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Herbaceous and non-inundated vegetation of Sahelian inselbergs in Burkina Faso

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Abstract

MÜLLER, J. (2008). Herbaceous and non-inundated vegetation of Sahelian inselbergs in Burkina Faso. *Candollea* 63: 57-79. In English, English and French abstracts.

"Inselbergs" (isolated hills or small mountains rising abruptly from a gently sloping or virtually level surrounding plain) and mountain ridges cover an insignificant total surface in the Sahelian zone although these geological formations are conspicuous landscape elements of this region. Based upon the example of Burkina Faso, the herbaceous and non-inundated vegetation of these formations have been studied. Field surveys with phytosociological relevés have been carried out on eleven inselbergs. Vegetation patterns observed depend on their location, their anthropogenic use and the geology. Five phytosociological associations and one community of only local interest are documented here. These plant communities have been grouped into the alliance *Pandiako angustifoliae-Aristidion funiculatae* and present for the most part many annual species with ruderal character and exozoochoric dispersal mechanisms. *Cleomo viscosae-Brachiarietum latae* is the most common and widespread association. The distribution of the plant communities and their ecological and floristic relationships are described for the Sahelian "inselbergs" and are compared with data from other bioclimatic regions.

Key-words

Sahel – Phytosociology – Rocks – Grasslands – Grazing – Sward communities – Mountain

Résumé

MÜLLER, J. (2008). Végétation herbacée et non inondée des inselbergs du Burkina Faso. *Candollea* 63: 57-79. En anglais, résumés anglais et français.

Les «inselbergs» (collines ou petites montagnes isolées s'élèvant abruptement depuis une légère déclivité ou une plaine virtuellement plate) et les chaînes de montagne couvrent une surface totale insignifiante de la zone sahélienne bien que ces formations géologiques sont des éléments manifestes du paysage de cette région. Sur l'exemple du Burkina Faso, la végétation herbacée et non inondée propre à ces formations a été étudiée. Des études de terrain avec des relevés phytosociologiques ont été menées dans onze «inselbergs». Les types de végétation rencontrés dépendent de leur location et utilisation anthropique ainsi que de la géologie du terrain. Cinq associations et une communauté phytosociologiques d'un intérêt local sont documentées ici. Elles ont été groupées dans l'alliance *Pandiako angustifoliae-Aristidion funiculatae* et présentent dans leur majeure partie beaucoup d'espèces annuelles avec des caractères de type rudéral et des mécanismes de dispersion exozoochorique. *Cleomo viscosae-Brachiarietum latae* est l'association la plus commune et la plus largement répandue. La distribution de ces communautés de plantes et leurs relations écologiques et floristiques sont décrites pour les «inselbergs» sahéliens et comparées avec des données issues d'autres régions bioclimatiques.

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Introduction

In the African Sahelian zone, large areas are characterized by a flat relief. However, "inselbergs" (isolated hills or small mountains rising abruptly from a gently sloping or virtually level surrounding plain) and mountain ridges rise often abruptly from the surrounding plains. They are old, conspicuous landscape elements. Although they cover only an insignificant total surface (less than five percent of the total area), these often monolithic mountains have considerable importance, for example as grazing areas for livestock or as holy places and assumed homes of mountain spirits. Others have great economic importance because of their mineral deposits.

"Inselbergs" and mountain ridges are in many cases ecologically isolated from surrounding areas and are often considered to be model systems for questions on island ecology (Porembski & Barthlott, 2000). Porembski & Barthlott (2000) and Porembski & al. (1994, 2000) provided instructive, general information about plant-environment relationships on tropical inselbergs and on physiognomically defined habitats. For example, dry habitats on slopes are typically colonized by sward communities and dominated by *Poaceae.* Taluses of tropical inselbergs are habitats poor in fine-grained substrate and often colonised by specialists in one-layered communities. Many of the characterising species are not or only reluctantly grazed by cattle.

Although the first locally based studies dealing with vegetation on West African inselbergs were published over fifty years ago (Adam, 1947; Jaeger, 1950; Schnell, 1952), first synopses of inselberg vegetation with data from (sub-)humid savanna and rainforest regions were published only very recently lists for different habitats (Porembski & Barthlott, 1992 with very rudimentary species; Müller, 2007). However, none of these synopses included data from the Sahelian zone. Other studies concentrated on (temporarily) wet or inundated habitats, such as ephemeral vegetation in rock pools (Mali: Monod, 1954; Raynal & Raynal, 1961; and Nigeria: Hambler, 1964), or *Afrotrilepis pilosa*-mats (Parmentier & al. 2006), or focussed on Saharan ecosystems (Ozenda, 1991). Apart from Gillet (1968) for Chad, no study exists that deals exclusively with non-inundated grasslands and herbaceous vegetation on Sahelian inselbergs.

This contribution aims to fill this gap and to answer the following questions, based upon the example of inselbergs in the Sahelian part of Burkina Faso, (i) whether floristically defined plant communities exist on Sahelian inselbergs, and whether these units are ecologically sound, (ii) whether grazing and geology influence the structure and floristic composition of these plant communities, and (iii) whether a floristic relationship exists to inselberg vegetation in neighbouring bioclimatic regions, especially to inselberg vegetation in the Guinean and Sudanian zones.

Material and methods

Study area

The study area is the northernmost Burkinian political province Oudalan and the northern parts of the neighbouring province Séno (Fig. 1). This area is a transition zone between a traditionally settled and a traditionally nomadic way of life: cattle breeding in the northern parts replaces the millet cultivation of the southern parts as the most important economic activity. The average annual precipitation (320 mm, 1968-1985) (Morel, 1992) shows large interannual fluctuations: the normalised rainfall anomaly in the region fluctuates between -2 and 2 (Wang & Eltahir, 2000). The mean annual temperature is approximately 30° C.

This study is restricted to herbaceous (i.e. non-ligneous), non-inundated vegetation of inselbergs and mountainous ridges (for definitions, see Porembski & Barthlott, 2000). This vegetation occurs in most cases and over large areas independently without any tree layer. Therefore ligneous species in the tree layer, if present at all in a generally very open shrub or tree layer, were not included. Vegetation of sand sheets and of agricultural fields or fallow land at the mountain foot zones was not taken into consideration. Such sand sheets and agricultural fields show different pedologic characteristics (different types of arenosols, the total soil nitrogen content being very low (0.02%)), thus their vegetation differs significantly from inselberg vegetation. It is characterised by *Aristida mutabilis* and *Tribulus terrestris* and is floristically very close to dune vegetation. All sections of the inselbergs – from the foot zones, lower, middle and upper slopes up to the summit plateau – are grazed by small ruminants (in particular on smaller inselbergs with a relative altitude of less than 100 m). In addition, foot zones, lower and middle slopes are often grazed by cattle. In contrast, grazing by large, wild herbivores practically no longer occurs. Soils are poorly developed, or soil development is in its initial phases.

Data collection and statistical analysis

Data collection took place on 11 inselbergs and mountain massifs (see Fig. 1 and Table 1) in the rainy seasons of the years 1999 to 2001. The floristic structure of the vegetation was documented with 123 phytosociological relevés. Selection of plots followed a stratified sampling approach, considering different relative positions on the inselbergs and aspects. According to the measured minimum area, plot sizes of the relevés were between 5 and 10 m² (in rare cases only 2 m² or up to 15 m²). The extended Braun-Blanquet scale was used to estimate cover and abundance of the species (see Barkman & al., 1964). Shannon and Simpson indices and the Evenness value were calculated for each relevé. The Evenness value has

Table 1. – Characteristics of studied inselbergs.

Inselberg	Abbreviations (used in Fig. 1)	Altitude [m]	Relative altitude [m]
Tin Ediar	T	498	200
Kolél	K	448	140
Bèldiabé	B	339	40
Bossey	Y	300	20
Colline de Gagara	C	310	30
Labka	L	400	100
Gargassa	G	365	50
Salmossi	S	331	55
Takabangou	A	300	30
Beliata	E	394	120
Gangaol-Bambga	N	462	160

values between 0 and 100 and takes its maximum value when all species are equally represented (PILOU, 1975). Voucher specimens are deposited in the Herbarium Senckenbergianum Frankfurt (FR), Germany.

At the beginning of the analysis, all relevés were manually classified. As a general rule, no relevés were deleted from the original dataset, in order to document even impoverished stands or transitions between certain vegetation units. A synoptic table of the plant communities allows to compare the floristic composition of each unit. From what is currently know about the distribution, sociology and ecology of many African plant species, it cannot be decided whether a taxon can be considered as a character or as a differential species in the sense of the Braun-Blanquet-approach. Following MÜLLER & DEIL (2005), the term "diagnostic species" (= DS) has been used in that study instead of character species.

In addition to the classification, relevés were ordinated with CANOCO for Windows (TER BRAAK & ŠMILAUER, 2002). Detrended correspondence analysis (DCA) was carried out (123 relevés, 139 taxa, presence/absence data, downweighting of rare species).

