Mapping of Ecological Land Units for Livestock Development in the Zone of "Mare d'Oursi", Burkina Faso

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1. Abstract

Natural resources in the Zone of "Mare d'Oursi", North East of Burkina, are under heavy anthropic influence, leading to continuous land degradation. To revert the trend and attain sustainable development, an Ecological Land Unit Map has been produced using satellite imagery, aerial photographs and data collected from literature and the field. Based on data gathered, recommendations have been made with an option for a low-level technology compatible with the technical know how of the populations in the Zone. Some of the measures are: reforestation with indigenous browse species, reseeding with local palatable grasses and other herbaceous species, improvement of soil moisture holding capacity, of soil fertility through crop association and chemical fertilizers, "improved forestry".

Key words: "Mare d'Oursi", Ecological Land Units, soils, vegetation, socio-ecological species groups, vegetation types, palatable plant species, livestock, grazing, degradation, low level technology.

2. Introduction

The "Mare d'Oursi" (Oursi Swamp) is located in the North-East of Burkina (Province Oudalan, Gorom-Gorom.) Covering about 1160km² (i.e 1157 km^2), the Zone is mainly a grazing area, periodically visited by semi-nomads and their livestock from Burkina and Mali, mostly during the dry season. The concentration of livestock in the Zone is usually very high, leading to overgrazing and heavy trampling of resources.

In 1988, CRTO[1] was contacted by FAO to carry out the mapping of the grazing resources. The ultimate objective of the Project was to develop the Area for grazing on a sustainable basis.

To achieve this objective, remote sensing techniques were used. Through the interpretation of SPOT imagery and aerial photographs, using topographic maps, geological and soil maps and with the support of field investigations, resources were inventoried and evaluated, leading to the production of an Ecological Land Unit Map.

Units of this Map were described and their areas estimated. Recommendations were made for their resources development and management.

[1] **Centre Régional de Télédetection à Ouagadougou (Ouagadougou, Burkina Faso)**

3. The Study Area

The Zone of “Mare d’ Oursi” is located between 14°32’ and 14°50’N and 0°16 and 0°41’W. The climate is the sahelian type with a very long dry season and a short rainy season (June/July to Sept)

The geological formations are of precambrian origin and comprise granites mainly and metamorphic and eroded volcano-sedimentary rocks. North of the Swamp proper, the precambrian basement is covered by quaternary dunes 20 to 50m high with fine quartzitic sand.

In the North of the Zone are found sand dune fields oriented East-West. In the South, are series of eroded hills. Locally, inselbergs are found.

The drainage network comprises mainly of drainages descending from the elevations in the South to the swamps of Oursi, Yomboli and Ganadaouri after going through the pediments. In this Zone, run-off water collects in internal depressions.

The soil types in the Zone are the following (Soil Survey Department, Burkina, 1981):

- lithosols on the lateritic hills in the South,
- regosols on the active sand dunes, North of “Mare d’Oursi”,
- poorly developed soils (with limited vertic alluvium content) in the drainage ways,
- vertisols in the South-West of the Swamp,
- isohumic soils found in most of the Zone,
- tropical ferruginous soils with mottles, especially in the East-Central and slightly in the West,
- hydromorphic soils in the swamps.

Livestock rearing, based on transhumance, is the main economic activity of the region. More than 80% of the surface area is rangeland.

Livestock is made up of rustic breeds comprising mainly the Bororo cattle breed and its hybrids, the Bali-Bali and Macina breeds of sheep and their hybrids, and the Sahel and the “Rousse de Maradi” breeds of goats - Camels and donkeys are common and are used as a means of transport.

Crop production is the traditional type and concerns mainly millet (*Pennisetum typhoides, v. americanum*) and sorghum (*Sorghum vulgare, v. bicolor*). Groundnuts are grown locally.

The physiognomy of the vegetation in the Zone is shrub steppe apart from that in the swamps where aquatic grasslands grow and in the drainageways where grass and shrub formations develop.

4. Materials and Methods

4.1 Materials and Data used

- a topographic basemap of Dori, 1:200,000 (1960),
- geological map of Rep. of Upper Volta, 1:1,000,000 (1976),
- geological map of Oudalan, 1:200,000 (1970),
- reconnaissance soil map of the Zone of “Mare d’Oursi,” 1:50,000,
- SPOT image, K.J. 55.321 (09-08-86),
- aerial photographs, IGB, 1:50,000(81-032B, Dori, 1981).

