

The Vegetation of Lateritic Crusts in Northwestern Benin (Atakora Region)

Robert Sieglstetter, Rüdiger Wittig, Karen Hahn

Summary: Most of the grass savannas on lateritic crusts found in the North-Western of Benin are free of trees and a shrub layer is only sparsely developed. The only constant member of the shrub layer, is *Terminalia laxiflora*. Intermediate constancy show *Entada africana* and *Annona senegalensis*. With regard to the herbaceous layer two types can be identified: On very shallow soils (<2 cm) *Loudetia togoensis* is highly constant and often dominating. The same is true for *Andropogon pseudapricus* on soils of a little bit more than 2 cm. In those types, *Lepidagathis anobrya* and *Spermacoce filifolia* show very high constancy (constancy class V) and *Cyanotis lanata* and *Melliniella micrantha* occur with high constancy (IV).

Key words: *Andropogon pseudapricus*, *Cyanotis lanata*, grass savanna, hardpan, *Lepidagathis anobrya*, *Loudetia togoensis*, *Spermacoce filifolia*, Sudanian zone, *Terminalia laxiflora*, West-Africa

LA VÉGÉTATION DES CUIRASSES LATÉRIQUES AU NORD-OUEST DU BÉNIN (RÉGION ATAKORA)

Résumé: Les savanes herbeuses des cuirasses latéritiques du Nord-Ouest Bénin ne contiennent presque pas d'arbres mais seulement une strate arbustive très clairsemée. Dans cette strate *Terminalia laxiflora* est la seule espèce régulière. *Entada africana* et *Annona senegalensis* possèdent une présence moyenne constante. Concernant la composition floristique de la strate herbacée, on peut distinguer deux types différents. Si la couche de sol au-dessus de la cuirasse latéritique est faible (moins de 2 cm), l'aspect du groupement est dominé par *Loudetia togoensis*. Si la couche de sol devient plus épaisse (plus de 2 cm), *Andropogon pseudapricus* devient l'espèce dominante. *Lepidagathis anobrya* et *Spermacoce filifolia* ont une présence constamment très élevée dans les deux types; *Cyanotis lanata* et *Melliniella micrantha* ont une présence constamment élevée.

Mots clés: Afrique de l'Ouest, *Andropogon pseudapricus*, cuirasses latéritiques, *Cyanotis lanata*, *Lepidagathis anobrya*, *Loudetia togoensis*, savane herbeuse, *Spermacoce filifolia*, *Terminalia laxiflora*, zone soudanienne

DIE VEGETATION AUF LATERITKRUSTEN IM NORDWESTEN VON BENIN (REGION ATAKORA)

Zusammenfassung: Die Grassavannen auf Lateritkrusten im Nordwesten von Benin besitzen nahezu keine Baum- und nur eine äußerst gering entwickelte Strauchschicht. In dieser ist *Terminalia laxiflora* die einzige hochstete Art. Mittlere Stetigkeiten weisen *Entada africana* und *Annona senegalensis* auf. Bezüglich der Zusammensetzung der Krautschicht sind zwei Typen zu unterscheiden: Ist über der Lateritkruste ein nur sehr geringmächtiger Boden vorhanden, so wird der Aspekt der Gesellschaft von *Loudetia togoensis* bestimmt, ist der Boden etwas mächtiger, so ist *Andropogon pseudapricus* die wichtigste Art. In beiden Typen gemeinsam treten *Lepidagathis anobrya* und *Spermacoce filifolia* mit sehr hoher Stetigkeit sowie *Cyanotis lanata* und *Melliniella micrantha* mit hoher Stetigkeit auf.

Schlagworte: *Andropogon pseudapricus*, *Cyanotis lanata*, Grassavannen, Lateritkrusten, *Lepidagathis anobrya*, *Loudetia togoensis*, *Spermacoce filifolia*, Sudanzone, *Terminalia laxiflora*, Westafrika

1 INTRODUCTION

Only a few relevés of the vegetation on lateritic crusts in West Africa have been taken to date. Moreover, these have been published in PhD theses and are not easily accessible (NASI 1994, HAHN 1996, KÜPPERS 1996, SIEGLSTETTER 2002, KROHMER 2004). Therefore, this paper will present relevés taken on lateritic crusts in the region of Atakora (north-western Benin).