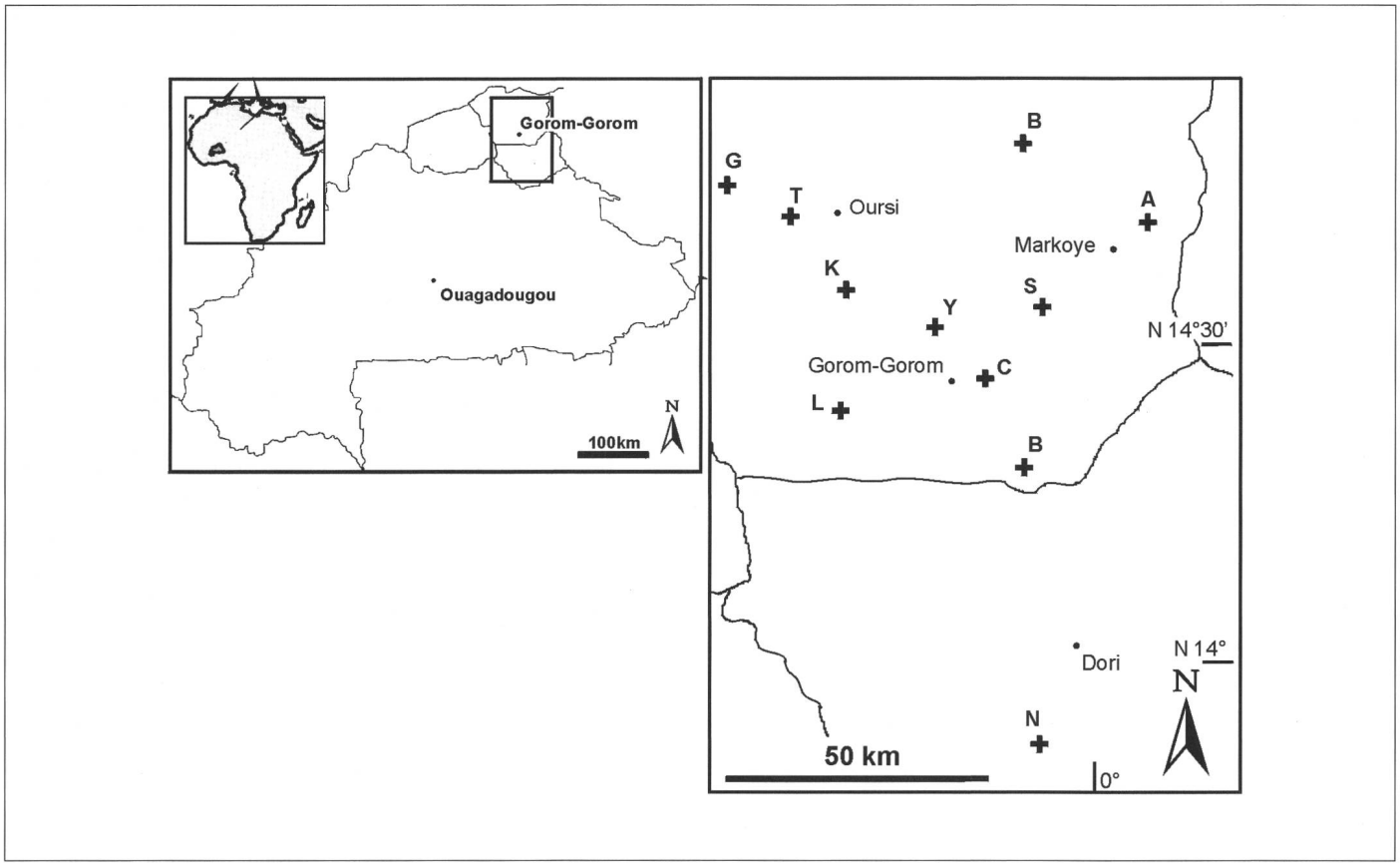

Fig. 1. – A. Location of the study area in northern Burkina Faso (indicated by rectangle), with borders of the three Sahelian provinces. **B.** Location of the studied inselbergs (for abbreviations, see Table 1).

Because it showed a total inertia of 5.02 implying a relatively short floristic gradient within the floristic data set (samples centered and standardized), Principal Component Analysis (PCA) was used to characterize the main gradients in the floristic data set.

LEBRUN & STORK (1991-1997) was used for names of vascular plants. Naming and typification of the plant communities follow the Code of Phytosociological Nomenclature (WEBER & al., 2000).

Results

Inselbergs in the Sahelian zone of Burkina Faso show different vegetation patterns depending on their location, geology and utilisation by humans. Five associations, one of them in several subassociations and in a fragmentary form, and one community of only local interest, are documented. In particular near permanent settlements, floristically impoverished stands are common. Aspect is not a differentiating habitat factor. With one exception *(Cymbopogon schoenanthus* subsp. *proximus),* all diagnostic species are annuals and more than half of them are grasses. The five associations and the community can be grouped into one alliance. A phytosociological conspectus follows, with the plant communities described and presented.

1. Alliance *Pandiako angustifoliae-Aristidion funiculatae:*
   - 1.1 *Pandiako angustifoliae-Aristidetum funiculatae*
   - 1.2 *Schizachyrium exile*-community
   - 1.3 *Cymbopogonetum proximi*
   - 1.4 *Andropogonetum fastigiati*
   - 1.5 *Cleomo viscosae-Brachiarietum latae*
     - 1.5.1 *typicum*
     - 1.5.2 transition between *typicum* and *aristidetosum adscensionis*
     - 1.5.3 *aristidetosum adscensionis*
     - 1.5.4 *sesametosum alati*
     - 1.5.5 impoverished form without *Brachiaria lata*
   - 1.6 *Enteropogonetum prieurii*

1. *Pandiako angustifoliae-Aristidion funiculatae,* all. nov. hoc loco (Appendix 1)

Holotypus: *Cleomo viscosae-Brachiarietum latae* (typification see below).

Diagnostic species: *Pandiaka angustifolia, Aristida funiculata, Pennisetum pedicellatum.*

Herbaceous, non-inundated vegetation of Sahelian inselbergs can be grouped into the new alliance *Pandiako angustifoliae-Aristidion funiculatae* which colonises inselbergs with very different geological characteristics (granites, quartzites, gabbro, amphibolitic rocks, biotites). In particular *Pandiaka angustifolia* is highly constant in all units. *Aristida funiculata* is a Sahelo-Sindian element (GILLET, 1968), which in Niger prefers sandy soils (POILECOT, 1999). Some plant species typical for the glacis, e.g. *Schoenefeldia gracilis* and *Panicum laetum,* are constant accompanying species. Such species are dispersed to inselbergs by grazing cattle. The *Pandiako angustifoliae-Aristidion funiculatae* comprises all plant communities described in this study.

1.1 *Pandiako angustifoliae-Aristidetum funiculatae,* ass. nov. hoc loco (Appendix 1, Appendix 2)

Holotypus: Appendix 2, rel. no 3 (Field no 839, JM, **BURKINA FASO. Oudalan:** Gagara, 14°26'N 0°09'W, 13.VIII.2001).

Diagnostic species: see alliance.

The new association *Pandiako angustifoliae-Aristidetum funiculatae* is the central association of the alliance *P. angustifoliae-Aristidion funiculatae.* It is characterised by the diagnostic species of the alliance. Records exist from Tin Ediar, Beliata and Gagara (quartzite, gabbro and amphibolitic rocks). A pisolitic cover can be present. This association, dominated by annuals, is generally poor in species (mean species number: 7.2) and mean cover is 48%, the lowest value of all studied inselberg plant communities.

1.2 *Schizachyrium exile*-community (Appendix 1, Appendix 2)

Diagnostic species: *Schizachyrium exile.*

Schizachyrium exile-community is well characterised by the Palaeotropical grass *Schizachyrium exile* but based on current knowledge, this is a plant community of only local importance. It is so far documented with three relevés from granitic inselbergs near Markoye (Takabangou); however it can also regularly be found on other inselbergs near permanent settlements. In particular towards the end of the rainy season, *S. exile*-community can be easily recognised by its foxy red aspect. *Schizachyrium exile* characterises lateritic, loamy or sandy soils and grows in the Sahelian zone preferably in the lower sections of inselbergs (POILECOT, 1999). Apart from *S. exile,* there are a few accompanying dune species (e.g. *Digitaria ciliaris*, *Alysicarpus ovalifolius).* The mean number of species is 11.3 and mean cover is 55%.

1.3 *Cymbopogonetum proximi,* ass. nov. hoc loco (Appendix 1, Appendix 2)

Holotypus: Appendix 2, rel. no 15 (Field no 557, JM, **BURKINA FASO. Oudalan:** Beliata, 14°16'N 0°06'W, 30.IX.2000).

Diagnostic species: *Cymbopogon schoenanthus* subsp. *proximus.*

Fig. 2. – The perennial grass *Cymbopogon schoenanthus* subsp. *proximus* dominates the aspect of the *Cymbopogonetum proximi* (Beliata, northern Burkina Faso).

The *Cymbopogonetum proximi* is only known from one single inselberg (Beliata), where it colonises the slopes and the summit plateau as well as taluses and drainage channels. Grazing impact in these areas is low. Floristically it is characterised by the highly constant perennial *Cymbopogon schoenanthus* subsp. *proximus,* which roots in silty areas between the rocks (Fig. 2). This perennial grass is widespread in semi-arid and arid areas in Africa and is normally avoided by cattle (POILECOT, 1999). The mean species number is 5.8 and mean cover is 60%.

1.4 *Andropogonetum fastigiati,* ass. nov. hoc loco (Appendix 1, Appendix 3)

Holotypus: Appendix 3, rel. no 2 (Field no 584, JM, **BURKINA FASO. Séno:** Gangaol, 13°50'N 0°05'W, 02.X.2000).

Diagnostic species: *Andropogon fastigiatus, Cassia mimosoides, Aristida sieberana* (weak).

Stands of the *Andropogonetum fastigiati* are recorded from the southern inselbergs Gangaol-Bambga and Labka. This association does not occur on the central and northern inselbergs. On the Gangaol-Bambga and Labka inselbergs, the association colonises the slopes and summit areas, grazed only by small ruminants. In many cases, a lateritic crust or pisolites are present. The substrate is sandy-loamy or silty. *Andropogon fastigiatus* is a valuable fodder plant for livestock (POILECOT, 1999). The stands are normally open and low growing, the mean cover is 57%. Mean number of species is 6.6.

1.5 *Cleomo viscosae-Brachiarietum latae,* ass. nov. hoc loco (Appendix 1, Appendix 4-7)

Holotypus: Appendix 4, rel. no 14 (Field no 339, JM, **BURKINA FASO. Oudalan:** Kolél, 14°34'N 0°27'W, 24.VIII.2000).

Fig. 3. – Stands of the *Cleomo viscosae-Brachiarietum latae* cover the ground layer in *Acacia* savannas over vast areas on Sahelian inselbergs (Kolél, northern Burkina Faso).

Diagnostic species: *Brachiara lata, Cleome viscosa, Sesamum alatum, Ipomoea coscinosperma, Cleome scaposa, Tephrosia uniflora, Monechma ciliatum.*

The *Cleomo viscosae-Brachiarietum latae* is the most common association in the study area and is found on inselbergs with of varying geology (Fig. 3). There are several forms: a typical subassociation (Appendix 1, column 5), a subassociation with *Aristida adscensionis* (column 7), a transition complex between these two subassociations (column 6), a subassociation with *Sesamum alatum* (column 8) and an impoverished form without *Brachiaria lata* (column 9). These different forms cover most areas on the studied inselbergs.

1.5.1 *typicum*, subass. nov. hoc loco (Appendix 1, Appendix 4)

Holotypus and diagnostic species: see association.

The typical subassociation of the *Cleomo viscosae-Brachiarietum latae* is documented from Beliata, Labka, Kolél and Tin Ediar (gabbro or amphibolitic rocks with a high proportion of quartzites), and from several mostly granitic inselbergs near Markoye and Gorom-Gorom. It occurs on the slopes on the lower parts and in the upper zones (slopes, summit or summit plateau) where cattle do not graze. *Brachiaria lata* is highly constant. The mean number of species is 11.8 and mean cover value is 66%.

