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Dynamics of floodable pastures in the Inner Niger Delta (IND). Case of grazing pastures in Burgu "*Echinochloa stagnina*" in the Mopti region of Mali

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Abstract

In Mali, plant cover has been undergoing changes for several decades due to climate change and human activity. This study contributes to a better knowledge of the floodable pastures and their dynamics in the DIN in Mali. The approach was based on a combination of field data from surveys and satellite images. The study was carried out on a sample of pastures from the list of pastures of all managers, listed at the commune level. According to the survey, 99% of pastoralists have reduced their area due to agricultural practices and 10% to climate change factors. Twenty-three percent (23%) of pastoralists observed changes during transhumance; Burgu is the dominant pasture grass. There are three types of management besides that of the *Dioros* (Traditional Pasture Managers in the DIN), one distinguishes those of the village chiefs and the management committees. For a better management of Burgu fields, it is necessary to invest more in the development of pastoral perimeters, and in the sensitization of farmers, private operators and *Dioros* for a greater awareness of the degradation of this heritage and the need for its sustainable management.

Keywords: Floodable pastures, Burgu, *Dioros*, sustainable managemen

Introduction

Mali is a continental country located in West Africa with an area of 1,241,000 km² and a population of 19,121,064 inhabitants (INSTAT, 2017). Agropastoral country, Mali has cropland and grazing land covering about 64% of the national territory. The livestock supply is provided mainly by natural pastures. Livestock contributes 10% of the GDP (Gross Domestic Product) and 80% of the income of the populations of pastoral areas. It accounts for 15 to 20% of average export earnings per year and ranks third after gold and cotton (INSTAT, 2015). Herds are composed of cattle, sheep, goats, camels, insects and horses, mixed or not. In 2016, the national herd population was estimated at 10,941,400 cattle, 15,900,500 sheep and 22,141,650 goats (DNPIA, 2016).

The Inner Niger Delta (IND) located in the center of Mali, mainly in the administrative territories of the Mopti, Segou and Timbuktu regions, is essential for the sustainability of the livestock system in the Sahel. Its position in the region makes it an area of high biological diversity. The DIN is a humid ecological ensemble located in a Sahelian context. This region contains many lakes forming the lacustrine zone. The soils are mostly slightly deep sandy in the deltaic zone with average natural fertility. The DIN has been recognized as a Ramsar site since 1 February 2004. The DIN is an alluvial plain and is the largest continental wetland in West Africa. At the African level, it is ranked second after Okawango in Botswana (WI 2012). The DIN is the 4th Ramsar site in the world (WI, 2012). Through a study, Hiernaux (1982) has identified 450 plant species with their ecological distribution in the DIN, and think that this cannot be fundamentally changed in so few years. Marie (2002) has inventoried 120 species that include 27 elemental associations on a total surface area of 22,262 km² in the DIN, of which Burgu, most often accompanied by wild rice and the vetiveraies Burgu, are the most important.

The Mopti region remains the largest cattle producing region (with 26%) followed by the Sikasso region with 20% of the cattle population. Livestock in the Mopti region was estimated in 2016 to 3,063,600 cattle, 2,932,000 sheep and goats 4226800 after Gao (DNPIA, 2016).

The main problems or constraints are: climate change and human action, a population increase which induces an increased need for food production, leading to an expansion of land under cultivation. The objective of this study is to contribute to a better knowledge of floodable pastures and their dynamics in the Inner Niger Delta.

Material and methods

This study was carried out in 2018 in the Youwarou rural district at the heart of the DIN. The rural commune of Youwarou is located between: Latitudes: 15 ° 36'84 " and 15 ° 22'6 " North and Longitudes: 4 ° 26'28 " and 4 ° 15'46 " West. The commune of Youwarou is one of the seven communes of the circle of the same name.

It is located north of the urban community of Mopti. It is bounded on the north by the rural commune of Soumpi (circle of Niafunké), on the south by the rural communes of Deboye and Bimbéré Tama, on the east by the rural communes of Deboye and Dirma and on the west by the commune of Farimaké.

The rural commune of Youwarou has 23,046 inhabitants (INSTAT, 2016) with a total of 4,366 households made up of Fulani (pastoralists), Bozos and Somonos (fishermen), Sonrai.

