

A Mapping Analysis to Explain Vegetation Evolution in Lake Débo and Walado Débo

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Abstract:

The evolution of the grasslands of Lake Débo and Walado Débo is in perpetual progression according to the hydrological cycles of high or low floods. Since 1969 the trend is towards the degradation of flooded grassland. The changes in floristic composition and the distribution in time and space have not yet been elucidated. The main objective of this study is to understand the evolution of plant formations as much as possible, through analysis of existing maps, in order to help decision-makers and the population in their plan for the sustainable management of the water resources of Lake Débo and Walado Débo. The method establishes a link between the hypotheses proposed by Jean Gallais regarding the evolution of the vegetation and the current situation of this vegetation, on the basis of mapping analysis and GPS surveys. The results of the mapping analysis corroborate a large part the hypotheses formulated in 1977 by J. Gallais on the evolution of plant formations. The useful information from this analysis is the destruction of vetiveraies. The vetiveraies were used as natural barriers to protect floodplains, ponds and the lake bed from erosion and silting. It is an environmental problem that can be remedied by regenerating.

Keywords —Mapping analysis, Lake Débo and Walado Débo, evolution of flooded vegetation, Restoring and managing natural resources, flooded pasture.

I. INTRODUCTION

The evolution of the grassland of Lake Débo and Walado Débo is in perpetual progression according to the hydrological cycles of strong or weak floods (Jean Gallais 1977). On this biological balance, interferes the exploitation of pastures by the cattle which, beyond a certain limit is a very active agent of degradation or floristic modification. Since 1969 he trend is towards the degradation of flooded grassland. A morpho-botanical map, was drawn up by ORSTOM (former name of IRD), to illustrate this evolution. From 2003 to 2006, the LaboSIG of the Faculty of Science and Technology (FST-USTTB) in partnership with “Association pour la Protection et la Sauvegarde du site RAMSAR du lac Débo and Débo et Walado Débo (APSLD)” carried out a series of studies on the water resources

of the site. A map of flooded vegetation was also drawn up. The changes in floristic composition and the distribution in time and space have not yet been elucidated. Some questions are being formulated. How to restore biodiversity and natural resources internationally important in Lake Débo and Walado Débo? But no less important, how to use natural resources in a sustainable way? In other words, how does the population use natural resources without destroying them? Scientific studies are a solution to these problems.

The main objective of this study is to understand the evolution of plant formations as much as possible, through analysis of existing maps, in order to help decision-makers and the population in their plan for the sustainable management of the water resources of Lake Débo and Walado Débo. The

study site is located in the Inner Delta of the River Niger in Mali.

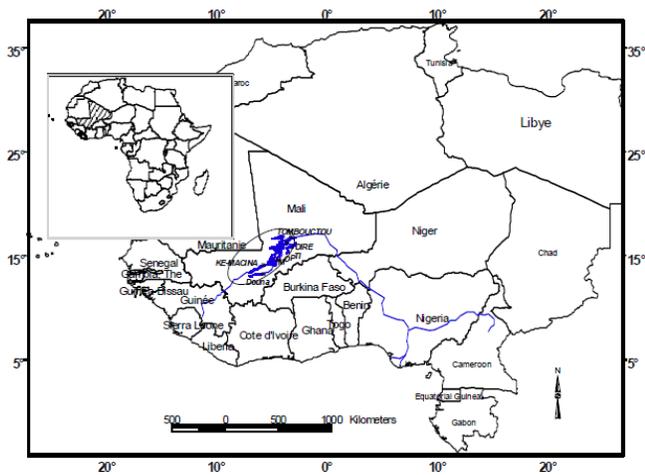


Fig.1: Study Site location

II. MATERIALS AND METHODS

Mainly, two maps were used in this study. The choice of these two maps to study the evolution of herbaceous vegetation of Lake Débo and Walado Débo is significant. These maps were constructed from information collected on a unique vegetation formation found in flooded plains from different periods and in the same site approximately. The first map, a scanned and unpublished one, gives a floristic analysis of the flooded plains of Lac Debo and Walado Debo from: 1904- 1952, 1952- 1960, 1960-1969 and 1969-1977, It was digitized under ArcGIS Desktop 2016. The second map made from vegetation data, GPS surveys are, for the most part, from our own study carried out between 2003 and 2006 and not yet published. Sampling was carried out in plots (30 / 50m) and materialized by GPS data all along our way between the villages of the site. The projection of the GPS data on each of the two maps makes it possible to know whether a particular floristic composition has changed or not in the flooded plain. The method establishes a link between the hypotheses proposed by Jean Gallais regarding the evolution of the vegetation and the current situation of this vegetation, on the basis of mapping analysis and GPS surveys.