1.5.2 transition between *typicum* and *Aristidetosum adscensionis* (Appendix 1, Appendix 5)

The transition complex between the typical subassociation of the *Cleomo viscosae-Brachiarietum latae* and the subassociation *aristidetosum adscensionis* (Appendix 1, Appendix 5) is primarily found in Kolél and Takabangou, but can also be found less frequently in Labka and Bèldiabé. Stands occur in all aspects in the lower and upper parts. The rocks are gabbros or granites with a high percentage of biotite or amphibolites. Both *Brachiaria lata* and *Aristida*

adscensionis are present with high constancy. Mean number of species is 14.9 and mean cover value is 76%: these are the highest values of all plant communities on the studied Sahelian inselbergs in Burkina Faso.

1.5.3 *aristidetosum adscensionis*, subass. nov. hoc loco (Appendix 1, Appendix 5)

Holotypus: Appendix 5, rel. no 18 (Field no 505, JM, **Burkina Faso. Oudalan:** Bèldiabé, 14°48'N 0°08'W, 26.IX.2000).

Diagnostic species: *Aristida adscensionis.*

The subassociation *aristidetosum* adscensionis is characterised by *Aristida adscensionis. Brachiaria lata* is not present. This subassociation is widespread on the middle and upper slopes, occurring on silty substrate between the rocks, with no preference for a certain rock type. Relevés are recorded from Takabangou, Bèldiabé, Gagara, Kolél and Gangaol-Bambga. Mean number of species is 11.8 and mean cover value 60%.

1.5.4 *sesametosum alati*, subass. nov. hoc loco (Appendix 1, Appendix 6)

Holotypus: Appendix 6, rel. no 4 (Field no 313, JM, **Burkina Faso. Oudalan:** Gargassa, 14°43'N 0°40'W, 22.VIII.2000)

Diagnostic species: *Sesamum alatum.*

The subassociation *sesametosum* alati is distributed in the northern and northwestern parts of the study area (inselbergs Gargassa, Kolél and Tin Ediar, with gabbro rocks). *Sesamum alatum* is a widespread accompanying species in dune communities (Lebrun & al., 1991) and an important indicator of grazing as it is not fed by livestock (Poupon, 1980). Mean number of species is 9 and mean cover value 56% (Fig. 4).

1.5.5 impoverished form without *Brachiaria lata* (Appendix 1, Appendix 7)

The impoverished form of the *Cleomo viscosae-Brachiarietum latae* is common in the study area and recorded from Gargassa, Tin Ediar, Kolél, Takabangou, Gorom-Gorom,

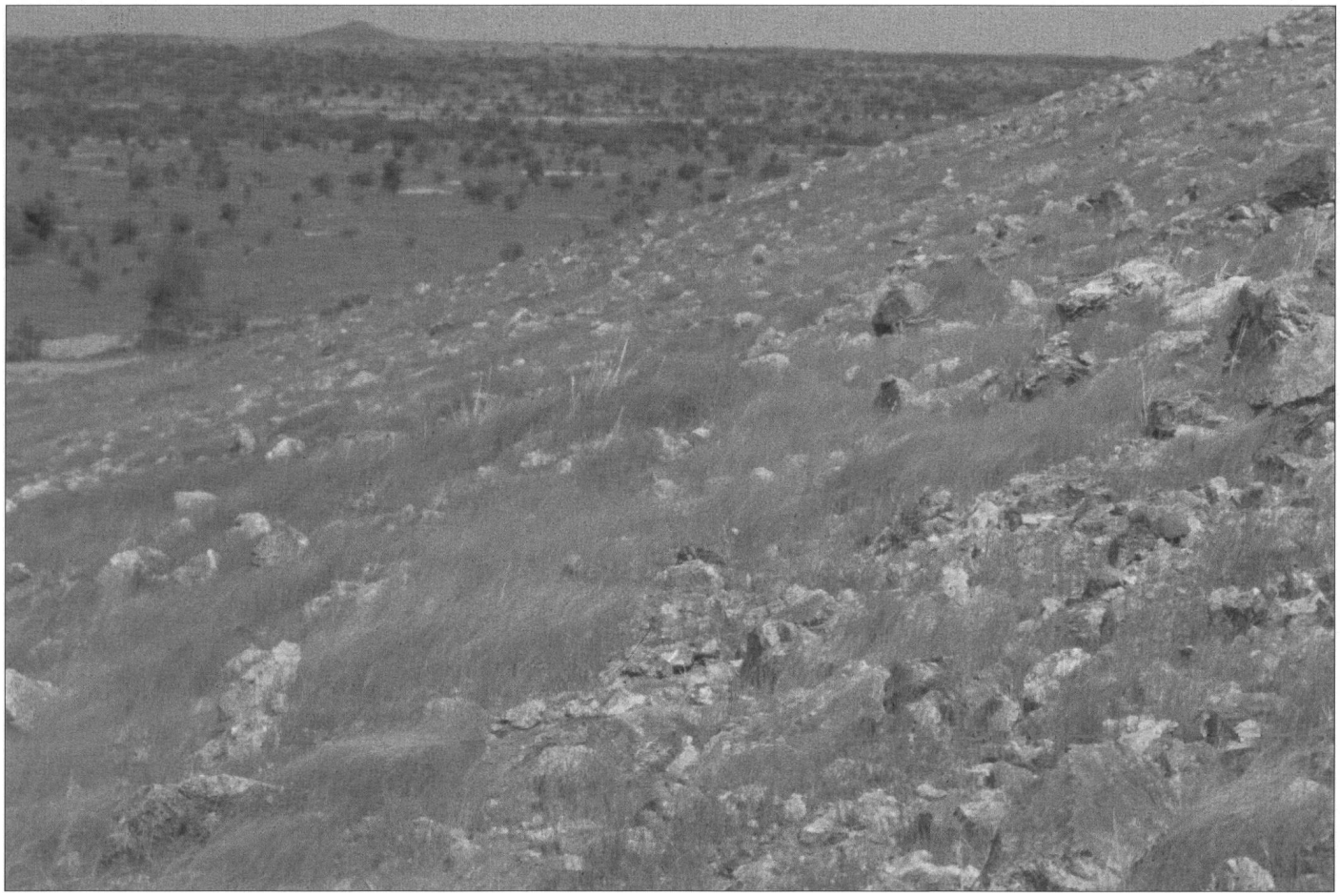

Fig. 4. – Aspect of the *Cleomo viscosae-Brachiarietum latae sesametosum alati*. Co-dominant plant species are *Aristida funiculata* and *Pandiaka angustifolia* (Gargassa, northern Burkina Faso).

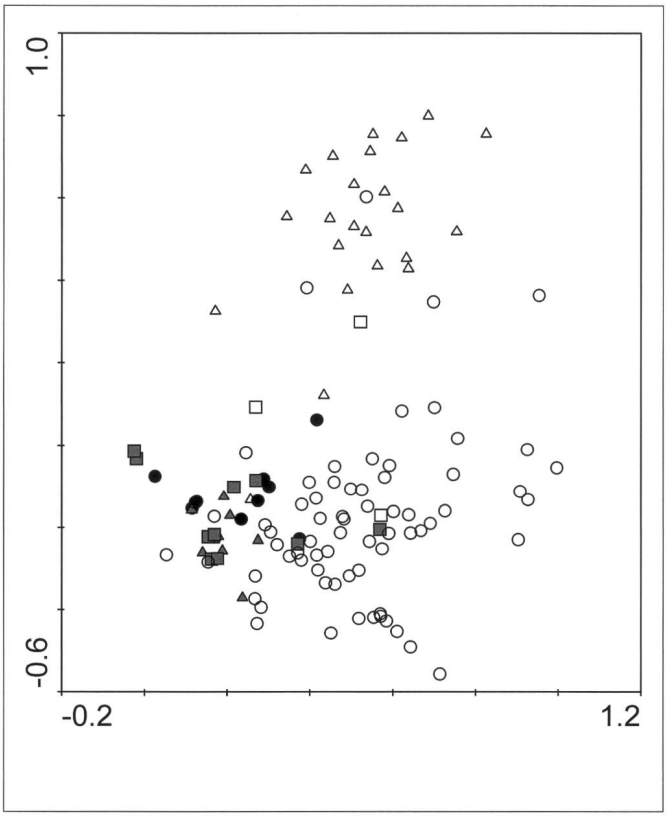

Fig. 5. – First and second axis of a PCA (cumulative percentage variance: 35.8) of 123 phytosociological relevés from inselbergs in Burkina Faso. Symbols represent the six plant communities: (●) *Pandiako angustifoliae-Aristidetum funiculatae*; (□) *Schizachyrium exile*-community; (▲) *Cymbopogonetum proximi*; (■) *Andropogonetum fastigiati*; (○) *Cleomo viscosae-Brachiarietum latae*, (△) *Enteropogonetum prieurii*.

Gagara, Labka and Beliata. It can be found on sandy, sandy-silty to loamy substrates. Rock types are coarse-grained granites, sometimes laterite or lateritic debris. *Brachiaria lata, Sesamum alatum, Aristida adscensionis,* and other species such as *Ipomoea coscinosperma, Tephrosia uniflora, Spermacoce chaetocephala* and *Digitaria ciliaris* are (almost always) absent. Accordingly, the mean number of species (9.4) is lower than in the typical or other subassociations of the *Cleomo viscosae-Brachiarietum latae.*

1.6 *Enteropogonetum prieurii,* ass. nov. hoc loco (Appendix 1, Appendix 8)

Holotypus: Appendix 8, rel. no 8 (Field no 940, JM, **Burkina Faso. Oudalan:** Oursi, 14°41'N 0°27'W, 30.VIII.2001).

Diagnostic species: *Enteropogon prieurii, Tragus berteronianus.*

The *Enteropogonetum prieurii* is characterised by the highly constant grass species *Enteropogon prieurii* and *Tragus berteronianus. Cleome viscosa, Tephrosia uniflora, Cleome scaposa, Ipomoea coscinosperma* and *Monechma ciliatum* are absent. In the study area this low-growing (mean height: 37 cm) plant community colonises sandy foot zones and lower parts of Beliata, Labka, Gagara and some smaller inselbergs near Gorom-Gorom, but also Iron Age settlement hills on dune ridges in the central and northern part of the study area whose occurrence is therefore particularly interesting: it is not only the only of the studied plant communities that can also be found on dune ridges but it may even be considered an indicator community for Iron Age settlement hills. Such hills are covered with in-situ debris, a thin sand cover and pisolites. The ecotone to the adjacent dune vegetation is floristically very sharp: a significant difference to the surrounding dune vegetation is the presence of *Aristida funiculata, Tetrapogon cenchriformis* and *Boerhavia coccinea.* Mean number of species is 11.5 and mean cover value is 65%.