2 AREA OF INVESTIGATION

The study area is the territory of the Tipéti and Péperkou villages, situated in the Department of Atakora, in northwestern Benin. The climate of this area shows an annual alternation of dry and wet seasons. The wet season extends from the end of April through the end of October (or the first days of November), with 60% of the annual precipitation falling between July and September. The annual rainfall is approximately 1300 mm (MAURICE 1986, TENTE 2000). The highest

temperatures (up to 38° Celsius average monthly maximum) occur in March and April. December and January are the coldest months.

Phytogeographically, the area belongs to the Sudanian zone (WHITE 1983). Applying the criteria of GUINKO (1984) for the division of this zone into a northern and a southern part, our area belongs to the South Sudanian zone.

3 METHODS

The relevés were taken by the first author between September and the first days of December in the years 1999 to 2001 using the method of BRAUN-BLANQUET (1964). In accordance with HAHN (1996), KÜPPERS (1996), KROHMER, (2004) and SCHUMANN et al. (2010), the woody layer and the herbaceous layer were surveyed separately. For the woody layer, we used a relevé area of 900 m²; for the herbaceous layer, we used an area of 25 m². The woody layer was separated into the tree layer (higher than 5 m) and the shrub layer (below 5 m).

Nomenclature of species follows the "West African Plants Database" (<http://www.westafricanplants.senckenberg.de>) and the database of the "Conservatoire et Jardin botaniques & South African National Biodiversity Institute" (<http://www.ville-ge.ch/musinfo/bd/cjb/africa/index.php?langue=an>).

4 RESULTS

A woody layer is only very slightly developed on lateritic crusts (Table 1). In most cases (15 of our 17 relevés), only a

shrub layer exists. On average, the shrub layer covers 11% of the relevé area. The average number of woody species ranges between five and six. *Terminalia laxiflora* is the only species of the woody layer represented in nearly all relevés (constancy class V). Second in constancy are *Entada africana* and *Annona senegalensis* (III), followed by *Detarium microcarpum*, *Pteleopsis suberosa*, *Daniellia oliveri*, *Euphorbia unispina*, *Gardenia erubescens* and *Combretum fragrans* (II). All other woody species only reach constancy class I at their maximum.

Table 1: Relevés of the tree and shrub layer / relevés des strates ligneuses / Aufnahmen der Baum- und Strauchschicht

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Location	Pe	Pe	Pe	Pe	Ti	Pe	Pe	Ti	Ti	Pe	Pe	Pe	Pe	Ti	Ti	Pe	Pe
Day	22	26	16	27	10	19	19	18	15	27	26	21	11	29	8	23	21
Month	10	10	10	10	11	10	10	10	10	10	10	10	10	10	11	10	10
Year	01	99	00	99	99	01	01	01	00	99	99	00	00	00	99	00	00
Cover of the tree layer (%)	0	0	0	0	0	0	0	5	0	5	0	0	0	0	0	0	0
Height of the tree layer (m)	0	0	0	0	0	0	0	6	0	6	0	0	0	0	0	0	0
Species number (tree layer)	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
Cover of the Shrub layer (%)	20	10	30	10	10	5	10	10	5	15	10	5	5	10	20	10	5
Height of the shrub layer (m)	3	4	5	2,5	2	2	3	2	3	3	3	1,5	1	2	2	2	2
Species number (shrub layer)	8	5	10	7	3	5	5	7	1	7	5	4	2	7	9	5	4

Tree layer																		C (%)	CC	
<i>Entada africana</i>																		2a	6	+
<i>Lannea acida</i>																		1	6	+
<i>Terminalia laxiflora</i>																		1	6	+