Each household consists of 5.2 persons with a rate of 48% men and 52% women. The municipality is located in the center of the DIN and is one of the last grazing areas after the exhaustion of fodder in many sites. The main activity in the rural commune of Youwarou is pastoralism.

The relief is flat overall with some elevations consisting of dunes and mounds whose heights are hardly more than 200 m. The climate is characterized by an arid and semi-arid regime. There is a rainy season and a dry season. The rainy season runs from June to September while the dry season starts in October and finishes in May. Rainfall varies between 200-600 mm per year and is unevenly distributed. The average daily thermal amplitude varies with minimum and maximum respectively 22 ° C (January) and 33 ° C (May). Two winds blow there: the monsoon from July to October which brings the rain and the harmattan from November to May which is a hot and dry wind.

The vegetation is steppe type of wood and herbs. The composition of the vegetation varies according to the topo-sequences: in the low-lying flood zones, one mainly encounters stands of Acacia (nilotica, seyal, Senegal, albida,), Balanites aegyptiaca and Borassus flabellifer. On exposed areas (light soils), Diospiros mespiliformis and Borassus flabellifer are mainly found. These formations are associated with a grass cover dominated by: Leptadonia pyrotechnica, Cenchrus biflorus, Echenicloa stagnina, Echenicloa colona, and Panicum Panicum laetum anabaptestum. The town has two classified forests: Youwarou (646 ha), the vegetation is dominated by Diospiros mespiliformis, Jujufus mauritiana, Acacia sp) and Enguem (2350 ha) with vegetation dominated Diospiros mespiliformis. Actions to regenerate the pastures of Echinochloa stagnina (Burgutière) and vetiveraies (Vetiveria nigritana), and the destruction of Mimosa pigra were undertaken by Youwarou populations in collaboration with IUCN (IUCN, 2002).

There are large areas of floodplains and ponds, the commune is watered by the Niger River, the Diaka arm and the lakes Debo (100 km²) and Oualadou (120 km²) which extend their waters on more than half of the local area during the flood. At these lakes, channels should be added to feed several pools indoors. Most of the water resources come from groundwater.

Agriculture, intensive livestock farming, small livestock (poultry, small ruminants), fishing, tourism and the sale of forest products are the main sources of income for the populations. The main crops are rice, millet and wheat. Vegetable crops (cabbage, peppers, eggplant, tomatoes, etc.) are practiced along the river. The local economy is essentially based on the sale of agricultural products, milk and fresh fish, smoked and fried and some forest products.

The methodology used consisted of the following steps:

- a documentary review that has collected data on pastures, the impact of pastoralism, the organization and management of pastoral areas, particularly the Burgu land;
- Cartographic analyzes of the dynamics of bougou land from Landsat images obtained at the AGRHYMET center were interpreted to evaluate the biomass from the calculation of DMP (Dry Matter Productivity). The maps of biomasses obtained were interpreted according to the rainfall and the flood of the river;

- direct observations of the environment in which the pastures are found and the management method of the different actors (managers);
- fact sheets and the interview guide were developed, tested and corrected. Three types of surveys were conducted during this study:
- interviews with target groups were organized with the aim of collecting global information on the study area in relation to the sections of the interview guide. In this study the focus groups were organized in the villages where there is a Burgu land. A map was produced with the help of all the Youwarou village chiefs and presidents of the village agriculture chambers. The choice of villages surveyed was made in a reasoned way. The number of pastoralists surveyed was obtained according to the criterion of possession of a herd equal to or greater than 50 heads of cattle called a "stick";
    - individual interviews with livestock farmers was carry out on the socio-demographic and socio-economic characteristics of households, the pastoral resources, the land management, the perception of climate change and adaptation strategies, the mode of management of the Burgu land;
    - talks with the administration through the governorate of Mopti and the Prefecture Youwarou relocated to Mopti and technical services from an interview guide;
- data collection sheets "points quadra aligned" of Daguet and Poissonet (1971), and Biomass yield squares were also used and GPS (Global Positioning System) was used to evaluate the biomass.