The data analysis was completed by PCA. The cumulative percentage variance of the first two axes was 35.8% (all four axes: 44.7%). Figure 5 shows the correlation matrix of the data along the first two axes and the relative positive position of the relevés using different symbols for the plant communities as worked out in the classification (see Appendix 1, results for axes 3 and 4 are not shown). As a result of the "background noise" of many highly constant accompanying species, the associations cannot be clearly separated by this technique. Relevés of the *Pandiako-Aristidetum funiculatae,* characterised only by the diagnostic species of the alliance, are in the centre of the plot. Relevés of the associations *Cymbopogonetum proximi, Andropogonetum fastigiati* and *Cleomo viscosae-Brachiarietum latae* overlap along the first axis. Relevés of the *Enteropogonetum prieurii* and *Cleomo viscosae-Brachiarietum latae* are separated along the second axis. Both communities form relatively homogeneous clusters.

Discussion

The herbaceous, non-inundated vegetation of inselbergs in the Sahelian parts of Burkina Faso can be grouped into surprisingly few plant communities, which are floristically close to each other and therefore all belong to the same alliance. Only relatively few species are diagnostic in these five plant communities, whereas many widespread, often short-lived species with ruderal character and exozoochoric dispersal mechanisms are highly constant in all plant communities. Müller (2003) interpreted the floristic similarity of many Sahelian communities and presence of many exozoochoric species as a result of grazing influence in these areas. Regeneration of tree species is rare and in many cases prevented by grazing. The fact that almost all diagnostic species are annu-

als, and that half of them are grass species, reflects the high proportion of *Poaceae* and annual species in the Sahelian flora in general (WHITE, 1983) and in the Burkinian Sahel in particular with 60% therophytes (CLAUDE & al., 1991). This might also be the result of the dry and often unpredictable climatic conditions in the Sahel, and is a distinct difference to inselberg vegetation in more humid areas further south. Not only the proportion of perennial species but also the total number of species is lower than that of comparable vegetation types on inselbergs in the West African rainforest zone (POREMBSKI, 2000). Certain plant families, typical for more humid regions, e.g. *Velloziaceae*, *Commelinaceae* or *Eriocaulaceae* (POREMBSKI, 2000), are far less frequent or completely missing. The mat-forming, poikilohydric sedge *Afrotrilepis pilosa* which is very typical for inselbergs in the Guinean zone of West Africa does not reach Sahelian inselbergs (PARMENTIER & al., 2006). Despite their high interannual variability of occurrence and cover and their often wide ecological amplitude and large distribution range, annual species are suitable as diagnostic species for Sahelian inselberg vegetation types (BREMAN & CISSÉ, 1977; MIEHE, 1988). In other bioclimatic zones some of the diagnostic species show a different ecological behaviour, for example *Pandiaka angustifolia,* in the Sahelian zone restricted to inselbergs and avoided by cattle, is a character species of the phytosociological class *Hyparrhenietea* Schmitz 1963 of Sudanian-Zambesian savannas (SINSIN, 1994). In the Chaîne de Gobnangou in southern Burkina Faso, *Pandiaka angustifolia* is an important component in the herbaceous layer of medium deep soils on the massif's plateau (KÜPPERS & WITTIG, 1995). In the North Sudanian zone, *Pennisetum pedicellatum* is a pioneer plant in fissures (KÜPPERS & WITTIG, 1995) or considered as a segetal plant (ATAHOLO & WITTIG, 1995).

Whereas *Schizachyrium exile* occurs in the Sahelian zone mainly on inselbergs, it is in the Sudanian zone a character species for fallow land communities of the order *Spermacocetalia stachydeae* Sinsin 1994. KÉRÉ (1998) described this as a character species of a North Sudanian fallow land community on sandy soils *(Schizachyrium exile-Aristida adscensionis-community).*

Regarding their ranges of distribution, the *Andropogonetum fastigiati* in the southern parts of the study area, the *Cleomo viscosae-Brachiarietum latae sesametosum alati* in the northwestern parts, and the *Cymbopogonetum proximi* on only one inselberg are particularly noteworthy. *Cymbopogon schoenanthus* subsp. *proximus,* often considered as an indicator for over-grazing, is in the presented study documented from the Beliata inselberg. During the field survey of this study it could not be found in the northeastern parts of the study area, where it was found by LEBRUN & al. (1991). The centre of its distribution is the Sahelian zone, though it is threatened by local extinction in some areas (LEBRUN & al., 1991). In the central and southern parts of the Sahara it is part of a species rich community of the alliance *Aerveto-Fagonion (Aerveto-Fagonietalia, Asterisceto-Forskhaletea)* on limestone pavement (QUÉZEL, 1965). *Cymbopogon schoenanthus* subsp. *proximus* is also present in the North Sudanian zone and characteristic for the *Guiera senegalensis-Cymbopogon schoenanthus*-community of heavily grazed, stone-rich soils (KÉRÉ, 1998). These examples show the large ecological amplitude within its distribution range.

Stands of the *Cleomo viscosae-Brachiarietum latae* colonise habitats with different geological characteristics. It is the most widespread plant community on Sahelian inselbergs. A restriction to a certain geology or topographic position is not detectable. Depending on location and utilisation, different subassociations and forms are realised. The large habitat amplitude of this community is reflected by the ecological amplitude of its diagnostic species (taken from POILECOT, 1999): in Niger, *Brachiaria lata* is a ruderal species on moist, loamy-silty soils and the pluriregional grass species *Aristida adscensionis* is a pioneer species with a broad habitat amplitude.

It is difficult to relate the described plant communities to other inselberg plant communities from the literature because comparable studies from the Sahelian zone in Burkina Faso or neighbouring countries do not exist. None of the communities are similar to those presented by KNAPP (1965, 1966). GUINKO (1984) and DJITEYE (1988) do not mention plant communities on Sahelian inselbergs. A few studies exist from Sahelian and Saharan mountain massifs 1500 to 2000 km distant to our study area, e.g. in Chad: Tibesti and Ennedi (QUÉZEL, 1965; GILLET, 1968), and in Sudan: Jabel Marrah (MIEHE, 1988). The floristic overlap of the plant communities from Tibesti and Jabel Marrah with those plant communities described in this paper is small. The mountain massifs of the Sahara are largely free of vegetation. The few described vegetation units from these massifs contain many Sahelian species. QUÉZEL (1965) considered *Cleome scaposa, Cleoma viscosa* and *Rogeria adenophylla* as character species in a *Cleome brachycarpa-Cleome aurea* community. *Cleome scaposa* and *C. viscosa* are diagnostic species of the *Cleomo viscosae-Brachiarietum latae.* On the other hand, none of these Saharan vegetation units could be found on the inselbergs in the study area. There are no floristic parallels or common species to plant communities from Atlantic Central Africa (PARMENTIER & al., 2006; PARMENTIER & MÜLLER, 2006).

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Appendix 1. – Synoptic table of plant communities on Sahelian inselbergs in Burkina Faso (DS: diagnostic species). Companions occurring only once and non-determined species are omitted (symbols represent constancy classes: +: 1-10%, I: 11-20%, II: 21-40%, III: 41-60%, IV: 61-80%, V: 81-100%).

	Pandiako angustifoliae-Aristidion funiculatae									
	Pandiako angustifoliae-Aristidetum funiculatae	***Schizachyrium exile*-community**	***Cymbopogonetum proximi***	***Andropogonetum fastigiati***	***Cleomo viscosae-Brachiarietum latae***					***Enteropogonetum prieurii***
					Typicum	***Transition between typicum and aristidetosum adscensionis***	***Aristidetosum***	***Sesametosum alati***	***Impoverished* form without *Brachiaria lata***	
No of releves	9	3	10	10	23	16	10	8	11	23
Cover [%]	48	55	60	57	66	76	60	56	57	65
Mean height [cm]	52	63	97	38	51	70	55	73	58	37
Mean no. of species	7.20	11.33	5.80	6.50	11.80	14.94	11.80	9.00	9.40	11.52
Shannon-Diversity	1.00	1.20	0.67	0.70	1.10	1.45	1.12	0.96	0.96	1.19
Evenness	50.00	51.00	38.20	41.40	47.00	53.81	45.00	44.75	46.20	48.96
Simpson	0.48	0.41	0.63	0.62	0.46	0.36	0.46	0.50	0.49	0.47
DS of *Pandiako angustifoliae-Aristidion funiculatae* communities:										
Schizachyrium exile	–	3	–	–	–	–	+	–	–	–
Cymbopogon schoenanthus subsp. *proximus*	–	–	V	–	–	–	–	–	–	–
Andropogon fastigiatus	–	–	–	V	–	–	–	–	–	–
Cassia mimosoides	–	–	–	II	+	–	–	–	–	–
Aristida sieberiana	–	–	–	I	–	–	–	–	–	–
Brachiaria lata	–	–	I	+	V	V	–	–	–	–
Aristida adscensionis	–	–	–	I	–	V	V	–	–	+
Sesamum alatum	–	–	–	–	–	–	–	V	–	–
Cleome viscosa	–	–	–	+	III	IV	II	IV	IV	–
Ipomoea coscinosperma	–	1	–	+	III	III	II	II	+	–
Cleome scaposa	–	–	–	I	II	I	I	III	II	–
Tephrosia uniflora	–	–	–	–	II	III	II	II	+	–
Monechma ciliatum	–	–	+	–	+	II	+	II	I	–
Enteropogon prieurii	–	–	–	–	+	I	–	–	–	V
Tragus berteronianus	–	–	–	–	–	+	–	–	–	IV
DS of the alliance *Pandiako angustifoliae-Aristidion funiculatae*:										
Pandiaka angustifolia	V	1	V	IV	IV	V	V	V	V	II
Aristida funiculata	III	3	+	–	IV	IV	III	IV	IV	V
Pennisetum pedicellatum	III	3	III	III	II	III	IV	II	III	+
Tree regeneration:										
Grewia tenax	–	–	III	–	–	–	–	I	–	+
Acacia tortilis subsp. *raddiana*	–	–	–	–	+	–	+	–	+	II
Acacia laeta	I	–	–	–	+	–	–	–	–	–
Guiera senegalensis	–	–	+	–	–	–	–	I	–	–
Boscia senegalensis	2	–	–	–	–	+	–	–	–	+
Companions:										
Digitaria ciliaris	*I*	*1*	–	–	*I*	*II*	+	–	–	*III*
Mollugo nudicaulis	*III*	*1*	+	*I*	*I*	+	+	*I*	*II*	*I*
Cassia obtusifolia	*II*	*2*	+	–	*I*	*I*	*I*	–	+	+
Alysicarpus ovalifolius	–	*2*	–	*I*	*III*	*III*	*III*	–	*II*	*V*
Zornia glochidiata	*I*	*3*	–	*I*	*II*	*III*	*III*	*II*	*II*	*V*
Schoenefeldia gracilis	–	*1*	*I*	+	*II*	*II*	*III*	–	*I*	*II*
Boerhavia coccinea	*III*	–	+	+	*I*	*II*	*II*	*II*	*II*	*III*
Leptadenia hastata	*II*	*1*	+	*II*	*II*	*II*	*II*	–	*I*	–