Shrub layer																		C (%)	CC				
<i>Terminalia laxiflora</i>	2a	1	1	1	1	1	1	1	1	1	1	1	1	+	+	+	+	94	V				
<i>Entada africana</i>	1	1	1	+	+	+											+	+	+	+	59	III	
<i>Annona senegalensis</i>	1	+		+		+	+											+	+		1	47	III
<i>Detarium microcarpum</i>				+	1			+	+	+								29	II				
<i>Pteleopsis suberosa</i>				1			+	+								+	1		29	II			
<i>Euphorbia unispina</i>	1											+	+	+				24	II				
<i>Daniellia oliveri</i>				1							1								+	+		24	II
<i>Gardenia erubescens</i>					1				1								2b	1		24	II		
<i>Combretum fragrans</i>	+						+	1														18	I
<i>Nauclea latifolia</i>				+			+										+		18	I			
<i>Parinari curatellifolia</i>								+									+		+	18	I		
<i>Pterocarpus erinaceus</i>	+													+				12	I				
<i>Grewia mollis</i>				+							1										12	I	
<i>Hymenocardia acida</i>				2b								+									12	I	
<i>Vitellaria paradoxa</i>						+	1													12	I		
<i>Stereospermum kunthianum</i>									1								+			12	I		
<i>Crossopteryx febrifuga</i>													+	2b				12	I				
<i>Combretum collinum</i>	2a																	6	+				
<i>Lannea microcarpa</i>		1																6	+				
<i>Dichrostachys cinerea</i>				2a														6	+				
<i>Terminalia glaucescens</i>																2a	6	+					

Additionally with + in relevé No. 1: *Gardenia aqualla*; No. 2: *Sterculia setigera*; No. 3: *Allophylus africanus* and *Lannea acida*; No. 4: *Erythrina senegalensis* and *Securinega virosa*; No. 10: *Combretum nigricans*, *Cussonia bateri* and *Tricalysia chevalieri*; No. 11: *Parkia biglobosa*; No. 12: *Hexalobus monopetalus* and *Strychnos spinosa*; No. 15: *Sphenostylis schweinfurthii*

Abbreviations: C (%) = relative constancy; CC = constancy class; Pi = Pépékou; Ti = Tipéti

Two communities can be identified in the herbaceous layer (Table 2). Where the soil is extremely shallow, *Loudetia togoensis* dominates the community, where it is developed a little more remarkably, *Andropogon pseudapricus* is dominant.

5 DISCUSSION

A woody community, poor in species and more or less dominated by *Terminalia laxiflora*, also occurs in the Chaîne

de Gobnangou in Burkina Faso (KÜPPERS 1986). There, however, *Terminalia laxiflora* grows on sandstone soils. Consequently, the two *Terminalia laxiflora* communities are not similar throughout the species spectrum. According to THIES (1995), *Annona senegalensis*, one of the second most important species of in the community examined in the current study, is often found on sites that are regularly burned. In the Atakora region, lateritic crusts are the first to be burned because they become dry immediately at the end of the rainy season.

Table 2: Relevés of the herbaceous layer / relevés des la strate herbacée / Aufnahmen der Krautschicht

Relevé No.	1	2	3	4	5	6	7			8	9	10	11	12	13	14	15	16
Location	Ti	Ti	Ti	Ti	Pe	Pe	Pe			Pe	Pe	Ti	Pe	Pe	Ti	Ti	Pe	Ti
Day	18	18	29	15	21	11	11			22	5	18	5	5	13	13	23	8
Month	10	10	10	10	10	10	10			10	11	10	10	10	10	10	10	10
Year	01	01	00	00	00	00	00			01	01	01	01	01	00	00	00	01
Cover of the tree layer (%)	0	10	0	0	0	0	0			0	40	0	20	20	0	0	0	0
Cover of the shrub layer (%)	10	20	10	0	5	5	5			20	30	15	20	20	0	0	10	0
Cover of the herb layer (%)	70	70	60	60	40	30	30			80	70	70	70	70	30	30	40	20
Height of the herb layer (m)	1,5	1,5	2	1	1	1,5	1			1,5	2	2	1,5	2	1	1	0,5	0,5
Species number (herb layer)	14	26	15	14	16	15	12			26	26	27	11	21	18	12	19	27