4.2 Preparation of the preliminary interpretation map:

- based on the Study Area delineated by the client on the topographic basemap, the Zone was demarcated on the satellite image and the corresponding aerial photographs were selected,
- a zoning was effected on the satellite image by delineating the main geomorphological units,
- an uncontrolled mosaic was prepared from the aerial photographs where these main units were also delineated on a transparent film,
- a general stereoscopic visualization of the photographs was made and the preliminary legend established,
- a stereoscopic interpretation was carried out of the aerial photographs based on the preliminary legend,
- establishment of a preliminary interpretation map and colouring for fieldwork,
- determination on the coloured preliminary map of sampling sites to be visited and of the route to be followed in the field.

4.3 Fieldwork

The fieldwork consisted of checking the accuracy of the units for which the interpretation was still doubtful and the collection of data on vegetation and the environment. The ITC-relevee Data Sheet (Veg. Survey) was used.

The sample area for herbaceous vegetation was 1m² and that for woody vegetation was 1 ha.

Thus, at each sampling point in the field, data were collected on geology, geomorphology, soils, vegetation, etc.

For vegetation, the Braun - Blanquet abundance-dominance scale was applied.

4.4 Preparation of the legend of the map

- based on their affinity, plant species were grouped into “sociological species groups” and relevees into “temporary vegetation types”,
- thereafter, the classification was fine-tuned and the groups described to finally arrive at socio-ecological species groups and vegetation types,

Socio-ecological species groups were used as characteristics of vegetation types, each vegetation type being characterized by a combination of a number of socio-ecological species groups.

Each vegetation type was named using the 2 woody species that characterize it best (e.g BrPl for *Bauhinia rufescens* and *Pterocarpus lucens*).

- after this classification, the classified sample sites were transferred on to the preliminary photo interpretation map,
- using a cross-table, preliminary interpretation units were cross-checked with the vegetation types for the production of the final map taking into account chorological aspects and field data,
- the final map was produced after re-interpretation of aerial photographs where necessary.

4.5 Final Map

The legend of the final map appears in Annex A.

The basemap used for the final map is a photographic enlargement of the 1:200,000 topographic map of Dori. The drainage network and place names of this map were used, whereas the location of some other habitats and the road network lifted were improved from the aerial photographs.

After re-interpretation of the aerial photographs, final map units were transferred on the basemap.

The final map is at the same scale as that of the aerial photographs. (1:50,000)

5. Results

5.1 Major geological and geomorphological units of the Study Area

Based on the geology and geomorphology, the Zone of “Mare d’ Oursi” can be subdivided into 5 major Units. These appear in Annex A.

5.2 Vegetation

Annex B (Fig 1) indicates the contribution of socio-ecological species groups in the different vegetation types.

It appears from the Figure that soil moisture is the most determining factor in the distribution of the vegetation in this semi-arid region. Favourable, in the swamps, soil moisture decreases continuously, becoming more and more a limiting factor across the drainage lines, the lateritic depressions, the pediments and the sand dune fields to the hills.

Each socio-ecological species group was described specifying its name, its species composition and its ecology.

All told, 75 plant species were listed and 12 socio-ecological species groups and 9 vegetation types were determined in the Study Area.

5.3 Final cartographic units

21 final cartographic units were delineated, based on all data collected and taking into account the final use (grazing) of the Map. Their full descriptions are given in Appendix A. Below some salient characteristics of the Zone are focused on:

- the Sand-dune fields cover the largest surface area of the Zone with 415.6km² (i.e 35.48% of Zone),
- they are followed by the Granitic formations with 391.25 km2 (i.e 33.82%),
- the Fluvio-alluvial unit and the Schist formations cover small size areas with respectively 93.9 and 52.43 km2 (i.e 8.12 and 4.53% of Zone),
- the Quartzitic sand formations cover a very limited area with 12 km2 (i.e 1.04% of Zone),
- portions of the Sand dune fields, of pediments of the Granitic formations, of Fluvio-alluvial unit are occupied by crop farming covering a total surface area of 19.77km^2 (i.e 17.01%) : 14.33% for dryland cultivation, 1.42% for wetland cultivation and 1.26% as follows.
- among the major units of the Zone, the Sand dune fields have the largest area of grazing land with 277.86 km2. A sizeable portion of these Dune fields is degraded or even barren (132.7 km^2, i.e 11.47% of Zone).

Vegetation in the Sand dunes grows on isohumic soils. It is composed of woody species such as *Acacia senegal*, *A. albida A.raddiana* and *A. seyal,* and mainly of annual grasses and leguminous species and other herbaceous species.