Pandiako angustifoliae-Aristidion funiculatae

	Pandiako angustifoliae-Aristidetum funiculatae	***Schizachyrium exile*-community**	***Cymbopogonetum proximi***	***Andropogonetum fastigiati***	***Cleomo viscosae-Brachiarietum latae***					***Enteropogonetum prieurii***
					Typicum	***Transition between typicum and aristidetosum adscensionis***	***Aristidetosum***	***Sesametosum alati***	***Impoverished* form without *Brachiaria lata***	
Tribulus terrestris	–	–	–	+	II	I	I	–	II	IV
Dactyloctenium aegyptium	–	–	–	–	I	II	I	–	I	V
Tetrapogon cenchriformis	–	–	+	–	+	IV	I	–	II	III
Panicum laetum	–	–	–	+	II	III	I	I	II	I
Cenchrus biflorus	–	1	–	–	I	I	+	I	II	III
Tragus racemosus	I	2	–	–	+	I	+	I	–	IV
Spermacoce chaetocephala	–	1	–	+	+	II	III	–	+	II
Corchorus tridens	–	1	+	+	II	III	I	–	–	+
Ceratotheca sesamoides	–	–	+	+	II	I	+	–	–	+
Indigofera aspera	–	–	–	+	I	II	+	–	–	+
Cucumis melo	–	1	+	–	I	II	–	II	–	–
Aristida mutabilis	–	1	–	–	+	–	–	–	II	II
Cienfuegosia digitata	I	1	–	–	–	I	–	–	+	+
Urochloa trichopus	–	–	–	+	I	–	I	–	+	+
Pupalia lappacea	–	–	II	–	+	I	–	–	II	–
Achyranthes aspera	–	–	+	–	+	I	–	–	+	I
Brachiaria orthostachys	I	–	+	+	–	–	–	–	I	+
Aristida stipoides	II	–	–	–	–	–	–	–	+	+
Abildgaardia congolensis	I	–	–	+	–	–	–	–	–	–
Caralluma adscendens	–	1	–	–	–	–	+	II	–	–
Pergularia tomentosa	I	–	+	–	+	I	+	–	–	–
Stylosantis erecta	–	–	+	–	–	+	–	–	–	+
Andropogon gayanus	–	–	+	–	–	+	–	–	–	–
Aspilia helianthoides	–	–	–	–	–	+	+	I	–	–
Diheteropogon hagerupii	–	–	–	+	I	–	–	I	–	–
Tephrosia gracilipes	–	–	–	II	–	–	+	–	–	–
Dalechampia scandens	I	–	–	+	–	–	–	I	I	–
Cucumis ficifolius	–	–	–	+	–	–	I	I	–	–
Portulaca oleracea	–	–	–	–	+	+	–	–	–	+
Tephrosia cf. *bracteolata*	–	–	–	–	+	–	–	II	–	–
Digitaria gayana	I	–	–	–	+	–	–	–	–	+
Indigofera senegalensis	–	–	–	–	I	–	+	–	+	–
Limeum viscosum	–	–	–	–	+	–	–	–	–	+
Phyllanthus maderaspatensis	–	–	–	–	+	I	–	–	–	–
Polygala erioptera	–	–	–	–	I	+	–	–	–	–
Gisekia pharnacioides	–	–	–	–	+	–	–	–	–	II
Bulbostylis barbata	–	–	–	–	+	–	–	–	–	I
Cassia nigricans	–	–	–	–	–	+	I	–	–	–
Brachiaria ramosa	–	–	–	–	–	I	+	–	–	+
Eragrostis pilosa	–	–	–	–	–	+	–	–	+	+
Rogeria adenophylla	–	–	–	–	+	+	–	–	–	–
Eragrostis atrovirens	–	–	–	–	–	–	I	–	+	–
Polygala cf. *fernandesiana*	–	–	–	–	–	–	+	–	–	+
Caralluma acutangula	–	–	–	–	–	–	–	I	–	–

Appendix 2. – Associations *Pandiako angustifoliae-Aristidetum funiculatae* , *Schizachyrium exile*-community and *Cymbopogonetum proximi* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).

(Rare species: the first number behind the name of the species indicates the relevé number: *Cymbopogon* sp. No. H 620b 1: 5; *Acacia laeta* 1: r; *Cleome monophylla* 3: r; *Microchloa indica* 4: 1; *Abildgaardia congolensis* 4: 2m; indet. "Nganba" 5: r; *Digitaria gayana* 6: +; *Colocynthis citrullus* 7: r; *Tephrosia purpurea* 9: +; *Dalechampsia scandens* 9: 2a; *Liliaceae* indet. 10: r; *Euphorbia forskalii* 11: r; *Spermacoce chaetocephala* 12: 1; *Ipomoea vagans* 12: r; *Ipomoea coscinosperma* 12: r; *Monechma ciliatum* 12: +; *Achyranthes aspera* 12: +; *Polycarpaea corymbosa* 14: +; *Indigofera* cf. *dendroides* 15: r; *Ceratotheca sesamoides* 15: +; *Guiera senegalensis* 16: r; indet. No. H 765 16: r; *Stylosantis erecta* 16: 2a; indet. No. H 767 17: 2a; *Tetrapogon cenchriformis* 17: +; *Andropogon gayanus* 21: 2b.)

	Pandiako angustifoliae-Aristidetum funiculatae									***Schizachyrium* exile-community**			***Cymbopogonetum proximi***									
No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Field no	327	1029	839	585	470	833	837	329	451	471	469	468	555	1032	557	1031	554	556	559	1028	558	552
Plot size [m²]	10	10	12	2	12	12	12	10	14	12	11	14	5	10	6	11	6	6	5	11	5	6
Exposition	NNE	E	SW	–	NE	E	NNW	NE	S	–	NW	N	–	NE	SW	SE	NE	N	NW	E	NW	N
Inclination [°]	18	26	25	–	30	6	20	23	2	–	6	30	–	2	3	27	–	5	40	22	35	30
Cover [%]	80	70	15	5	83	10	45	65	55	35	45	85	95	85	90	34	90	90	40	20	35	20
Vegetation height [cm]	130	50	50	5	70	20	30	40	70	50	60	80	90	105	120	120	140	80	90	80	75	70
Number of species	4	17	7	3	6	9	6	4	9	15	6	13	4	9	8	8	8	4	5	4	6	2
Shannon-Diversity	0.42	1.64	0.99	0.69	1.29	1.15	0.87	0.19	1.37	1.67	0.91	1.02	0.62	0.53	0.72	0.81	0.95	0.11	1.10	0.67	1.09	0.06
Evenness	31	58	51	62	72	52	48	14	62	62	51	40	45	24	34	39	46	8	68	49	61	8
Simpson	0.78	0.25	0.41	0.52	0.30	0.39	0.49	0.91	0.31	0.22	0.48	0.52	0.68	0.75	0.65	0.52	0.49	0.96	0.35	0.55	0.37	0.98
DS of the *Schizachyrium exile*-community:																						
Schizachyrium exile	–	–	–	–	–	–	–	2a	3	2b	–	–	–	–	–	–	–	–	–	–	–	–
DS of *Cymbopogonetum proximi*:																						
Cymbopogon schoenanthus subsp. *proximus*	–	–	–	–	–	–	–	–	–	–	–	5	5	5	2b	2a	5	2b	2b	2a	2b	
DS of alliance																						
Pandiaka angustifolia	2a	4	2a	–	2a	2a	2a	4	2b	–	–	1	2a	2a	1	2a	1	1	2b	2a	2b	–
Pennisetum pedicellatum	–	–	–	r	3	–	–	2m	3	+	1	5	2a	1	2a	+	4	–	–	–	–	–
Aristida funiculata	–	–	2a	–	3	2a	2b	–	–	2a	2b	1	–	–	–	–	–	–	–	–	2a	–
DS of other units:																						
Brachiaria lata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	r	–	–	–	–
Tree regeneration:																						
Grewia tenax	–	–	–	–	–	–	–	–	–	–	–	–	+	–	+	–	+	r	–	–	+	–
Companions:																						
Cassia obtusifolia	1	–	r	–	–	–	–	–	–	r	–	r	–	–	–	–	–	–	–	+	–	–
Mollugo nudicaulis	–	+	1	–	–	+	1	–	–	r	–	–	–	–	–	r	–	–	–	–	–	–
Aristida cf. *adscensionis* No. H 973	–	r	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	r	–	–
Brachiaria orthostachys	–	r	–	–	–	–	–	–	–		–	–	–	–	–	–	+	–	–	–	–	–
Boerhavia coccinea	–	–	–	–	+	+	r	r	+	–	–	–	–	r	–	–	–	–	–	–	–	
Aristida stipoides	–	–	+	–	–	+	+	–			–	–	–	–	–	–	–	–	–	–	–	–
Schoenefeldia gracilis	–	–	–	–	–	–	–	–	–	+	–	–	–	1	–	–	–	–	+	–	–	
Digitaria ciliaris	–	–	r	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	
Zornia glochidiata	–	–	–	–	–	r	–	–	–	2m	1	+	–	–	–	–	–	–	–	–	–	–
Alysicarpus ovalifolius	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	
Corchorus tridens	–	–	–	–	–	–	–	–	–	r	–	–	–	r	–	–	–	–	–	–	–	–
Tragus racemosus	–	–	–	–	–	1	–	–	–	1	+	–	–	–	–	–	–	–	–	–	–	
Leptadenia hastata	–	–	–	–	2b	–	–	–	+	–	–	2a	–	–	–	–	r	–	–	–	–	–
Cienfuegosia digitata		–	–	–	–	–	+	–	–	–	–	r	–	–	–	–	–	–	–	–	–	
Caralluma adscendens		–	–	–	–	–	–	–	r	r	–	–	–	–	–	–	–	–	–	–	–	–
Pergularia tomentosa	–	–	–	–	–	–	–		2a	–	+	–	–	–	–	–	–	–	–	–	–	–
Aristida mutabilis	–	–	–	–	–	–	–	–	+	2a	–	–	–	–	–	–	–	–	–	–	–	–
Cenchrus biflorus	–	–	–	–	–	–	–	–	1	r	–	–	–	–	–	–	–	–	–	–	–	
Pupalia lappacea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	+	+
Cucumis melo	–	–	–	–	–	–	–	–	–	–	–	r	–	r	–	–	–	–	–	–	–	–

Appendix 3. – Association *Andropogonetum fastigiati* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).
(Rare species: the first number behind the name of the species indicates the relevé number: *Cucumis ficifolius* 1: r; seedling indet. 3: +; *Dalechampia scandens* 3: r; *Spermacoce chaetocephala* 3: r; *Brachiaria orthostachys* 5: +; *Piliostigma reticulatum* 5: r; *Cleome viscosa* 8: 1; *Ipomoea coscinosperma* 8: +; *Panicum laetum* 8: +; *Brachiaria lata* 8: 1; *Ceratotheca sesamoides* 8: 1; *Indigofera aspera* 8: +; *Urochloa trichopus* 8: 1; *Diheteropogon hagerupii* 8: 4; *Tribulus terrestris* 8: r; *Boerhavia coccinea* 8: 7+; *Corchorus tridens* 9: r; *Schoenefeldia gracilis* 9: +.)