Differential species of the <i>Andropogon pseudapricus</i> community	C (%)								CC	C (%)								CC			
<i>Andropogon pseudapricus</i>	2b	2a	2a	1	2a	+	+	100	V				1					+		22	II

Differential species of the *Loudetia togoensis* community

<i>Loudetia togoensis</i>										2a	2a	2a	2a	2a	2a	2a	2a	1		89	V
<i>Pandiaka heudelotii</i>										+	+	+	+	+				+	+	78	IV
<i>Polygala multiflora</i>										+	+	+	+		+					56	III
<i>Andropogon asciodis</i>										2b	2a	+			+	+				56	III
<i>Aspilia rudis</i>										+	+	1		+					+	56	III

Differential species of the vegetation on lateritic crusts

<i>Lepidagathis anobrya</i>	+	+	1	+	1	1	2a	100	V	1	+	+	+			1	2a	1	78	IV
<i>Spermacoce filifolia</i>	2a	2a	2a	1	1	+	+	100	V	1	+			1	1	1	2a	2a	78	IV
<i>Cyanotis lanata</i>		+	+		1	1	1	71	IV		+	+			+	+	1	+	67	IV
<i>Melliniella micrantha</i>		+	+		+	+		57	II	1		+		1		+	+	+	67	IV

Companions

<i>Schizachyrium ruderale</i>	2a			+	1	+	+	71	IV		+		1	2a		+	1		56	III
<i>Loudetiopsis kerstingii</i>		+	1				+	43	III	1	1		2a	2a	1			1	67	IV
<i>Rhytachne gracilis</i>		+	+	+	1			57	III			+			1	1	+	1	56	III
<i>Cassia mimosoides</i>	+	+	+					43	III		+	+		+		+	+		56	III
<i>Ctenium villosum</i>	1			1	+	1	+	71	IV								1	2a	22	II
<i>Hyparrhenia subplumosa</i>		3	2a					29	II	1		3	2a	2a				1	56	III
<i>Tephrosia pedicellata</i>	2b	2a				+		43	III		+	1			+		1		44	III
<i>Andropogon fastigiatus</i>						+	+	29	II	1				+	+		1		44	III
<i>Abildgaardia abortiva</i>	+	1			+			43	III	+		+						1	33	II
<i>Hibiscus asper</i>				1	+			29	II	+	+				+			+	44	III
<i>Michrocloa indica</i>					1	1	+	43	III				1		+			1	33	II
<i>Cochlospermum tinctorium</i>		1	+					29	II	1		+					+		33	II
<i>Ctenium elegans</i>		+				1	1	43	III			+					+		22	II
<i>Desmodium hirtum</i>					+			14	I	+				+		+		+	44	III

Relevé No.	1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16		
<i>Elionurus elegans</i>					+	+	+	43	III							1	+	22	II
<i>Andropogon gayanus</i>		+						14	I	1	+		1					33	III
<i>Indigofera geminata</i>			+			+	+	43	III	+								11	I
<i>Loudetia simplex</i>		+		4				29	II		1					+		22	II
<i>Scleria atrovirens</i>	1	1						29	II		+						+	22	II
<i>Urelytrum annum</i>	1	+						29	II	1	+							22	II
<i>Cochlospermum planchoni</i>				+				14	I			+	+					22	II
<i>Indigofera bracteolata</i>	1							14	I	1							+	22	II
<i>Macrotyloma biflorum</i>		+						14	I	+	+							22	II
<i>Monocymbium cerasiiforme</i>	1	+						29	II		1							11	I
<i>Basilicum polystachyon</i>										+	+	+						33	II
<i>Monechma ciliatum</i>										+		+	+					33	II
<i>Tephrosia flexuosa</i>											+			+	+			33	II
<i>Rhynchelytrum repens</i>														+	+		+	33	II
<i>Aeollanthus pubescens</i>			+		+			29	II										
<i>Chasmopodium caudatum</i>												+	+					22	II
<i>Bidens borianiana</i>				+				14	I					+				11	I
<i>Crotalaria leprieurii</i>											+						+	22	II
<i>Elymandra androphila</i>										1			2b					22	II
<i>Englerastrum gracillimum</i>										+			+					22	II
<i>Euclasta condylotricha</i>			+					14	I	+								11	I
<i>Euphorbia hyssopifolia</i>		+						14	I		+							11	I
<i>Hyparrhenia involucrata</i>						+	+	29	II										
<i>Micrageria filiformis</i>		+						14	I					+				11	I
<i>Neurotheca loeseloides</i>		1						14	I								+	11	I
<i>Orepethium spec.</i>														+	+			22	II
<i>Panicum brazzavillense</i>										+							+	22	II
<i>Tephrosia bracteolata</i>					+			14	I							+		11	I
<i>Polygala spec.</i>		+						14	I		+							11	I
<i>Andropogon schirensis</i>	1							14	I										
<i>Crotalaria microcarpa</i>		2a						14	I										
<i>Aspilia helianthoides</i>									1									11	I
<i>Rottboellia cochinchinensis</i>									1									11	I
<i>Pennisetum polystachion</i>										2a								11	I
<i>Indigofera dendroides</i>													1					11	I
<i>Genlisea africana</i>																	1	11	I
<i>Xyris straminea</i>																	1	11	I

