	(+)			1.1	+				44
Commiphora africana (Rich.) Engler			+	+		(+)	1.1			44
Combretum constrictum (Benth.) Lawson				+	+	(+)			(+)	44
Chordia somaliensis Baker	+	+	(+)	(+)						44
Thespesia danis Oliver	1.2	2.2				+				33
Cadaba farinosa Forsk.	+	+							(+)	33
Boscia coriacea Pax	1.1			1.1						22
Maerua oblongifolia (Forsk.) Rich.			+						1.1	22
Commiphora cfr. *lughensis* Chiov.			(+)						+	22
Cassia longeracemosa Vatke							1.1			11
Dobera glabra (Forsk.) Juss.		(+)								11
Chordia gharaf (Forsk.) Aschers.		+								11
Grewia villosa Willd.		(+)								11
Dicrostachys glomerata (Forsk.) Chiov.	+									11
Grewia cerasifera Chiov.					+					11
Allophylus rubifolius (Hochst.) Engler									+	11
Hildenbrandtia africana Vatke		+								11
B_2 - Lower shrubs (5-20 dm) %	20	5	5	0	5	5	1	5	5	
Indigofera schimperi Jaub. et Spach	+	1.1			1.1	1.1	+	1.1		66
Barleria waggana Rendle		1.1	1.1		+.2	+.2		+	1.2	66
Grewia tenax (Forsk.) Fiori	+	+	+.2	+	+	+				66
Hibiscus crassinervis Hochst.	1.1	+			+				+	44
Aerva persica (Burm.f.) Merrill	+						2.3	+		33
Pavonia sp.	1.1			+				+		33
Corchorus erinaceus Weinmarck					+	+		+		33
C - Herbs (5-80 cm) %	10	40	20	30	25	25	40	30	40	
Commelina forskahlei Vahl	1.1		1.1	2.1	1.1	1.1	1.2	2.3	2.3	89
Justicia flava (Vahl) Vahl	+	1.2	(+)	+	1.1	1.1	2.3	+		89
Ipomoea garckeana Vatke	1.1	+		1.1	+	1.1		+		66
Asystasia gangetica (L.) Anderss.	+	+			+	1.1	1.2			55
Urochloa panicoides P.Beauv.		2.2		+		+		+	+	55
Psilotrichum gnaphalobryum (Hochst.) Schinz	+	+	+	+				+		55
Ocimum hadiense Forsk.		+	1.1					1.2	1.2	44
Latipes senegalensis Kunth				+.2	+	+		+		44
D - Climbers %	10	1	1	1	2	5	5	1	1	
Momordica balsamina L.	(+)	1.1		(+)	1.1	1.1	1.1		+	77
Combretum constrictum (Benth.) Lawson			+	(+)	+	(+)	+		+	66
Pentatropis spiralis (Forsk.) Decne			+	+	+	+			+	55
Cucumis dipsaceus Ehrenb.	+	+			+			+	+	55
Coccinia grandis (L.) Voigt		+				(+)			(+)	33
Triumfetta actinocarpa Moore								+		11
Cissus digitata (Forsk.) Lam.		+								11
Sarcostemma viminale (L.) R.Br.		(+)								11
Ipomoea garckeana Vatke									+	11
Pergularia daemia (Forsk.) Chiov.									(+)	11
Sporadical species (under 20 %)	2	7	4	1	1	3	–	–	6	

For a survey cfr. SCHNELL (1976). Phytosociological tables have been published by QUEZEL (1969) from the Darfur area in Sudan (the *Acacia mellifera*-, the *Acacia nubica*- and the *Digera-Aeschyomene* communities). This vegetation is probably related to the microphyllous thorny woodland of the Transvaal Bushveld (South Africa), which shows (VAN DER MEULEN, 1978) *Acacia tortilis*, *A. misera*, *A. nilotica* and other species present in Southern Somalia and close vicarism at the genus level. It seems likely, that a "Sahelian" vegetation class with continental distribution still exists, but the informations deriving from scattered territories are up to now too fragmentary for a more precise definition.

3. The vegetation of shady places: Justicio-Asystasietum gangeticae (tab. 4)

Acacias produce a feeble shadow, particularly when covered by climbers and a dense community of *Justicia flava* and *Asystasia gangetica* regularly occurs on these shady niches. In most cases there are only fragments of 1-5 m^2 which are hardly sufficient for relevés. Several species of the pastures and of the thorny woodland are also present. Therefore the community can be identified only in a very confuse form. A similar vegetation is described by QUEZEL for the Darfur area (Sudan) as meso-sciaphilous community of *Craterostigma plantagineum* and *Kalanchoe modesta*. In this community some species occuring also in Somalia have been found, namely *Achyranthes aspera*, *Ocimum hadiense* and another *Justicia* (*J. galeopsis*). The syntaxonomical position of this vegetation is quite obscure.