	Andropogonetum fastigiati									
No	1	2	3	4	5	6	7	8	9	10
Field no	583	584	594	589	591	592	587	817	590	588
Plot size [m²]	7,5	7	9	6	9	8	8	10	7	6
Exposition	NE	NE	SE	NW	SW	SSE	NE	S	SE	S
Inclination [°]	23	30	10	35	3	20	10	21	28	35
Cover [%]	73	40	85	60	30	35	60	70	57	55
Vegetation height [cm]	60	30	50	30	40	25	35	40	40	30
Number of species	8	5	9	4	6	2	2	13	9	7
Shannon-Diversity	1.1	0.9	0.7	0.1	0.7	0.2	0.6	1.1	1.4	0.2
Evenness	58	58	30	2	39	29	80	43	66	9
Simpson	0.38	0.48	0.64	0.99	0.49	0.9	0.63	0.43	0.28	0.93
DS of the *Andropogonetum fastigiati*:										
Andropogon fastigiatus	4	3	1	4	3	3	4	3	2a	4
Cassia mimosoides	+	+	r	–	–	–	–	–	–	–
Aristida sieberiana	2a	+	–	–	–	–	–	–	–	–
DS of alliance:										
Pandiaka angustifolia	r	2a	1	+	+	1	–	1	–	+
Pennisetum pedicellatum	2a	2a	5	r	3	–	–	–	1	–
Companions:										
Leptadenia hastata	3	–	2b	–	+	–	–			
Aristida adscensionis	+	–	–	–	–	–	–	–	2a	–
Alysicarpus ovalifolius	–	–	+	–	–	–	–	+	–	–
Tephrosia gracilipes	–	–	–	r	–	–	–	–	r	1
Abildgaardia congolensis	–	–	–	–	–	–	2b			r
Mollugo nudicaulis	–	–	–	–	–	–	–	–	2m	r
Cleome scaposa								–	2m	+
Zornia glochidiata	–	–	–	–	–	–	–	–	r	r

Appendix 4. – Association *Cleomo viscosae-Brachiarietum latae, typicum* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).
(Rare species: the first number behind the name of the species indicates the relevé number: *Boscia senegalensis* 1: r; *Acanthaceae* No. H 919 2: r; *Pavonia zeylanica* 2: r; *Pergularia tomentosa* 3: r; *Rogeria adenophylla* 3: r; *Aristida mutabilis* 4: 2b; *Fabaceae* No.H 634 4: +; *Pupalia lappacea* 5: 1; cf. *Vernonia galamensis* No. H 975 5: +; *Sida ovata* 7: r; *Scrophulariaceae* No. H 899 8: +; cf. *Dalechampsia scandens* No. H 938 9: 2a; indet. No. H 917 11: +; *Corchorus olitorius* 11: r; *Cassia mimosoides* 12: r; *Aristida* sp. No. H 632d 14: 1; *Tephrosia* cf. *bracteolata* 17: +; *Acacia laeta* 17: r; *Tetrapogon cenchriformis* 20: 1; *Rhynchosia minima* var. *memnonia* 20: r; *Enteropogon prieurii* 22: +; *Portulaca oleracea* 22: r; *Gisekia pharnacioides* 22: +; *Limeum viscosum* 22: r; *Limeum pterocarpum* 23: r; *Digitaria gayana* 23: 2a.)

	Cleomo viscosae-Brachiarietum latae typicum																						
No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Field no	331	332	807	342	1034	330	338	827	903	811	886	815	816	339	335	341	334	876	875	1035	881	813	832
Plot size [m²]	10	10	12	12	10	10	15	12	8	12	12	10	12	12	14	12	15	10	10	12	10	10	10
Exposition	SW	NW	N	NE	SSE	SWW	-	SSW	N	SW	SSW	NNW	W	NE	N	NW	N	NE	SE	SE	SW	SEE	N
Inclination [°]	20	17	22	11	38	10	-	5	6	17	7	14	21	3	4	10	2	7	21	22	20	2	5
Cover [%]	60	82	30	70	12	75	96	40	95	50	96	73	83	70	42	75	50	95	60	55	75	75	60
Vegetation																							
height [cm]	40	70	45	90	30	40	60	40	150	30	60	40	35	80	50	40	40	50	45	40	35	25	30
Number of species	9	10	16	11	8	6	7	19	15	12	18	15	15	15	8	7	8	9	9	10	12	17	15
Shannon-Diversity	0.84	1.03	1.69	1.24	0.88	0.83	0.66	1.95	0.90	1.25	0.95	0.76	1.23	1.78	1.52	0.74	0.45	0.78	1.50	1.11	0.90	1.47	1.88
Evenness	38	45	61	52	42	46	34	66	33	50	33	28	45	66	73	38	22	36	68	48	36	52	70
Simpson	0.50	0.47	0.28	0.37	0.53	0.47	0.65	0.19	0.60	0.49	0.54	0.68	0.43	0.21	0.26	0.65	0.80	0.67	0.25	0.48	0.54	0.35	0.19
DS of the *Cleomo viscosae-Brachiarietum latae* und subunits:																							
Brachiaria lata	+	4	2b	1	1	3	1	2a	2a	+	2a	1	+	2b	2a	+	r	1	2a	1	1	+	r
Cleome viscosa	+	1	2m	+	–	–	–	r	1	r	r	+	+	+	1	1	+	+	–	–	–	–	–
Ipomoea																							
coscinosperma	1	–	–	–	r	–	–	r	–	1	1	r	1	+	–	–	–	–	+	1	+	–	–
Cleome scaposa	r	–	–	–	–	–	–	r	–	–	–	1	r	r	–	–	1	1	–	1	–	–	–
Tephrosia uniflora	–	–	–	–	r	r	–	1	+	–	+	–	–	–	–	–	–	–	–	+	–	–	–
Monechma ciliatum	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–
DS of alliance:																							
Pandiaka																							
angustifolia	2b	1	1	1	2a	3	–	1	+	2m	2b	+	2a	2a	2b	1	–	1	2a	2a	1	–	1
Aristida funiculata	3	2b	2a	3	–	–	1	2b	–	3	–	5	2b	2b	3	4	3	5	2b	3	2b	–	2a
Pennisetum																							
pedicellatum	+	2a	–	–	–	1	–	–	5	–	–	–	–	+	–	–	–	–	1	–	–	–	–
Tree regeneration:																							
Acacia tortilis																							
subsp. *raddiana*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	r
Companions:																							
Alysicarpus																							
ovalifolius	–	r	+	r	–	–	2b	1	r	2m	+	2a	+	1	–	–	–	–	+	–	+	3	+
Ceratotheca																							
sesamoides	–	–	1	–	–	–	–	1	–	–	r	+	1	–	–	–	–	+	+	–	+	–	–
Leptadenia hastata	–	–	r	+	–	–	–	2a	–	–	+	–	+	r	–	–	–	–	–	–	–	–	–
Corchorus tridens	r	–	r	–	–	–	–	–	r	–	r	+	–	–	–	–	–	–	–	–	–	r	–
Tribulus terrestris	–	+	1	–	–	+	–	–	–	1	–	+	–	–	–	–	–	–	–	–	–	2m	–
Boerhavia coccinea	–	+	1	–	–	–	–	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Cassia obtusifolia	–	r	+	–	r	–	–	–	–	+	–	–	–	–	–	–	–	–	–	+	–	–	–
Mollugo nudicaulis	–	–	+	–	r	–	–	r	–	+	–	–	+	–	–	–	–	–	–	–	–	+	–
Urochloa trichopus	–	–	1	–	–	–	–	–	–	1	–	1	1	–	–	–	–	–	–	–	–	1	–
Polygala erioptera	–	–	+	–	–	–	–	r	–	–	r	–	r	–	–	–	–	–	–	+	r	–	–
Dactyloctenium																							
aegyptium	–	–	–	+	–	–	–	r	r	–	–	–	–	–	–	–	–	–	–	–	–	1	+
Panicum sp.	–	–	–	2a	–	–	5	–	–	–	–	–	–	–	r	1	–	–	–	–	–	–	–
Zornia glochidiata	–	–	–	–	–	–	–	r	r	1	–	+	–	–	–	–	–	–	–	–	r	+	2a
Panicum laetum	–	–	–	–	–	–	–	1	+	–	2m	–	–	–	–	–	–	2a	2a	–	1	2a	–

	Cleomo viscosae-Brachiarietum latae typicum																							
Schoenefeldia gracilis	–	–	–	–	–	–	–	2a	–	–	–	–	–	1	2a	2a	1	1	–	–	–	–	+
Cucumis melo	–	–	–	–	–	–	–	–	–	–	r	–	+	+	r	–	r	–	–	–	–	–	–
Indigofera aspera	–	–	–	–	–	–	–	+	–	–	r	1	–	–	–	–	–	–	–	–	+	–	–
Cenchrus biflorus	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Digitaria ciliaris	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	+	+
Indigofera senegalensis	–	–	–	r	–	–	–	–	–	–	–	–	–	–	–	r	–	1	–	–	–	–	–
Cymbopogon sp. No. H 620b	–	–	–	–	–	+	–	–	–	–	–	–	–	2a	2a	–	–	–	–	–	–	–	–
Diheteropogon hagerupii	–	–	–	–	–	–	–	–	–	–	5	–	4	–	–	–	–	–	–	–	4	–	–
seedling indet	–	–	–	–	–	–	r	–	–	–	–	r	–	–	–	–	–	–	–	–	r	–	–
Phyllanthus maderaspatensis	–	–	–	–	–	–	+	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Spermacoce chaetocephala	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	–	–	1
Tragus racemosus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2a	1
Bulbostylis barbata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	1

Appendix 5. – Associations *Cleomo viscosae-Brachiarietum latae,* transition between *typicum* and *aristidetosum adscensionis* and *Cleomo viscosae-Brachiarietum latae, aristidetosum adscensionis* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).