Common annual species are *Cenchrus biflorus*, *Eragrostis tremula*, *Aristida_mutabilis, Zornia glochidiata, Alysicarpus ovalifolius*,. These annuals are highly palatable and nutritious even when they are dry.

- on the Pediments, grazeable areas are very limited with only 68.62km2 (i.e 5.93%), a most important portion of these Pediments (278.24 km2) being in an advanced stage of degradation (i.e 24.05% of Zone)
- grazeable areas of the Fluvio-alluvial unit are found in the wadis of the Pediments (33.44 km2) and of the Sand dune fields (25.98 km²), on the borders of swamps (15.96 km2) and in the swamps with their aquatic grasslands (18.52 km2), that is respectively 2.89%, 2.25, 1.38 and 1.60% of the Zone.

In the swamps of Oursi, Yomboli and Ganadaouri, highly palatable perennial grass species develop on hydromorhphic soils and vertisols. Common species, there, are *Echinochloa stagnina, E.colona*. When allowed to grow, these perennials are highly productive.

- grazing land in the Lateritic pediplain covers 50.33 km 2 (i.e 4.35%).

On the Schist formations where poorly developed soils (with limited vertic alluvium content in the drainageways) are found, palatable browse species like *Pterocarpus lucens, Dichrostachys glomerata, Graewia bicolor, G.mollis, Dalbergia melanoxylon and A. seyal* grow. Around and inside the local Depressions of these Formations, other highly palatable browse species develop and remain green all year round: *Bauhinia rufescens. Piliostigma reticulatum, Combretum aculeatum.*

The local Depressions of the Schist formations is also the habitat of the perennial grass *Andropogon gayanus* and of other annual grass species such as *Brachiaria laeta, Panicum laetum, Chloris pilosa, Eragrostis pilosa, Pennisetum pedicellatum, Panicum anabaptistum.*

- like in the Sand dune fields and the Pediments, the Lateritic plain has degraded surface areas (2.10 km2, i.e 0.18% of Zone.) In these Units, degraded and barren surfaces occupy very important portions (413.12 km2, i.e 35.71% of Zone.) To these figures should be added those surface areas of hills and inselbergs with lithosols where vegetation has almost disappeared (56.39 km²).

6. A Development and Management Approach for the Zone of "Mare D' Oursi"

The salient characteristics above of the Study Area, and Annex A even more, show that the Zone of "Mare d'Oursi" is subject to heavy anthropic impact through man and his livestock. The ecosystem there is heavily affected.

To develop the Zone on a sustainable basis, drastic measures appear necessary. Below, recommendations are made as feasible and realistic as possible considering the physical data collected in this study, the condition of the Zone and the technical know-how of the local populations:

1. the Zone of "Mare d Oursi" must be closed to grazing temporarily for a period of about 3 years. The Zone should be allowed 'to rest' to enable reinvigorate its potential and resilience;

2. during that period (3 years), actions for the restoration and improvement of resources of the Zone must be carried out thoroughly. Measures recommended are: improvement of moisture holding capacity of soils, reseeding of palatable herbaceous species, protection and reforestation of browse species, improvement of soil fertility locally, planting of "improved forest";

3. in addition to the swamps in the central part and the North-East of the Zone where livestock have access to water, 2 boreholes should be drilled, more specifically in the South and the North-West;

4. intensive foodcrop production should be allowed to some extent in the Zone along with its development and management for livestock, the objective being to contribute to satisfying foodcrop needs of the local populations;

5. the Zone should be managed for sheep and cattle, with only a limited population of goats allowed because of the negative impact on vegetation of this latter livestock species;

6. upon arrival in the Zone each year (Oct/Nov), cull out those animals fit for slaughter and treck them down to slaughter houses of urban areas.

The other part of the herd (or flock) should be divided into 2 groups.

- G1: lactating/milking stock (plus calves or lambs) and pregnant stock,

- G2: the remaining part of the herd (or flock);

7. both groups G1 and G2 must graze under close herding at night with a moderate to light stocking rate - G1 should be complemented with livestock feed during the day after return from grazing grounds;

In the following, more specific proposals are made according to each of the 5 major Units of the Study Zone:

***Sand Dunes**

8. general reforestation with *A. albida, A. seyal, A.senegal* should be carried out. These species are highly proteinous and palatable to both sheep and cattle.

During the dry season, *A.albida* is green and its leaves and pods are nutritious to livestock. Moreover, concerning *A.senegal*, arabic gum can be extracted from the plant in the long term.