During this study, average water levels of the Niger River and rainfall were obtained at the Regional Directions of Hydraulics and Meteorology of Mopti. The data on the total population of pastoralists were obtained from the Regional Chamber of Agriculture (CRA) called 'the farmer's house'. The data of livestock farmers were obtained from the Regional Chamber of Agriculture (CRA) called 'the farmer's house'. These data were collected at the Regional Directorate of Industrial and Animal Productions (DRPIA) of Mopti. Thus, the total number of pastoralists is estimated at 2363.

The size of the sample was determined according to the formula of Solvin: n = N / 1 + Ne2

N = 2363 livestock farmers the margin of error was set at 10% given the limited means, the difficult access to certain villages, the constraints related to time and insecurity.

n = sample size. We obtain the size of the sample n = 96 livestock farmers that we rounded to 100 (Table 1).

Table 1: Selected villages and sample distribution

N°	Village	Population			Households	Latitude	Longitude	Sample
		Men	Women	Total				
1	Aouré	637	648	1 285	397	4°18'27'W	15°31'10''N	7
2	Banquita	270	267	537	225	4°21'07'W	15°17'05''N	5
3	Enguem	502	538	1 040	59	4°17'10'W	15°28'34''N	6
4	Fafou	190	202	392	157	4°21'02'W	15°28'01''N	5
5	Oualadou	1 058	1 009	2 067	275	4°15'09'W	15°14'00''N	5
6	Ouanam	344	435	779	67	4°19'16'W	15°33'30''N	5
7	Pirso	149	132	281	45	4°24'16'W	15°29'30''N	6
8	Sakamara	81	94	175	56	4°23'23'W	15°33'23''N	3
9	Youwarou	4 027	4 665	8 692	8 997	4°15'09'W	15°14'00''N	58
10	Tiadal Pourry					4°26'07'W	53°75'07''N	
	TOTAL	**8 390**	**8 890**	**17 229**	**4 111**			**100**

Analysis and data processing

For analysis and data processing, several tools were used:

- SPSS software was used for survey data analysis and chart and figure development;
- Remote sensing has resulted in satellite imagery; DMP images from the PROBA-V satellite;
- ARCGIS software enabled the development of maps;
- Microsoft Word has been used for word processing.

Results

Socio-economic characteristics of the population

They concerned the age groups, the locality of origin, the origin, the ethnic groups, the level of education and the activities practiced. The analysis of the results of the study shows that: 27% are between 41 and 50 years old, 22% between 51 and 60 years old, 17% between 61 and 70 years old, 16% between 31 and 40 years old, 16% between 20 and 30 years and 2% are over 70 years old (Figure 1). The 98% of pastoralists surveyed come from the Mopti region and the rest are from Timbuktu and Gao regions. The majority of the livestock farmers surveyed come from Youwarou-Ouro

(36%), Homboloré (22%) and the rest is divided between Aouré, Fafou, Pirso, Ouanam, Enquem, Oualado and Sakamara. In term of ethenic, 48% livestock farmers of are Peulhs, and the rest are Tamasheqs (23%), Bambara / Malinke (10%), Bozos (10%), Sonrais (8%), and Arab (1%). 44% of livestock farmers are illiterate, 35% have gone to Koranic education and only 8% have reached primary level and 8% are literate in the local language. Livestock is the main activity practiced (90%), followed by fishing (4%), agriculture (3%), trade (2%) and others made up of artisans and civil servants, (1%) .

