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Research Article

Typology of Cattle Herds in Transhumance in the Municipality of Djidja in Southern Benin

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Abstract: Dryland herders traditionally move to the wettest areas including southern Benin in search of pasture and water to ensure the survival of their livestock. The main objective is to characterize the cattle herds in transhumance in the municipality of Djidja in Southern of Benin. Inquiry data has been collected through semi-structured interviews of 61 cattle herds with a total of 4,772 heads. Using the methods of factorial analysis of multiple correspondences (FAMC) and ascending hierarchical classification (AHC), a typology of three types of transhumant cattle herds were established. The cattle herds of type 1 have carried out cross-border transhumance and mostly consist of Hausa (75.7%) from Nigeria. They are led by herdsmen whose average age was 26 ± 5 years. They had a high size (102 ± 33 heads) and taking part in decisions-making with the herds' managers. The type 2 had in transhumance in the municipality outside of its home area. This was mostly consisting of two to three relatively young Fulani herdsmen (24 ± 4 years) and mostly of herds' managers. They were not involved in decision-making. These herds had an average size of 80 ± 28 head. The cattle herd of type 3 has been in transhumance in the municipality since more than one year. They are led by young herdsmen (25 ± 3 years) relative to herds' managers. These herds have led by one or two herdsmen with a low rate of (53 ± 24 heads) with Borgou race in majority. The typology implementation will allow us to analyze the different transhumance management modes in the municipality of Djidja.
Keywords: Benin, cattle herd, Djidja, pastoralism, characterize.

INTRODUCTION

In Benin, livestock is the second most important resource in the primary sector, sometimes contributing up to 44% of agricultural GDP [1]. It also contributes for 6% to the national GDP and proves to be a source of income for over 70% of the workforce and the first form of capitalization to almost all rural households and even urban [2]. The national herd, numerically important and diverse amounted, in 2013 was 2.222 million for the bovine species alone [3].

Cattle breeding is quite developed around towns and villages in the fluvio-lacustre area such as So-Ava, Dangbo and Abomey-Calavi, where it contributes 20% of the income of breeders [4]. Effective pastoral production requires flocks to be mobile as part of a series of responses to the unequal distribution of resources, including pastures, water, trees, salt to lick, and large areas. The emphasis on mobility, particularly transhumance, is explained by the fact that it remains a very important issue both in the West African sub-region in general and in South Benin in particular.

The Municipality of Djidja has in some places forest patches that give the appearance of tree or shrub vegetation and two forests classified as maintained and supplemented by teck plantations in Dan and Setto [5]. It has become a destination for both transhumant and foreign migrants, despite the conflicts between breeders and farmers. To address this concern, it is necessary to make a diagnosis on the presence of transhumant cattle herds in this area. The typology of cattle herds in transhumance in Djidja is the starting point of our study. This typology would allow better characterization of cattle herds in transhumance in the municipality of Djidja and improve the effectiveness of policies for the sustainable management of pastoral resources.

Studies carried out in the North and South of Benin on the typology show a diversity of herds [6-9]. Faced with the extreme diversity of the situations to be described, the typologies have the ambition of constituting a class game that simplifies reality while respecting the main peculiarities [10]. Typologies of farms make it possible to compare groups of farms with each other, to judge their functioning, to identify

possible solutions to the problems encountered and to develop adapted recommendations [11]. The aim of the typologies is therefore to provide decision-makers with an image of local agricultural activity to guide development actions [12].

The purpose of this study is to characterize, through a survey, a typology of transhumant cattle herds in the Municipality of Djidja.

MATERIAL AND METHODS

Study area

This study was carried out in the Municipality of Djidja, located in the south-west of Benin (Figure 1) in the Zou department at an altitude of 183 meters, between latitude 7 ° 20 '46' N and 1 ° 56 '8 " of longitude East. It covers an area of 2,184 km² (41.66% of the total area of the department) [5]. The municipality of Djidja is bounded on the south by the municipalities of Abomey and Bohicon, on the south-west by the department of Couffo, on the east by the municipality of Za-Kpota and Cove and to the north by the department of the hills (Municipalities of Dassa and Savalou). It enjoys a humid tropical climate characterized by four seasons: a great rainy season from mid-March to the end of July; A small dry season from mid-July to early September; A small rainy season from early September to mid-November and a large dry season from mid-November to mid-March. In Djidja, the annual rainfall is of the order of 1,100 to 1,200 mm. In the middle year the rainy season begins in March-April where the monthly rainfall amounts reach 90 mm [25]. The average temperature is 28.5 °C; the maxima recorded between February and March are of the order of 36 °C and 37 °C and the minimums vary from 22 °C to 25 °C during the months of July and November.