Additionally with + in relevé No. 1: *Tephrosia platycarpa*; No. 2: *Schizachyrium brevifolium*, *S. nodulosum* and *Scleria sphaerocarpa*; No. 3: *Eriosema linifolium*, *Hypoestes aristata* and *Polygala arenaria*; No. 4: *Annona senegalensis* juv., *Entada africana* juv., *Hackelochloa granularis*, *Parinari curatellifolia* and *Terminalia avicennioides* juv.; No. 5: *Indigofera pulchra* and *Vigna nigrifolia*; No. 6: *Crotalaria macrocalyx*; No. 8: *Ceratolobos sesamoides*, *Setaria pumila*, *Tridax procumbens*, *Triumfetta pentandra*; No. 9: *Spermacoce stachydea*, *Rourea coccinea*, *Dioscorea togoensis*, *Euphorbia kouandenensis*, *Mitracarpus hirtus*, *Panicum hochstetteri* and *Trachypogon spicatus*; No. 10: *Spermacoce spermacocina*, *Kohautia tenuis*; No. 12: *Biophytum umbraculum*, *Wahlenbergia hirsuta* and *Panicum pansum*; No. 13: *Heliotropium strigosum* and *Pandiaka involucrata*; No. 15: *Heteropogon contortus* and *Chlorophytum spec.*; No. 16: *Aeschynomene lateritia*, *Cassia nigricans*, *Drosera indica*, *Panicum spec.* and *Tripogon minimus*

Abbreviations: C (%) = relative constancy; CC = constancy class; Pi = Péperkou; Ti = Tipéti

Lepidagathis anobrya was also identified by KÉRÉ (1998) as characteristic of flat soils on lateritic crusts in the area of Tenkodogo (Burkina Faso). HAHN-HADJALI (1998) describes a *Loudetia togoensis* community growing on lateritic crusts. Her relevés of this community, taken in the region of Fada n’Gourma and Pama (Burkina Faso), contain *Spermacoce filifolia* and *Melliniella micrantha*, both represented in our relevés with intermediate constancy. KÜP-

PERS (1996) reports a *Loudetia togoensis* community from flat soils of the Chaîne de Gobnangou (Burkina Faso) that also shows certain congruences with our community because *Cyanotis lanata* and *Spermacoce filifolia* are represented with intermediate constancy. *Loudetia togoensis*, *Cyanotis lanata* and *Spermacoce filifolia* are mentioned by ZWARG et al. (2012) as important species on lateritic crusts in and around the Burkina Faso portion of the W National Park.

In Mali (NASI 1994), *Lepidagathis anobrya*, *Loudetia togoensis* and *Spermacoce filifolia* are often found on lateritic crusts. Obviously, throughout the Sudanian zone of West Africa, lateritic crusts show a typical form of vegetation that deserves more attention.

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