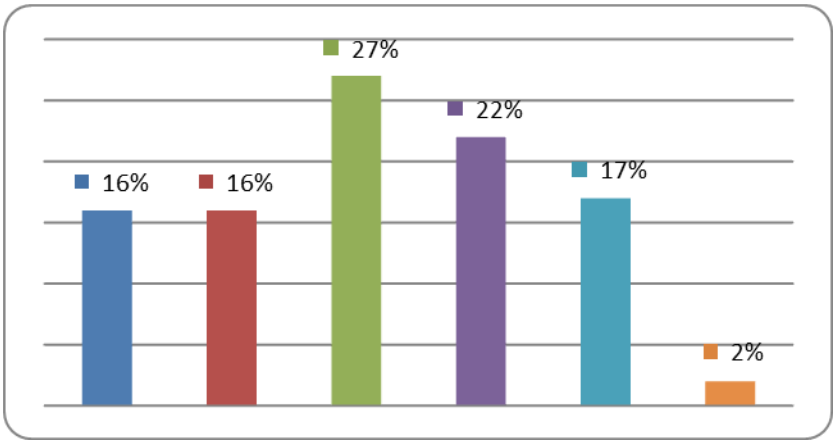


Figure 1: Distribution of surveyed populations by age group

Characteristics of the Burgu land of Youwarou commune

The Burgu land were characterized according to their mode of management and importance (Table 2). the characteristics are limited to access to water points, Burgu land, crop residues and various foods. Thus, the results of the study revealed that 99% of pastoralists have free access to water, 98% have paid access to Burgu pastures, 11% have access to crop residues and 56% of respondents have access to water. mainly used Burgu as a feed source for their animals, rice straw (12%), and the rest is composed of rice bran, livestock feed, crop residues, bush woody fodder.

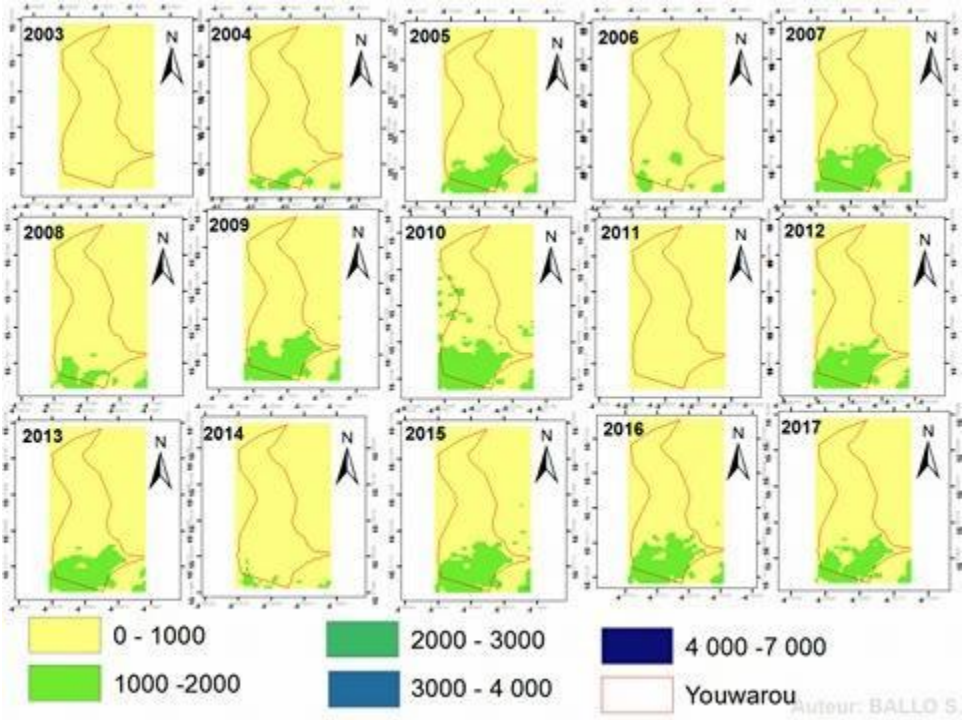
Table 2: Classification of Burgu land and management method

N°	Locality/village	Area (ha)	Mode de gestion	Remarks
1	Youwarou	180 à 200	*Dioro*	Pastures managed by the Dioros are the most important
2	Oualado	150 000	*Dioro*	
3	Tiada Pourry	100	COGES	Pastures managed by a local committee
4	Ouanam	≤ 50	*Amiri*	Pastures managed by the village chief
5	Aouré	≤ 50	*Amiri*	
6	Pirso	≤ 50	*Amiri*	
7	Sakamara	≤ 50	*Amiri*	
8	Banquita	≤ 50	*Amiri*	
9	Enquen	≤ 50	*Amiri*	
10	Fafou	≤ 50	*Amiri*	

Dynamics of the Burgu land

The study reveals that 99% of livestock farmers surveyed said that areas were reduced. Using remote sensing, maps of the state of the Burgu land were carried out over a series of 15 years (2003-2017) to see the variability of the biomass in the Burgu land of the rural municipality during the same period (last decade of 'October). In 2006 and 2009 there is little biomass while in 2010 biomass was abundant. The years of greatest biomass production are 2010, 2012 with respectively (867.8 and 690.4 kg.MS / ha) and the years of lower productions, 2008 (86.14 kg.MS / ha) and 2014 (58.51 kg.MS / ha). In the case of the decade of October 2003 and 2011, we could not have information from the database that was available to us.