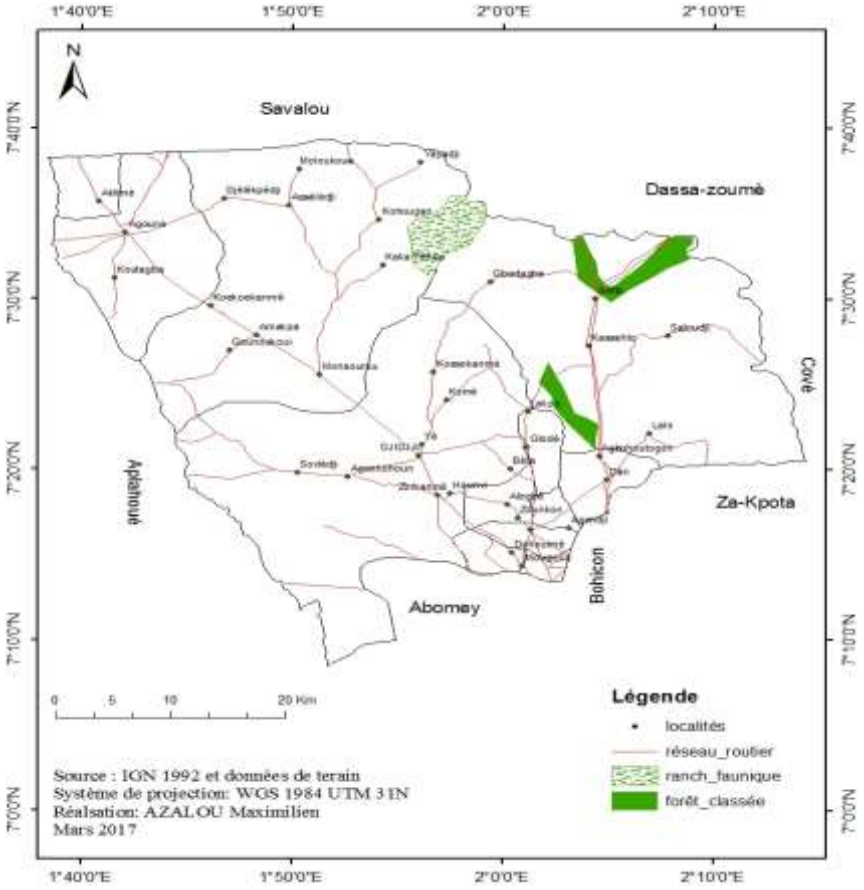

Fig-1: Location of the municipality of Djidja

METHODOLOGY

The survey method used was developed by the Institute of Animal Husbandry and Veterinary Medicine in Tropical Countries. It was used for the typology of cattle farming systems in many tropical countries, including Burkina Faso [13] and Benin [6, 7, 9, 14].

The study focused on transhumance cattle herds encountered in the district of the Djidja municipality (Table 1). These districts were chosen in consultation with the Fulani authorities, the farmers and the Communal Sector for Agricultural Development in Djidja. The herdsmen by profession, conducting the cattle herds were approached and counted using a maintenance guide from October 2015 to March 2016 and the semi-structured maintenance technique was adopted.

The questions concerned the herder (Nationality, number and age of herdsmen, ethnic

group, relationship between herd manager and herdsmen, mode of decision making, choice of camp), the animals (cattle numbers, breeds of animals and acquisition mode of the herd) and the practices of transhumance (point of departure, entry points, places frequented, movements, final destination, period and reasons of entry into Djidja, watering places).

The transhumant herds were under the responsibility of herds' managers which the owners of the animals entrusted them. Herds' managers were taking major decisions (starting transhumance, vaccination, deworming, purchase of medicines and salt). They also resolved conflicts caused by animals and affected the costs to owners. Herdsmen engaged in implementing the grazing circuit, monitoring of animals, parking, watering and milking. In exchange for this work, they enjoyed the milk and remuneration in cash or livestock head per season.