9. by mid-September to mid-October when the nutritive value of annuals is high, the common herbaceous species in the Sand dunes should be harvested and stored as hay for the critical period for livestock feeding, that is the dry season;

10. in the degraded and barren portions of the Sand dunes, pitting should be implemented and reseeding effected with the local palatable grasses and leguminous species;

11. for foodcrop production, favourable sites for millet are to be demarcated where this crop should be grown in association with groundnuts or local beans.

12. on less moist areas of the Sand dunes, *A. albida* should be planted in rows on the millet farms. In between the rows, millet should be grown;

The objective of these associations is to get a positive influence on soil fertility and consequently on millet production;

13. on millet farms, rotation of livestock campsites (kraals) should be effected during the stay of the animals in the Zone. This is to improve soil fertility.

In addition, appropriate chemical fertilizers should be applied on millet farms.

***Schist Formations**

14. there is need to protect and let browse species in the Schist formations develop to complement feeding during the critical period for livestock.

15. *Andropogon gayanus* and the common palatable annual grasses in the local Depressions should be grown intensively for he production of hay or silage for livestock feeding in the dry season;

16. campsites of livestock should be located close to local Depressions selected for hay or silage production to facilitate manuring.

17. on degraded portions of the Schist formations, pitting should be effected to improve soil moisture and the pits reseeded with *A.gayanus, B. laeta., P. laetum, C. pilosa and E. pilosa*

18. concerning foodcrops, some of the local Depressions should be earmarked for intensive production of sorghum and maize.

Manuring and appropriate chemical fertilizers should be applied.

***Fluvio-Alluvial Unit**

19. *E. stagnina and E. colona* should be sectioned into small pieces to be planted for reseeding the swamps.

Similar experiments have been undertaken in the Sahel region (e.g. Mali) with *E. stagnina*_and results revealed positive;

20. after harvest in Nov/Dec. the forage can be fed directly to livestock or left to dry for dry season feeding;

21. for farming, intensive cultivation of sorghum, maize and vegetable gardening should be developed on borders of the swamps.

Livestock manure and chemical fertilizers should be applied for the intensification;

22. portions of the swamps should be reserved for intensive production of rice.

Chemical fertilizers must be used to boost the production.

23. in addition, fish farming may be worth considering in the swamps.

***Granitic Formations and Quartzitic Sandstone Formations.**

24. these Units must be fenced out and protected to allow natural regeneration;

25. when browsing and grazing are feasible after regeneration, only very light stocking rate should be allowed;

26. on the pediments of these hilly areas where ferruginous tropical soils and vertic sub arid brown soils are found and where degradation has reached an advanced stage, based on the general condition of the terrain and the soils, pitting or contour furrowing must be implemented to improve soil moisture and for reseeding. Seeds of annual grass species like *P. laetum and B.laeta* should be selected for the regeneration.

27. on the lower pediments, sizeable portions of land should be earmarked for 'Improved forest" for the production of fuelwood and timber.

Species like *Azadirachta indica* and *Eucalyptus camadulensis* which are growing in the Zone should be planted and properly managed.

As general management policy, Authorities should enforce that:

28. after harvest, cereal stalks (millet, sorghum, maize, rice) are chopped into small pieces and mixed with leguminous hay (groundnuts, beans) and salt for stock feeding;

29. hay, cereal stalks or silage produced in the Zone are reserved for the critical period for livestock feeding, the dry season;

30. in addition, group G1 of the livestock is supplemented with cottonseed, a livestock feed largely produced in the Southern part of Burkina.

7. Conclusion

The present study has led to the production of an Ecological Land Unit Map of the Zone of "Mare d' Oursi" (about 1160km^2) from the interpretation of a SPOT image and aerial photographs (1:50,000) and from the use of existing data complemented with field data collection.

Five (5) major units were identified based on the geology and then subdivided according to the terrain morphology.

Data were thereafter collected on vegetation and the environment and analyzed, thus obtaining 12 socio-ecological species groups and 9 vegetation types for each of which a detailed description was given.

By integrating all data collected and taking into account the final use of the Map (rangeland development), 21 mapping units were delineated and fully described.

The results show that the Zone of "Mare d'Oursi" is heavily affected by the influence of man and his livestock.

From the results, it is clear that the Zone needs "rest" to recover and reinvigorate its potential. A period of 3 years has been recommended during which vigorous measures need be implemented: improvement of moisture holding capacity of soils through pitting and contour furrowing, reseeding of palatable herbaceous species, protection and reforestation of browse species, improvement of soil fertility, planting of "improved forest".