The map made it possible to calculate biomass values. After analysis of the table, the following classification was made according to the amount of biomass DMP (Dry Matter Productivity).



Map 1: Production of biomass in kg.MS/ha in the rural commune of Youwarou

The DMP images come from the PROBA-V satellite. The calculation is made from the production of potential biomass DMP series of images of the last ten days of October with the SPIRITS software and Landsat.
Here the biomass is all organic matter (Burgu associated with crop residues etc)

- High or abundant biomass with rainfall ∫≥800∫ a good pastoral year (2010) therefore a correlation between the average rainfall, the flood and the abundance of pastures.
- Average biomass with a rainfall of between ∫100-600∫ average pastoral year (2007, 2009, 2012, 2013, 2015, 2016, 2017) correlated with heights and average rainfall.
- Low biomass with a rainfall ∫≤100∫ a bad pastoral year (2006, 2008, 2014) correlated with heights and average rainfall.

This allows us to confirm a correlation between the production of biomass above the water level and rainfall. The biomass production of 2003 and 2017 in the third decade of October is shown in Figure 2. It can be seen that in the years 2009 and 2011, average rainfall and the quantity of biomass decreased. The years 2010 and 2012 were marked by an increase in rainfall and the amount of biomass. Overall, the same trends are observed (Figure 2).

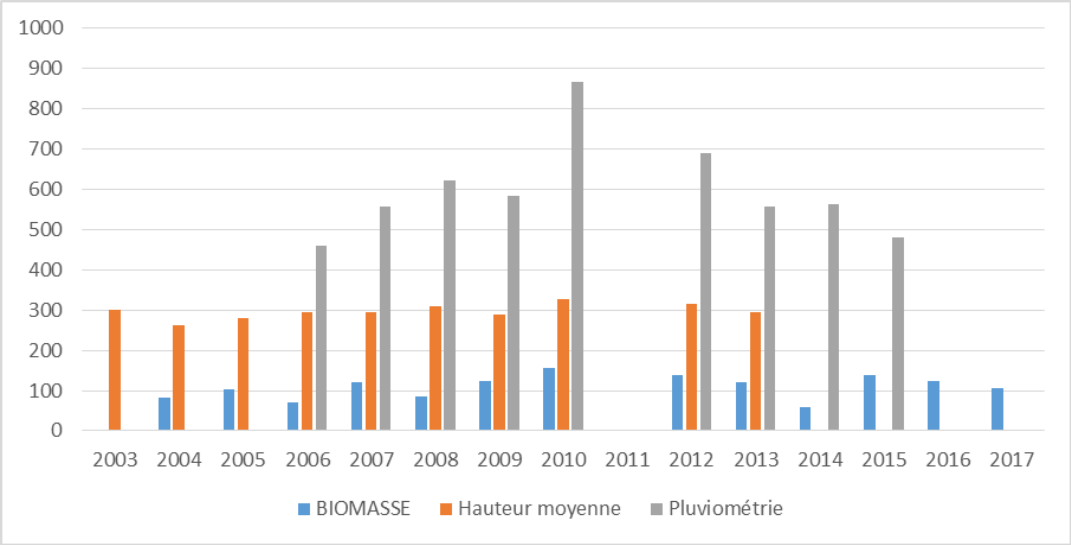


Figure 2: Correlation between biomass, water level and rainfall

Degradation factors of Burgu land and impacts

Agriculture is the main factor of degradation of Burgu land (90%), followed by overgrazing (5%), floods (4%) and drought (1%). These factors are Village Irrigated Perimeters (PIV) and fire practices. Thus, agricultural development is a major consumer of pastoral space (90%). The results of the study show that 78% of surveyed households do not practice bushfires. The remaining 22% practice bushfires with the intention of facilitating the regeneration of the Burgu land in 68% of the cases and for the improvement of the quality of the Burgu in 32% of the cases. The 85% of the respondents do not adopt the installation of a firewall device. The results of the survey show that 97% of respondents believe that overlapping of the highest rainfall are observed in August, 85% think that there is more flooding in August and 83% think that the rains are more and more intense. Also, 88% of the respondents maintain that there are more dry sequences and 92% think that these dry sequences are longer and longer.