(Rare species: *Tragus berteronianus* 1: +; cf. *Dalechampsia scandens* No. H 938 1: r; *Waltheria indica* 1: +; cf. *Pavonia triloba* No. H 926 3: r; *Polygala erioptera* 4: r; Rubiaceae No. H 924 4: 1; seedling indet. 5: r; *Eragrostis pilosa* 7: 1; *Rogeria adenophylla* 10: r; *Portulaca oleracea* 10: r; *Evolvulus alsinoides* 13: +; *Blepharis maderaspatensis* 13: +; indet. No. H 920 13: r; *Andropogon gayanus* 15: 3; *Stylosantis erecta* 16: r; *Hibiscus* sp. No. H 613a 16: r; *Amaranthus graecizans* 17: r; *Indigofera senegalensis* 18: +; *Polygala* cf. *fernandesiana* 18: +; *Euphorbia balsamifera* 18: r; indet. No. H 708 19: +; *Acacia tortilis* subsp. *raddiana* 19: r; *Schizachyrium exile* 21: 3; *Spermacoce* cf. *senensis* 24: +; *Caralluma adscendens* 24: 1; *Cadaba farinosa* 25: r; indet. "Nganba" 25: +; *Tephrosia gracilipes* 25: +.)

	Cleomo viscosae-Brachiarietum latae																									
	Transition between *typicum* and *aristidetosum adscensionis*																***aristidetosum adscensionis***									
No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Field no	899	907	884	882	900	905	904	506	906	809	877	880	879	878	883	553	901	505	457	885	838	595	455	596	456	593
Plot size [m²]	10	13	10	12	10	12	12	10	12	10	12	10	10	12	11	6	10	10	15	10	12	8	15	10	15	11
Exposition	S	SE	W	-	S	SSE	NE	NE	SW	SSW	S	NNE	-	W	S	NE	-	NE	-	SE	N	NW	S	NE	N	SW
Inclination [°]	13	5	17	-	21	10	4	8	6	40	8	19	-	20	3	27	-	10	-	20	27	6	10	15	8	10
Cover [%]	55	60	60	65	75	90	80	85	80	68	80	85	100	72	90	65	45	30	50	85	70	60	50	77	60	70
Vegetation height [cm]	85	40	50	100	100	50	40	75	35	40	60	90	90	70	140	60	80	65	65	60	40	40	60	40	45	50
Number of species	25	17	11	17	17	19	16	10	12	13	9	18	20	13	13	9	14	13	14	14	11	9	10	12	13	8
Shannon-Diversity	2.29	1.69	1.20	1.94	1.92	0.87	1.54	1.19	0.82	0.98	1.06	1.87	1.36	1.75	1.84	0.84	0.95	1.58	1.36	1.61	1.31	0.54	1.24	0.69	1.21	0.66
Evenness	71	60	50	69	68	30	55	51	33	38	48	65	45	68	72	38	36	62	51	61	55	24	54	28	47	32
Simpson	0.13	0.24	0.36	0.20	0.22	0.65	0.37	0.41	0.62	0.57	0.44	0.20	0.34	0.20	0.21	0.57	0.61	0.25	0.31	0.24	0.35	0.72	0.40	0.67	0.36	0.68
DS of the *Cleomo viscosae-Brachiarietum latae* und subunits:																										
Brachiaria lata	2a	1	1	2a	1	+	+	1	1	4	1	1	3	2b	1	r	–	–	–	–	–	–	–	–	–	–
Cleome viscosa	+	+	r	+	1	+	1	2a	+	1	–	–	–	–	–	–	1	+	r	–	–	–	–	–	–	–
Aristida adscensionis	1	1	3	2m	2m	1	1	4	2a	2a	1	1	+	2a	1	+	1	2a	2a	2b	1	2a	2a	1	2a	1
Ipomoea coscinosperma	+	1	+	+	2a	1	–	–	–	–	+	+	+	–	–	–	–	–	–	2a	2a	r	–	–	–	–
Tephrosia uniflora	2a	+	+	1	–	+	–	–	–	–	–	1	r	–	1	–	–	–	+	+	–	–	–	–	+	–
Cleome scaposa	–	–	–	–	–	–	–	+	–	–	+	–	–	–	–	–	–	1	–	–	–	–	–	–	r	–
Monechma ciliatum	–	–	1	2m	–	–	–	–	–	–	–	2a	1	2a	2a	–	–	–	–	2a	–	–	–	–	–	–
DS of alliance:																										
Pandiaka angustifolia	2m	2b	3	2a	2a	2a	2a	2b	2a	+	2b	2b	1	2b	2a	2a	1	2a	2a	2b	2b	1	1	2a	3	1
Aristida funiculata	–	2b	2a	2a	2a	5	4	–	5	–	3	2a	–	2a	2a	–	–	–	3	–	1	–	2a	–	3	+
Pennisetum pedicellatum	–	+	–	3	+	–	1	–	–	–	–	2b	4	+	2b	4	+	–	3	–	–	4	3	4	1	4
DS of other units:																										
Enteropogon prieurii	+	–	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	–	–	–
Companions:																										
Alysicarpus ovalifolius	1	–	–	r	1	1	1	–	+	–	–	–	r	–	–	–	–	r	+	–	r	+	r	–	–	–
Zornia glochidiata	1	r	–	–	+	+	1	r	–	–	–	–	–	r	–	–	r	+	–	+	+	–	–	–	–	r
Boerhavia coccinea	1	1	–	–	–	–	–	–	+	1	–	–	–	–	–	–	+	–	–	–	–	–	r	r	–	–
Schoenefeldia gracilis	–	–	–	–	–	1	1	+	r	–	+	–	–	–	–	–	+	1	+	–	–	–	r	+	+	–
Tetrapogon cenchriformis	2a	2b	+	–	3	1	2a	2a	1	–	1	1	r	1	–	–	3	2a	–	–	–	–	–	–	–	–
Panicum laetum	+	r	+	2a	–	–	+	–	+	–	–	–	2a	1	–	–	1	–	–	1	–	–	–	–	–	–
Leptadenia hastata	–	–	–	2a	–	r	–	–	–	–	–	–	r	–	+	2a	–	–	–	–	+	r	–	+	–	2a
Corchorus tridens	–	+	–	–	r	+	–	+	–	–	–	+	r	r	–	–	–	–	–	r	–	r	–	–	–	–
Dactyloctenium aegyptium	+	+	–	–	1	+	2a	–	–	–	–	r	–	–	–	–	r	–	–	–	+	–	–	–	–	–
Indigofera aspera	+	–	–	+	–	r	r	–	–	–	–	–	+	–	r	–	–	–	–	–	–	–	–	r	–	–

	Cleomo viscosae-Brachiarietum latae																									
	Transition between typicum and aristidetosum adscensionis																*aristidetosum adscensionis*									
Ceratotheca sesamoides	–	–	–	–	2a	r	–	–	–	–	–	+	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Cassia obtusifolia	–	–	–	–	–	–	–	–	–	r	r	–	–	–	–	–	–	–	–	r	–	–	–	r	–	–
Cenchrus biflorus	2a	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Digitaria ciliaris	1	1	–	–	1	+	–	–	–	+	–	–	2a	–	–	–	–	–	–	–	–	–	–	–	+	–
Spermacoce chaetocephala	r	–	–	–	+	+	+	–	–	–	–	–	–	–	–	–	+	–	+	–	–	r	–	r	–	r
Cucumis melo	–	–	–	r	–	–	–	–	–	r	–	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Tribulus terrestris	r	+	–	–	–	–	–	–	–	2m	–	–	–	–	–	–	–	–	–	–	–	–	+	–	r	–
Tragus racemosus	+	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–
Pergularia tomentosa	2a	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	–
Achyranthes aspera	r	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
indet. No. H 917	–	–	–	–	–	–	–	–	–	–	–	+	r	r	–	–	–	–	–	+	–	–	–	–	–	–
Cienfuegosia digitata	r	–	–	–	–	–	–	–	r	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	–	–
Eragrostis cilianensis	–	+	–	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tephrosia lathyroides	–	–	–	r	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mollugo nudicaulis	–	–	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–
Pupalia lappacea	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Brachiaria ramosa	–	–	–	–	–	–	–	–	–	–	–	1	–	–	2a	–	–	–	–	3	–	–	–	–	–	–
Cassia nigricans	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	+	–	+	–	–	–	–	–	–
Phyllanthus maderaspatensis	–	–	–	–	–	–	–	–	–	–	–	r	–	–	+	–	–	–	–	–	–	–	–	–	–	–
Aspilia helianthoides	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	+	–
Panicum sp	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	1	–	–	–
Urochloa trichopus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–
Cucumis ficifolius	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	r	–	–	–	–
Eragrostis atrovirens	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	1	–	–	–

Appendix 6. – Association *Cleomo viscosae-Brachiarietum latae, sesametosum alati* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).
(Rare species: *Tragus racemosus* 1: r; *Panicum laetum* 3: +; *Cenchrus biflorus* 3: +; *Cucumis ficifolius* 3: r; *Mollugo nudicaulis* 4: r; *Merremia pinnata* 4: r; indet. No. H 621a 5: +; *Guiera senegalensis* 5: r; *Grewia tenax* 6: 3; *Cymbopogon* spec. No. H 620b 6: 3b; *Caralluma acutangula* 6: 2a; *Pterocarpus lucens* 6: 2a; *Aristida* sp. H 632d 7: 2m; *Pavonia triloba* 7: +; *Dalechampia scandens* 8: 2a; *Aspilia helianthoides* 8: 1; *Panicum* sp. 8: +; *Ipomoea* sp. 8: r; *Diheteropogon hagerupii* 8: 3; *Phyllanthus maderaspatensis* 8: r.)