Considering the particular condition of each major Unit, specific development and management lines of actions have been recommended. The recommendations give preference to low level technology, which is, in reality, close to the technical know-how of the rural populations of the Zone.

Generally, the Sahel region appears to have a high recovery potential and often, after a few important rains, the land turns from yellow to green in a period of a few days or weeks.

It is therefore desired that the approach, herein recommended, will be tested and that the outcome will be positive. The ultimate hope behind the approach being to contribute to improving the living conditions of the populace in the Zone of "Mare d' Oursi" and elsewhere in the African region.

8. Annex A

8.1 Ecological Land Units of the Zone oF "Mare D'oursi"

A. Granitic formations

a. Granitic hills

* B1a:
  - area: 44.39km^2 (i.e. 3.84% of Zone),
  - about 90% barren land,
  - lithosols,
  - shrub steppe made of almost exclusively vegetation type Boscia angustifolia - Combretun glutinosum (Ba Cg, 100%)

b. Pediments

* Ga (superior and medium pediments):
  - area: 65.82km^2 (i.e. 5.69% of Zone)
  - tropical ferruginous soils with mottles and brown red soils, with wind, sheet and rill erosion features.
  - shrub to grass steppe made of veg. types Acacia raddiana - C.glutinosum (Ar Cg, 70%) and Pterocarpus lucens - Tribulus terrestris (Pl Tr, 30%)

* GD (GD and GN: degraded forms of Ga):
  - area: 212.38km^2 (i.e. 18.6% of Zone)
  - 60 - 70% barren; sheet, rill and wind erosion.

* GN (degraded form of Ga):
  - area: 30.91km^2 (i.e. 2.67% of Zone)
  - more than 80% barren,

* Gt (low pediment):
  - area: 2.80km^2 (i.e. 0.24% Zone)
  - shallow aeolian cover on pediment with termite mounds; sheet and wind erosion,
  - shrub and grass steppe made of veg. type P. lucens - T.terrestris (Pl Tt, 100%)

With highly palatable shrub species, such as P. lucens and Graewia bicolor, this Unit (Gt) can be a substantial protein source for livestock, if developed as a dry season grazing land.

* GtD (degraded form of Gt):
  - area: 34.95km^2 (i.e. 3.02% Zone)
  - 60 - 70% barren with a high development of rill erosion

B. Quatzitic sandstone formations

Quartzitic and/or lateritic hills

* B2a:
  - area: 12km2 (i.e. 1.03% Zone),
  - about 90% barren, lithosols,
  - shrub steppe with vegetation types B. angustifolia and C.glutinosum (Ba Cg)

C. Sand dune fields

a. Recent Dunes

* D.V. ("Dune Vive": Active Dune):
  - area: 3.50km^2 (i.e. 0.30% Zone).

* S1a:
  - area: 128.62km^2 (i.e. 11.12% Zone),
  - intradunal depressions (ϕ: 400-600m) with very dense thickets,
  - brown red soils with a lot of wind erosion.

This Unit, one of the largest of the grazeable areas should be managed with a moderate stocking rate because of the high risk of soil erosion there.

* S1aD (degraded form of S1a):
  - area 27.26km^2 (i.e. 2.36% Zone)

* S2a:
  - area: 58.6km^2 (i.e. 5.07% of Zone)
  - ancient sand dune with barren land locally; brown red soils with sheet erosion, but mainly wind erosion,
  - shrub steppe made of veg. types of Acacia seyal - Leptadenia pyrotechnica (As Lp, 50%) and A.raddiana - C.glutinosum (Ar Cg, 50%)

Like S1a, only a moderate stocking rate should be allowed on this Unit.

* S2aD (degraded form of S2a):
  - area: 96.58km^2 (i.e. 8.35% Zone),
  - wind and sheet erosion very important,
  - degraded shrub steppe.