The impacts are: the impoverishment of farmers, deteriorating terms of trade, declining values of solidarity and the reduction of pastoral resources. The 50% of the pastoralists are poor, 47% have seen a deterioration of the terms of trade and 4% believe that there is a decline in the terms of trade. In addition, 97% of respondents believe that there is a weakening of animals due to the reduction of pastoral resources.

According to the results of the study, 68% of respondents believe that the pasture causes the decline in the amount of Burgu; 25% estimate that the pasture leads to a decline in the quality of Burgu and 80% say that small ruminants are the first to enter Burgu lands.

In relation to the conflicts, it was revealed that 80% of the conflicts around the Burgu lands and the water points in Youwarou commune are due to the non-payment of the tax fixed by the *Dioro*, 12% are due to the political rivalries and only 4% to the extension of cultivated land. The analysis of the results shows that 95% of the diseases are infectious and parasitic. In addition, according to the perception of pastoralists, 72% estimated that there is the appearance of new diseases and 93% of the pastors surveyed attributed the mortality of animals to telluric diseases.

Improvement options

Many farmers in the area practiced forage cultivation (74%), fodder conservation mainly concerned Burgu (53%), crop residues (28%), and straw (19%). Ninety percent (90%) of livestock farmers estimated that transhumance improved pasture and 96% thought that this transhumance activity favored the introduction of new species.

The herds are mainly composed of cattle (55%). Sheep represent 25% goats (19%), the rest are camelids and equines (1%). 60% of the pastors make the fragmentation of the herd between several shepherds like Innovations in the practices of transhumance. The intervention of the partners is constituted of the State and the NGOs (98%).48% of the livestock farmers stated that the opening and the exploitation of the controlled areas are done in dry season. The mowing is practiced by 50% of breeders at any time during the current season, 37% in the middle of the rainy season and 13% at the end of the rainy season. 23% of farmers observed changes in the transhumance departure period (early or late depending on the availability of biomass during the year).

Pastoralists in the area have developed several adaptation strategies depending on the circumstances, which may be due to climate (drought, flood), pathologies or pasture degradation. Thus, in case of drought, 90% of respondents choose transhumance as an adaptation strategy, compared with only 5% for business diversification, 4% diversify activities and 1% destocking. In case of flood, displacement is the only option for all pastoralists (100%).

With regard to the occurrence of pathologies, 42% of pastoralists surveyed proceed to vaccination and displacement, while 39% are content with displacement only and 19% stick to the vaccination of their animals. The 52% of the surveyed mowed and the conservation of the Burgu in the event of degradation of the pastoral resources, 43% make the forage crops, 3% constituted by the residues of harvest, of the ligneous fodder, of the sounds of rice and food livestock and 2% of SPAI (agro-industrial by-products). In addition, 26% made the practice of forage crops.

The results of the survey showed that more than 51% of livestock farmers belong to a professional organization that is made up of 78% of cooperative societies, 10% of associations, 8% of unions and 4% of federations. The 57% of the respondents practice the rotation of pastures, 4% put in defense, no Assisted Natural Regeneration (RNA) and 39% take no action. The 45% of the farmers asked for the security of the herds, 35% think that it would be necessary to review the management by the *Dioro*, 4% ask for support in cattle feed and the other 4% ask for support in veterinary products.

Discussion

Livestock is the dominant activity in this locality. The haven of grazing and water that possess the DIN in the Sahelian atmosphere of the region attracted, more and more, a large number of herds sometimes coming from distant regions, upsetting, among others, habits and the land regulations that have governed the area until then (Cissé, 1981). The Pastures have been defined according to the type and management mode. The management of the *Dioro* overrides the other two namely the village chief and the COGES.

A first stratification following a visual inventory, of flora in different strata: high, medium and low (Wuillot, 1994 read by Bouaré, 2012). In the DIN access to water is free. The access of the pastures to Burgu is conditioned by a payment of a royalty paid to the *Dioro*. That of crop residues is negotiated. This is due to the fact that there is nothing left after the passage of the animals, because the owners have made the maximum to store it for their animals or for sale (focus group). Only the study of satellite images provides insight into the spatio-temporal dynamics of flooding (Mariko et al., 2003). These results confirmed in the DNPIA reports (2010, 2011, 2012 2013, 2014, 2015, and 2016). According to Houérou and Hiernaux (2006), the distribution of precipitation during the rainy season, modulated by their redistribution through surface runoff, is a determining factor in plant cover diversity and production.