	Cleomo viscosae-Brachiarietum latae sesametosum alati							
No	1	2	3	4	5	6	7	8
Field no	325	311	310	313	312	328	343	337
Plot size [m²]	12	15	14	15	15	10	12	13
Exposition	N	S	SW	NE	NE	N	NE	NE
Inclination [°]	20	8	7	20	10	11	17	21
Cover [%]	45	40	40	55	45	63	85	73
Vegetation height [cm]	20	40	30	40	30	130	90	150
Number of species	7	7	8	9	12	8	10	11
Shannon-Diversity	0.8	0.9	0.7	0.9	0.5	1.6	0.9	1.3
Evenness	42	48	35	40	20	76	41	56
Simpson	0.47	0.44	0.60	0.56	0.81	0.24	0.53	0.32
DS of the *Cleomo viscosae-Brachiarietum latae* und subunits:								
Cleome viscosa	r	–	r	+	+	–	r	–
Sesamum alatum	1	1	1	1	+	+	1	+
Cleome scaposa	r	+	–	–	1	–	+	–
Ipomoea coscinosperma	–	+	–	+	–	–	–	–
Tephrosia uniflora	–	–	–	–	–	+	+	–
Monechma ciliatum	–	–	–	–	–	–	+	2b
DS of alliance:								
Pandiaka angustifolia	3	2b	2a	2a	5	2b	2a	2a
Aristida funiculata	3	2b	3	3	2m	–	–	–
Pennisetum pedicellatum	–	–	–	–	1	1	3	–
Companions:								
Boerhavia coccinea	+	–	–	1	1	–	–	–
Zornia glochidiata	–	+	+	–	+	–	–	–
Tephrosia bracteolata	–	–	–	+	r	–	–	r
Caralluma adscendens	–	r	–	–	r	–	–	–
Cucumis melo	–	–	–	–	–	–	r	r

Appendix 7. – Association *Cleomo viscosae-Brachiarietum latae*, impoverished form without *Brachiaria lata* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).
(Rare species: *Eragrostis pilosa* 1: r; *Ipomoea coscinosperma* 1: r; *Urochloa trichopus* 2: 1; *Spermacoce chaetocephala* 2: 1; *Eragrostis atrovirens* 2: +; *Achyranthes aspera* 3: 1; *Cymbopogon* sp. No. H 620b 4: 2a; *Boscia senegalensis* 4: 2a; *Aristida stipoides* 5: +; *Acacia tortilis* subsp. *raddiana* 6: r; *Tephrosia uniflora* 8: 1; *Indigofera senegalensis* 8: r; *Aristida* sp. H 632d 8: 2a; *Cassia obtusifolia* 9: +; *Cienfuegosia digitata* 11: r.)

	Cleomo viscosae-Brachiarietum latae* impoverished form without *Brachiaria lata										
No	1	2	3	4	5	6	7	8	9	10	11
Field no	452	453	454	326	840	814	1030	344	1027	309	1033
Plot size [m²]	14	14	13	12	12	12	10	10	10	14	10
Exposition	SE	SSE	N	NNW	N	-	NE	NW	E	SW	SE
Inclination [°]	2	2	40	16	22	-	25	5	4	15	40
Cover [%]	65	35	70	75	35	60	100	80	62	30	15
Vegetation height [cm]	80	70	75	60	25	35	110	80	40	25	35
Number of species	11	13	11	8	7	10	7	11	12	7	6
Shannon-Diversity	1.02	1.75	1.41	1.01	0.47	1.22	0.55	1.25	1.05	0.74	0.93
Evenness	43	68	59	49	24	53	28	52	42	38	52
Simpson	0.47	0.21	0.33	0.52	0.80	0.37	0.75	0.40	0.52	0.59	0.52
DS of the *Cleomo viscosae-Brachiarietum latae* und subunits:											
Cleome viscosa	+	2a	1	1	+	+	+	r	–	–	–
Cleome scaposa	–	–	–	–	–	–	–	–	1	r	+
Monechma ciliatum	–	–	–	–	–	–	1	2b	–	–	–
DS of alliance:											
Pandiaka angustifolia	1	1	2m	4	3	–	1	1	1	2a	2a
Aristida funiculata	–	+	1	1	1	–	–	+	4	3	–
Pennisetum pedicellatum	4	2a	3	–	–	–	5	4	–	–	–
Companions:											
Boerhavia coccinea	1	r	r	–	–	–	–	–	1	–	–
Alysicarpus ovalifolius	r	–	–	–	–	2b	–	–	r	–	–
Panicum laetum	–	–	–	+	–	–	–	–	r	2m	–
Cenchrus biflorus	2a	–	–	–	–	2a	–	–	+	–	–
Tribulus terrestris	r	r	–	–	–	1	–	–	+	–	–
Aristida mutabilis	2b	1	–	–	–	3	–	–	–	–	–
Dalechampia scandens	–	+	2a	–	–	–	–	–	–	–	–
Mollugo nudicaulis	r	–	–	–	1	–	–	–	–	r	–
Pupalia lappacea	–	–	2b	–	–	–	2a	–	–	–	1
Panicum sp.	–	–	+	–	–	–	–	r	–	–	–
Schoenefeldia gracilis	–	r	–	–	–	–	–	–	2a	–	–
Tetrapogon cenchriformis	–	–	–	–	+	–	–	–	2a	–	1
Zornia glochidiata	–	–	–	–	r	+	–	–	–	+	–
Brachiaria orthostachys	–	–	–	–	–	–	+	–	–	–	+
Dactyloctenium aegyptium	–	–	–	–	–	1	–	+	–	–	–
Leptadenia hastata	–	–	–	–	–	–	+	2a	–	–	–

Appendix 8. – Association *Enteropogonetum prieurii* (DS: diagnostic species; symbols: cover-abundance classes according to BARKMAN & al. (1964).
(Rare species: seedling indet. 1: r; *Pennisetum pedicellatum* 2: r; *Liliaceae* No. H 901 2: r; *Brachiaria orthostachys* 5: r; *Pancratium trianthum* 6: +; *Aristida stipoides* 13: 2a; *Urochloa trichopus* 14: +; *Portulaca oleracea* 14: +; *Bulbostylis* sp. H 902 16: 2m; *Eragrostis tremula* 16: 1; *Cenchrus ciliaris* 16: +; *Cassia obtusifolia* 16: +; *Ceratotheca sesamoides* 16: +; *Cleome gynandra* 19: r; *Digitaria gayana* 21: +; *Cienfuegosia digitata* 21: r; indet. No. H 767 22: 2a; *Stylosantis erecta* 22: r; *Grewia tenax* 22: r; *Polygala* cf. *fernandesiana* 23: r.)

	Enteropogonetum prieurii																						
No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Field no	866	826	862	402	966	860	938	940	403	863	406	941	830	812	831	836	835	810	407	939	834	560	401
Plot size [m²]	11	10	10	10	9	12	10	10	10	12	10	10	11	10	12	12	12	10	10	10	12	5	10
Exposition	-	SEE	E	NE	-	-	E	E	-	-	SW	W	W	SWW	W	-	-	SW	-	N	SWW	W	SSW
Inclination [°]	-	2	1	5	-	-	4	20	-	-	5	8	4	2	4	-	-	4	-	8	5	25	5
Cover [%]	80	60	65	70	85	70	35	70	90	55	80	70	55	55	50	80	72	86	70	40	30	40	85
Vegetation height [cm]	35	30	50	60	40	30	40	25	25	35	30	25	40	20	40	60	30	20	80	25	30	40	30
Number of species	18	23	13	11	6	13	12	10	9	10	10	8	12	16	14	16	10	13	7	9	9	6	10
Shannon-Diversity	1.70	1.96	1.30	0.92	0.50	1.61	1.55	1.07	0.52	1.13	0.38	0.90	1.71	2.09	1.49	1.13	1.34	1.64	0.87	1.11	1.03	1.01	0.47
Evenness	59	63	51	38	28	63	62	46	24	49	17	43	69	76	57	41	58	64	44	51	47	56	20
Simpson	0.27	0.22	0.45	0.59	0.81	0.27	0.30	0.51	0.80	0.47	0.86	0.59	0.21	0.16	0.29	0.53	0.37	0.30	0.51	0.48	0.50	0.46	0.82
DS of the *Enteropogonetum prieurii*:																							
Enteropogon prieurii	2b	2a	2a	2a	2a	1	+	+	+	+	+	r	r	1	+	+	+	+	+	–	–	–	–
Tragus berteronianus	2a	2m	2m	2m	1	1	2b	2a	1	1	+	2m	r	–	–	r	–	–	–	2a	+	–	–
DS of alliance:																							
Aristida funiculata	4	3	4	4	5	3	2b	4	5	3	5	4	1	2m	1	–	–	–	–	3	3	2a	5
Pandiaka angustifolia	–	–	–	–	–	–	–	–	–	–	–	–	r	r	+	–	–	–	–	–	2a	3	–
DS of other units:																							
Aristida adscensionis	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–
Tree regeneration:																							
Acacia tortilis subsp. *raddiana*	+	–	+	–	–	+	–	–	–	r	–	–	–	–	+	–	–	–	–	–	–	–	–
Companions:																							
Zornia glochidiata	2m	1	1	+	2a	1	1	–	1	1	+	+	1	2m	2a	4	4	2b	r	–	2m	–	1
Alysicarpus ovalifolius	2a	1	2a	+	2a	2a	1	2a	1	2a	1	2a	2b	2a	3	1	2b	4	–	1	–	–	1
Dactyloctenium aegyptium	2b	2b	1	1	2b	2b	+	+	1	–	1	–	1	2a	+	1	1	2a	+	–	–	–	+
Tragus racemosus	1	1	1	1	–	1	+	1	–	1	+	1	–	2b	–	–	–	1	–	1	1	–	1
Tribulus terrestris	2m	1	1	1	+	2a	1	2m	1	2m	1	2m	–	1	–	+	–	2a	–	1	–	–	2m
Cenchrus biflorus	+	1	+	–	1	+	–	–	–	–	r	–	2b	2a	2b	2a	2a	2a	–	+	–	–	–
Digitaria ciliaris	1	+	+	–	1	–	–	–	–	–	–	–	2m	2m	2a	+	1	2m	2b	–	–	–	–
Tetrapogon cenchriformis	–	1	–	–	–	–	1	1	–	–	–	1	–	+	–	–	–	+	–	1	1	1	+
Boerhavia coccinea	r	r	–	+	r	r	1	+	+	–	–	–	–	–	–	–	–	–	–	+	–	–	r
Spermacoce chaetocephala	1	1	–	–	1	–	–	–	–	r	–	–	2b	–	2m	1	2a	–	–	–	–	–	–
Schoenefeldia gracilis	r	+	–	+	+	–	–	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r
Panicum laetum	–	2a	–	–	–	–	–	–	–	–	–	–	–	1	+	–	–	–	–	–	–	–	–
Gisekia pharnacioides	–	r	–	–	+	–	–	–	–	–	–	–	–	–	r	1	+	+	–	–	–	–	–
Aristida mutabilis	–	1	1	r	1	–	–	–	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–

	Enteropogonetum prieurii.																							
Bulbostylis barbata	–	–	–	–	–	–	–	–	–	–	–	–	–	1	r	–	2m	1	–	–	–	–	–	
Brachiaria xantholeuca	+	–	–	–	–	+	–	–	–	+	–	–	–	–	–	–	–	1	–	–	–	–	–	
Mollugo nudicaulis	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	1	–	–	+	–	–	
Euphorbia cf. forskalii	–	r	–	–	+	–	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Achyranthes aspera	+	–	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	
Corchorus tridens	r	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Indigofera aspera	–	+	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	–	–	–	–	
Limeum viscosum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	+	–	–	–	–	–	–	–	
Eragrostis pilosa	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	–	–	–	–	–	–	
Brachiaria ramosa	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	2a	–	–	–	–	