TAB. 4 - JUSTICIO-ASYSTASIETUM GANGETICAE

Number of relevés	27	28	29	30	31*	32	33	
Elevation in m	120	90	90	90	90	90	75	
Slope in %	-	2	2	-	-	-	-	
Exposure	-	N	N	-	-	-	-	
Cover in %	100	100	100	70	60	95	100	
Surface in m^2	6	8	4	4	10	25	8	
Character-species of ass. and higher syntaxa								
Asystasia gangetica (L.) Anderss.	2.2	2.2	(+)	1.1	1.1	2.2	1.1	100
Justicia flava (Vahl) Vahl	+	1.2	(+)	2.2	2.3	+	3.3	100
Achyranthes aspera L.	(+)	1.2				1.1		43
Ocimum hadiense Forsk.			2.2		(+)			29
Climbers								
Pergularia daemia (Forsk.) Chiov.		1.1			+	+	+	57
Cucumis dipsaceus Ehrenb.		+				+		29
Momordica balsamina L.			+					14
Pleuropterantha revoilii Franchet	+							14
Coccinia grandis (L.) Voigt	+							14
Paleotropical weeds								
Commelina forskahlei Vahl	2.2	3.3	2.2	1.1	1.1	1.1	+	100
Urochloa panicoides P.Beauv.	1.2		1.2	+		2.2	+	72
Cenchrus ciliaris L.					+	2.2	+	43
Indigofera ciferrii Chiov.	+		+					29
Borreria scabra (Schum. et Th.) K.Schum.			1.1					14
Companions								
Monechma debile (Forsk.) Nees	2.2				(+)	1.1	+	57
Ipomoea garckeana Vatke		1.1	+	+			+	57
Indigofera arrecta Hochst.				1.1	+		+	43
Pavonia sp.	+				+	+		43
Tridax procumbens L.	+		1.1		1.1			43
Psilotrichum gnaphalobryum (Hochst.) Schinz					1.1	+	+	43
Solanum cfr. *somalense* Franchet	1.1		+					29
Barleria waggana Rendle	1.2		+.2					29
Cassia longeracemosa Vatke					+	+		29
Withania somnifera (L.) Dunal		+				(+)		29
Boerhaavia diffusa L.				+	+			29
Solanum arundo Mattei					+	+		29
Acacia tortilis (Forsk.) Hayne (young plants)						3.3		14
Sporadical species (under 20 %)	5	1	1	2	1	2		

LANDSCAPE ECOLOGY

The Boscaglia is the vegetation complex consisting of the *Gisekio-Tephrosietum*, *Acacietum tortili-bussei* and *Justicio-Asystasietum*. In most places the three vegetation types occur together, often with mosaic-like patterns. The thorny woodland dominates the landscape; pastures are also frequent and mostly cover 20-30% of the area, whereas the vegetation of shady places is quite rare and without an appreciable cover.

Natural growth, pasture and human activity are responsible of succeccional cycles in the boscaglia. At least 3 phases can be distinguished:

I) young phase - only higher shrubs, mostly with discontinuous cover. Dominant species are *Acacia senegal* and *A. bussei*; elements of the *Gisekio-Tephrosietum* are almost abundant; pasture intense.

II) optimal phase - higher shrubs compose a dense and almost continuous vegetation 2-6 m high (*Acacia senegal*, *A. bussei* and *A. tortilis* are co-dominant) with single umbrelliform trees of *A. tortilis* reaching 6-8 m in height; herbs became very rare; pasture activity is scarce and limited to the marginal zones.

III) senescence phase - umbrelliform trees became more frequent, higher and with denser canopy. In their shadow the shrubs show reduced vitality or disappear; such places are often occupied by nomads as temporary refuge, lower shrubs are cut, climbers (sometimes favourished by man) and nitrophilous species became more frequent; elements of the *Justicio-Asystasietum* often spread in more shady places.

The phase III allows more or less frequent passage of humans and cattle, intensive pasture and cutting of the woody species. When the umbrelliform trees disappear (cut for wood or naturally dead) direct sunlight can penetrate up to the soil surface and the vegetation turns back to phase I. Then, the cycle is complete.

In present time this dynamism is chiefly caused by human activity and can be interpreted as completely anthropogenous. Despite this, vegetation seems to be in a semi-natural condition. It is a matter of fact, that pasture intensity in this ecosystem was always high: presently by cattle, but before the settlement of man by wild species: dig-dig, antelopes, giraffes, donkeys and other big mammals of the savanna- and sahelian-environment. Human action substituted the action of wildlife without producing major changes in the vegetation. Plant growth, natural decay of organic matter and pasture compose in Southern Somalia a well integrated ecosystem which works since immemorial times in a condition of steady state.

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Anschriften der Verfasser:

Prof.Dr. Sandro Pignatti
Istituto Botanico - Città Universitaria
I - 00100 Roma (Italy)

Ahmed Mumin WARFA'
Università Nazionale Somala
Facoltà di Agraria
p.o. box 801
Mogadishu (Somalia)