The grouping of herds in the the lakeside area cause a disorder to the feed. The indigenous peoples are forced to take refuge in other places and in certain pastoral enclaves like the protected areas and grasslands (focus group) in the hope of finding better conditions for the survival of their herd despite the ban. Boudet (1978), Boutrais (1994 and 1996), Fournier (1994 and 1996), Carrière (1996), confirmed that the action of cattle, through grazing and trampling, causes changes in the structure of the soil in places frequented by animals. But the reduction of forage selection that it implies, severely affects animal production (Hiernaux et al., 2016). Overgrazing is a factor in animal overload. A high degree of stripping of the compacted soil is observed. Trampling turns the straw into litter, then fragments it and buries it. Fertilization by faecal and urinary excrement is followed by a transfer of fertility in space with concentration poles important for crops and for biodiversity. The droppings of animals are a strong stimulant for the herbaceous tissue in the Burgu land. The positive effect is that animal droppings are a strong stimulant for the herbaceous tissue in the Burgu land. The livestock feet on grass tufts can stimulate tillering and rooting stolons, and thus improve the recovery of the vegetation which is also a positive effect. The negative effect is most noticeable in places where trampling is repeated, such as tracks, contours of water points and resting places for livestock (Hiernaux et al., 2012).

The livestock farmer's perceptions of the variability of Burgu land revealed a downward trend in rainfall. This perception is, in fact, supported by the analysis of historical rainfall data over the period from 1950 to 2010, which in fact revealed interannual variability and a downward trend in rainfall totals. According to Sarr et al. (2015), an alternation of dry years and wet years has been noted over the last twenty years. The rainy season that started between May and June, goes until July sometimes today. The analysis of the length of the season shows a downward trend. This corroborates with the livestock farmer's perception that the rainy seasons are becoming shorter due to the late start of the rainy seasons and their abrupt cessation. This disrupts the vegetative cycle of plant formations. The dynamics is a fundamental aspect of pasture knowledge and must be estimable in order to adopt farming systems that maintain and, if possible, increase productivity as a function of climate-soil-grazing relationships.

This trend can be explained and confirmed by data from the expansion of the agricultural front. A sharp expansion of agricultural areas in West Africa is at the expense of pastoral areas (LULC / CILSS-USGS, 2015).

In order to measure the impact of pasturing on pastoral areas by agriculture, it is essential to take into account not only the extent of land that is annexed by the fields, but also the strategic nature of the areas concerned. In contrast, savannas are more susceptible to grazing (Caesar 1991). Indeed, the agricultural pressure is particularly aggressive on the shallows, the shores of some semi-permanent pools that are coveted for market gardening, as well as on former dune pastures. This phenomenon has important consequences on livestock farming because it greatly reduces the carrying capacity. The rapid reduction of area of the rangelands and their fragmentation resulting from all these processes, especially in the rainy season during which the pastoral herd ensures its annual growth. It's are accompanied by an increase in livestock that has largely recovered after the hecatombs that accompanied the regional droughts of 1972-1973 and 1983-1984 (Touré et al., 2012).

The factors of degradation are summarized in the action of human and the factors of climate change. This is confirmed by the increase in livestock and the reduction of pastoral areas, which has direct impacts on the vegetation cover. The courses Sahelian annual grasses have demonstrated great resilience to drought, but also to livestock (Breman and Cisse, 1977; Boudet, 1982; Dardel et al, 2015.). In contrast, savannas are more susceptible to grazing (Caesar 1991). Fire practices occur despite the prohibition of water and forest services, and are often considered by naturalists as a natural factor in savannah environments because it has an ecological role (Fournier, 1991). Nevertheless, anthropologists, sociologists, agro-pastoralists and geographers consider it an anthropogenic factor because it is triggered by populations for multiple-use purposes (Bruzon 1994, Dugast 2008). Thus, fires are used as a means of stimulating the natural regeneration of vegetation and for obtaining fodder (Dembélé et al., 1997 as read by Yaya, 2016).