III. RESULTS AND DISCUSSIONS

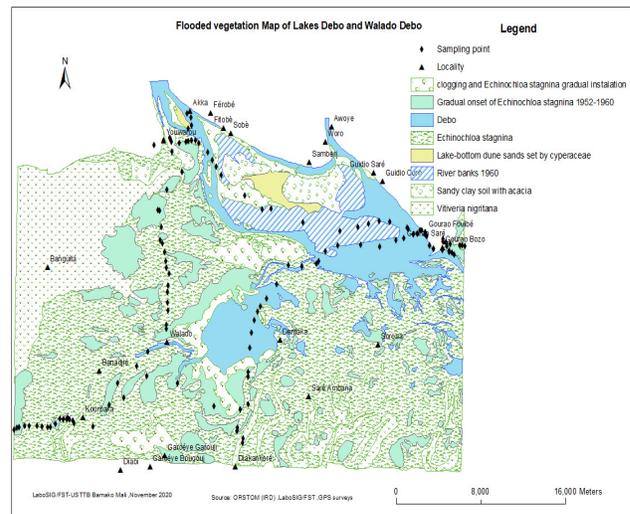


Fig.3 Morpho-botanical map 1977

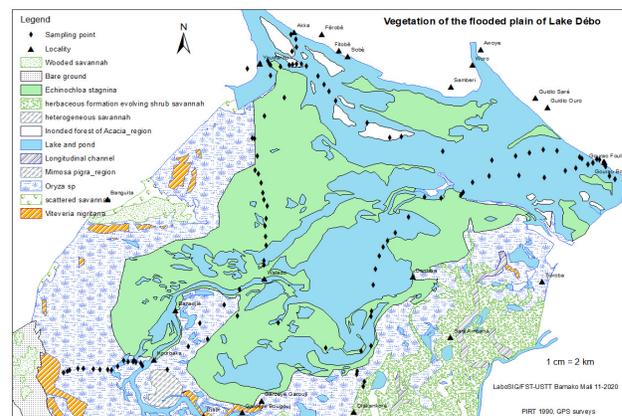


Fig.4 Vegetation map 2006

Lakebed morphology data are not used in this study. The analyses performed are based only on the flooded vegetation. The ORSTOM study site is more extensive from east to west than ours. We have defined the limits of the main plant formations with GPS between 2003 and 2006.

A first study of the contents of two maps reveals an almost clear disappearance of the vetiveraies (*Vetiveria nigritana*) in the western part of the flooded plains of the lake towards Banguita. The remains of degraded vetiveraies extending from

West and southwest. The area of the vetiveraies in the east of the lake is minimal to be mapped. The destruction of the vetiveraies, a natural belt protecting, has accentuated erosion and silting of the flooded plains in the west and southwest side.

The disappearance of the ponds in the same zone between Banguita and the lake can be explained by erosion and silting.

The ponds not far from the lake resisted and became a suitable habitat of *Echinochloa stagnina*. These analysis confirms the constants established by Jean Gallais who mentioned the progressive installation of *Echinochloa stagnina* in these ponds between 1952 and 1960. The quality of a pasture or bourgou (in local language) is considered to be better if the dominant species is *Echinochloa stagnina*.

The second map gives the approximate limits of bourgou dominated by: *Echinocloa stagnina*, *Oryza sp* (oryzaies), *Vetiveria nigriflora* (vetiveraies). The estimation of bourgou type degraded is not possible by use of the second map. Probably *Echinocloa sp*, has dominated the bourgou from 1904 to 1977. Nowadays, from the general point of view the vetiveraies have disappeared and with regression of the best bourgou. *Vicia cuspidata*, invasive species, is a closely related species to *Echinochloa stagnina* and becomes more and more dominant depending on the low water depth. *Vicia cuspidata* can be frequently found in the oryzaies (*Oryza barthii* and *longistaminata*). In the south of the site, we have delimited a zone invaded by *Mimosa pigra*. In order to stop this harmful species and without pastoral value. campaigns of its destruction have been organized with the assistance of NGOs.

The clogging carried out around the edges of the Walado to the south and north have developed best quality of bougou, with a covering > 95% (our own study). This evolution has been predicted by Jean Gallais: “clogging and *Echinochloa stagnina* gradual installation”.

“River banks 1960” and “Sandy clay soil with acacia” described by Jean Gallais ,are partially suitable for the installation of *Echinochloa stagnina* by planting or regeneration (own studie). With the help of NGOs, the regeneration of natural resources has become a reality. The bourgou (pasture) of

Gourao Peulh and Harima of Youwarou has been regenerated by planting *Echinochloa stagnina*. The flooded forest of Akka between Youwarou and Akka has been also regenerated in its former limits with *Acia Kiirki*.

IV. CONCLUSIONS

The first useful information from this analysis is the destruction of vetiveraies (*Vetiveria nigriflora*). The vetiveraies were used as natural barriers to protect floodplains, ponds and the lake bed from erosion and silting. The silting up of the plains disturbs the installation of bourgou and destroys the plant biodiversity consequently animal biodiversity. The degradation of vetiveraies is therefore an environmental problem that can be remedied by regeneration.

The second information is the disappearance of the ponds which are an integral part of the flooded pastures. Nowadays the restoration of ponds is reclaimed by the population.

With good rainfall from 2010 to 2020, a study is needed to see changes in vegetation dynamics..

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REFERENCES

- [1] F. Koné, *Etude des formations végétales inondées du site RAMSAR du Lac et Walado Debo au Mali*. Mémoire de fin d'études, FST-USTTB Bamako Mali, Décembre 2005, .
- [2] M. Gawler, B Bérédogo. *Evaluation finale, Projet d'appui à la gestion des zones humides dans le Delta Intérieur du fleuve Niger.* : UICN, Mali., 2002
- [3] A. Niaré, *Inventaire des superficies pastorales actuellement disponibles dans le Delta inondé, leurs potentialités fourragères, pour le développement du potentiel existant. Mémoire de fin d'études, IPR, Katibougou, , Mali. Décembre 1977*
- [4] C.H.Diakitè , M.F.Courel, M.A. Schilling , *Suivi de l'Ecosystème dans le Delta Intérieur du Niger (Mali)*. UICN, Gland, Suisse 2000.
- [5] J.Gallais, *Etude des anomalies de la crue du Niger*. ORSTOM Mali 1977
- [6] J.Gallais, *Le Delta intérieur du Niger - étude de géographie régionale*. Mémoires de l'LF.A.N. - 2 tomes