Table 1: Distribution of breeders and the number of livestock by district

District	Number of breeders surveyed	Cattle size
Agouna	11	1008
Dan	8	471
Djidja	16	1182
Monsourou	8	724
Setto	18	1387
Total	**61**	**4772**

Data analysis

Analysis of the survey data was performed using the software R.3.1.3® in two steps:

- A Factorial Analysis of Multiple Correspondence (FAMC), which has produced a representation of the farms in the form of projections on the planes defined by the first factorial axes [15].
- An Ascending Hierarchical Classification (AHC), classification method (from the holdings of the coordinates on the main factor axes), which lets you group farms according to their proximity to each other. All individuals is represented as a tree (dendrogram) and different typology group correspond to the main "branches" of the tree [13].

RESULTS

Development of the typology

Correlations between the variables allowed to retain a set of 19 active variables giving 52 terms. The analysis of coordinate's major projection axes of the FAMC is summarized in Table 2. The cumulative contribution to the total inertia of the first three factorial axes retained was approximately 65.0% (Table 3).

Table 2: Definition of factorial axis.

Axes	Négative	Positive
1	High number of cattle Foreign breeders Zebu and Crossbreed between Zebu More than 2 cattlemen Decision by herd manager and herdsmen Pasture of Djidja only One batch Water + fodder	Low number of cattle National breeders Purebred Borgou One to two cattlemen Decision by herd manager only Pasture at Djidja and other places All batches Water + fodder + peace
2	Feeding Arrival of dry season Herdsmen parents and employees	Feeding and socio-economic Arrival of dry season + raining season Employee herdsman
3	Herdsmen rather older Herd formed purchase, inheritance and gift	Herdsmen rather young Herd formed inheritance and purchase

Table 3: Cumulative contribution to the total inertia of the factorial axes

Factorial axes	% of Inertia	% cumulative
1	29.3	29.3
2	23.8	53.1
3	12.3	65.4

Definition of groups

In order to define more precisely the herd types from the FAMC examination, an AHC was carried out with all the data (Figure 2). This analysis allowed to distinguish three types of cattle herds in transhumance in the municipality of Djidja. The best graphical representation was provided by a projection is a plane defined by the factorial axes 1 and 2 (Figure 3).

Analysis of the distribution of cattle herd types on the FAMC and AHC charts revealed the characteristics of each type of cattle herd. The frequencies of the different terms of the variables related to the three types of cattle herds identified were given in Tables 4 and 5.

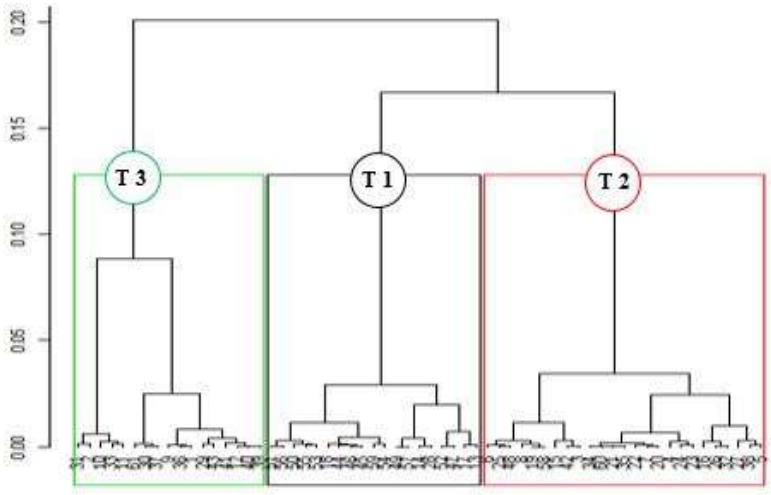

Fig-2: Dendrogram resulting from the ascending hierarchical classification showing the three identified groups

Type 1 (19 herds or 31.15% of the sample)

Herds of this type are from Nigeria, Niger and Burkina Faso. These herds are present in the districts of Setto, Djidja, Monsourou and Agouna. There were 2 to 3 herdsmen per herd, with an average age of 26 ± 5 years. They are mostly Hausa from Nigeria (75.7%) and Fulani from Niger and Burkina Faso (24.3%) and relatives of the herdsmen. They are considered to be experienced in the field, and they come back to make decisions with the herd manager for the conduct of the animals.