* S2t:
  - area: 90.64km^2 (i.e. 7.83% Zone),
  - shallow aeolian cover in the Lateritic pediplain,
  - brown red soils with wind erosion and locally sheet erosion,
  - shrub steppe with "tiger bush" made of veg. types A.raddiana - C.glutinosum (Ar Cg, 100%)

* S2tD (degraded form of S2t):
  - area: 5.36km^2 (i.e. 0.46% Zone),

- 70 - 80% barren land with development of wind and sheet erosion

D. Schist formations

a) Lateritic depressions and/or pediplain

* Lt1:
  - area: 25.63km^2 (i.e. 2.22% Zone),
  - patches of barren land (40 - 80%) in between drainage ways,
  - brown vertic soils with wind, sheet and rill erosion,
  - "tiger bush" with grass and woody formations made of veg. types P. lucens - A. seyal (Pl As, 50%) and B. rufescens - P. lucens (Br Pl, 50%)

* Lt2: only the density of the vegetation cover makes the difference between Lt2 and Lt1, the latter being denser.
  - area: 24.70km^2 (i.e. 2.13% Zone)
  - patches of barren land (60.80% of Unit)

Cartographic units Lt1 and Lt2, where the woody species (veg. types P. lucens - A. seyal and B. rufescens - P. lucens) are highly palatable, should be developed as dry season grazing lands because of their high potential of protein feed content.

* LN (degraded form of Lt1 and Lt2):
  - area: 2.10 km^2 (i.e. 0.18% Zone),
  - more than 80% of barren land.

E. Fluvio-alluvial unit

a. Wadis and borders of drainages

* F1:
  - area: 33.44km^2 (i.e. 2.89% Zone)
  - drainages in the Pediments with cracking clay,
  - grass and woody formations made of vegetation types B. rufescens - P. lucens (Br Pl, 100%).

* F2:
  - area: 25.98km^2 (i.e. 2.25% Zone)
  - drainages in the Sand dune fields - Termite mounds and slight depressions are found locally; sheet and wind erosion
  - thickets, woody and grass formations made of veg. types Balanites aegyptiaca - A. seyal (Ba As, 50%) and B. rufescens - E. colona (Br Ec, 50%)

* F3:
  - area: 18.52km^2 (i.e. 1.59% Zone)
  - borders of swamps: hydromorphic soils,
  - woody and grass formations made of veg. types B. rufescens - C. aculeatum (Br Ca, 100%)

The floors of wadis and the borders of swamps where grow several forage shrubs species (veg. types B. rufescens - P. lucens, Balanites aegyptia C. aculeatum) should be developed as dry season grazing lands in view of improving livestock feeding during the dry season.

It is in these cartographic units that is developed wetland cultivation (e.g sorghum).

* M:

- area: 18.52km2 (i.e. 1.60% Zone),

swamps with aquatic grassland, the dominant species being Echinocloa stagnina, E. colona, Oryza longistaminata and Nymphea micrantha).

Agricultural land use

Portions of land occupied by crop farming in the relevant mapping units above have been mapped out and their surfaces estimated:

+ C (dryland cultivation: 165.78km^2, i.e. 14.33% Zone)
+ b (wetland cultivation: 16.43km^2, i.e. 1.42% Zone)
+ J (fallows: 14.56km^2, i.e. 1.26% Zone)

9. Annex B

Table 1. Diagramme indiquant la contribution des groupes socio-ecologiques des especes au sein des groupements vegetaux.(Diagram showing contribution of socio-ecological species groups within vegetation types)

	GroupementsVegetaux (Veg. Types)								
Groupes Socio- Ecologiques Des Especes (Socio-Ecological Species Groups)	**Ba Cg**	**Ar Cg**	**As Lp**	**Ba As**	**Pl Tt**	**Pl As**	**Br Pl**	**Br Ca**	**Br Ec**
1. Boscia angustifolia	▬								
2. Combre-tum glutinosum	▬	▬	▬	▬	▬	▬	▬	▬	
3. Acacia rad-diana	─	▬	▬	▬	▬	▬	▬	▬	▬
4. Leptadenia pyrotechnica	─	▬	▬	▬	▬			─	
5. Acacia senegal	─	┈	▬	▬	▬	▬			
Citrillus Colocynthis				▬					
7. Tribulus terrestris		┈			▬				
8. Pterocarpus lucens	┈		┈	─	▬	▬	▬		┈
9. Combretum aculeatum			─	▬	▬	▬	▬	▬	▬
10. Bauhinia rufescens				─			▬	▬	▬
11. Echino-chloa colona									▬
12. Echino-chloa stagnina									▪

▬ **On doit y retrouver la plupart des especes de ce groupe socio-ecologique. (Most species of this socio-ecological species group occur)**

─ **On y retrouve frequemment quelques especes de ce groupe socio-ecologique. (Some species of this socio-ecological species group often occur)**

┈ **On pourrait y retrouver quelques especes de ce groupe socio-ecologique. (Species of this socio-ecological species group might occur)**