The climate is the most significant factor in determining plant growth and productivity. It is therefore likely that changes in climate will upset the World Agricultural Landscapes (FAO, 2001) like the Burgu land of Youwarou. During the second half of the twentieth century, West Africa experienced a sharp decrease in rainfall with a clear break in the years 1968-1972. The decline in rainfall has not spared the Sudan and Guinea zones during this period. The climate change is likely to increase the frequency and severity of floods and droughts in areas already experiencing high rainfall variability. Since 2000, the climate variability has increased (CILSS-AGRHYMET, 2017).

The flooding can be a consequence of some of our actions that we do not always control (IPCC 2013, Vischel et al., 2015). The flooding is an important factor in climate change in this study. The concept of flood and recession cut the time in the DIN "Widely flooded late flood, the flood plain turns into the beginning of low water in the pond of main branch, emissaries, strings of ponds and Great Lakes at the end of the low water period, it is no more than a vast dry area where the only areas still flooded are the minor beds of the rivers, some large ponds and some permanent lakes "(Niaré et al., 2000). This period corresponds to the return of the livestock in the pastures of the Delta that the flood has renewed during their absence. The life in DIN is governed according to the flood.

The DIN is recognized by the authorities as a conflict zone, especially around its pastoral resources. The situations such as the destruction of a crop field by a cattle herd especially, or the anarchic occupation of pastoral areas by crop fields (extension of fields in meager pastures and Bourtol), either negligence or The carelessness of some livestock farmers has often been called 'the problem of migration of crop fields or livestocks, depending on whether one is a farmer or a breeder (Djiré, 1996).

As part of this study, a number of adaptation strategies were identified. These practices are: forage crops, mowing and conservation of the Burgu and use of SPAI, transhumance, destocking and the use of crop residues. These results are consistent with those obtained by Dioum et al. (2017) in their report on diagnosis of threats, constraints and opportunities related to climate change and indigenous knowledge on adaptation in the Silvo-Pastoral Zone, the Groundnut Basin and eastern Senegal. But the results of these do not take into account the efficiency of these different coping strategies.

In Mali, spaces and rangelands are enrolled in the domain of the State and their management is transferred to local government (CT) by the Law on the Pastoral Charter. It is the Law N ° 01/004 / of February 27th, 2001 relative to the Pastoral Charter in the Republic of Mali (this law defines the fundamental principles and the general rules which govern the exercise of the pastoral activities in Mali). But the Burgu land are under the aegis of the Dioro of his locality (CF Pastoral Charter Act). The Burgu land belong to the Dioro who manage them, but the infrastructures that remain belong to the Territorial Communities (CT) whose management is entrusted to the Professional Organizations (OP).

Conclusion

The problematic of the present study resides in the climate change (drought, flood, flood, pathologies, and regression of the pastoral resources) and the anthropic action (extension of the lands of cultures, fires). The area of Burgu is reduced by the fact of anthropic actions (90%) and the factors of climate change (10%). The practice of fire is justified for a regeneration of the Burgu on the one hand and the improvement of the quality of the Burgu on the other hand. In the delta access to water is free for livestock. The entry of livestock in the Burgu land is consecutive to the payment of a fixed fee payed to the Dioro. Crop residues are not accessible.

At the end of this study, it was noted that in the DIN,the Burgu land are governed by the flood and their degradation is mainly due to the effect of humans through its agricultural development to ensure partial food security and the factors of climate change. Livestock farmers are negatively evolving in the Delta and especially in Youwarou commune. Proposed solutions are: herd rotation, reduced residence time, development of pastoral perimeters, introduction of more productive species (relationship with research), seeding of denuded areas coupled with rotation in order to ensure the increase of pastoral areas.

The present study has shown the decrease in the pasture area of herds. This situation is explained by the overgrazing that has also been observed, a multiplication of PIV (Perimeters irrigated Villagers) all along rivers and floodplains, privileged areas for Burgu production. This explains an expansion of cultivated land at the expense of grazing areas. However, in the region, the management of the pastoral area is the responsibility of the Dioro. In Mali, the Burgu land are valuable fallback areas for pastoral farming and are gradually lost or under-valued. Pastoralism remains closely linked to the exploitation of surface waters and Burgu in the dry season.

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