The herd size was very high (102 ± 33 bovine heads), and consists mainly of inheritance and purchase, followed by inheritance and a combination of purchase, inheritance and gift. The White Fulani, M'bororo and Goudali Zebu and the crossbred (White Fulani or M'bororo x Gudali) were the most commonly encountered in this type of herd. The lack of pasture areas and the search for water were the main reasons for their entry into the municipality. The periods of attendance were much more during the dry season. The length of their stay varies from a few days to four months. The municipality of Djidja constitutes a transit zone, of great transhumance towards Togo for certain breeders and of reception for others. The rivers Zou and Couffo serve as water sources for this type of herds.

Table 4: Frequency (%) of the terms describing the breeder as cattle herds' type identified

Variables	Modalities	Type 1	Type 2	Type 3
NAB = Nationality of breeders	Beninese	10.5	91.3	94.7
	Foreign	89.5	8.7	5.3
DIS = District	Djidja	5.3	30.4	36.8
	Setto	47.4	21.7	26.3
	Dan	0	26.1	10.5
	Monsourou	21.1	0	21.1
	Agouna	26.3	21.7	5.3
NUH = Number of herdsmen	NUH= 01 herdsman	5.3	0	31.6
	NUH= 02 herdsmen	52.6	69.6	63.2
	NUH> 02 herdsmen	42.1	30.4	5.3
EBR = Ethnic of breeder	Haoussa	75.7	37.5	0
	Fulani	24.3	62.5	100
AGE = Age of herdsmen	AGE < 20 years	15.8	21.7	10.5
	20 < AGE < 30 years	52.6	56.5	78.9
	AGE ≥ 30 years	31.6	21.7	10.5
MDM = Mode of Decision Making	Herd manager	10.5	100	78.9
	Herd manager + herdsmen	89.5	0	21.1
RHL = Relationship between herd manager + herdsmen	Yes	89.5	82.6	57.9
	No	10.5	17.4	42.1
REM = Remuneration	Salary	52.6	34.8	63.2
	Calf	36.8	17.4	36.8
	No remuneration	10.5	47.8	0

Table 5: Frequency (%) of the terms describing the cattle herds surveyed for different type identified

Variables	Modalities	Type 1	Type 2	Type 3
BRA= Breeds of Animals	Borgu	0	0	63.2
	Zebu	42.1	78.3	26.3
	Crossbreed between Zebu	57.9	21.7	10.5
NUF = Number of cattle	NUF ≤ 50 head	10.5	13	47.4
	50 < NUF ≤ 100 head	21.1	56.5	47.4
	NUF > 100 head	68.4	30.4	5.3
HCM = Herd Constitution Mode	Inheritance	21.1	13	15.8
	Inheritance and Purchase	52.6	34.8	47.4
	Inheritance, Purchase & Confide	5.3	30.4	26.3
	Inheritance, Purchase & Don	21.1	21.7	10.5
PMO = Food Mode	Herbaceous plants alone	31.6	4.3	36.8
	Herbaceous and Ligneous	47.4	52.2	26.3
	Herbaceous, Ligneous & Salt	21.1	43.5	36.8
POT = Places of transhumance	Djidja	31.6	34.7	42.1
	Djidja + Other	68.4	65.2	57.9
PEC = Periods of entry into the Municipality	Dry season	52.6	4.3	26.3
	Rainy season	21.1	39.1	0
	Dry season and rainy season	26.3	56.5	73.7
WAP = Watering Place	Watercourse + Zou (river)	10.5	47.8	57.9
	Watercourse + Kouffo (river)	42.1	26.1	15.8
	Watercourse + Zou + Kouffo (river)	47.4	26.1	26.3
RAP = Recourse to protected areas	Yes	47.4	47.8	36.8
	No	52.6	52.2	63.2
ARE = Animals remains in the municipality of Djidja	Yes	5.3	30.4	21.1
	No	94.7	69.6	78.9
BAT = Concerned batch	One batch	73.7	52.2	63.2
	All the batch	26.3	47.8	36.8
LEF = Place frequented	Follow	52.6	0	0
	Follow + Residue crop	10.5	60.9	10.5
	Follow + Residue crop + Watercourse	36.8	39.1	89.5

Type 2 (23 herds or 37.70% of the sample)

Herds of this type are present in the districts of Djidja, Setto, Dan and Agouna. They belonged to the Benin transhumant's residing in the surrounding Municipality s. The herdsmen were mostly related to herd manager and had an average age of 24 ± 4 years. They are often two or three people per flock. The ethnic group of Fulani constitutes a little more than half and the others are of the socio-cultural group Hausa. The decision of the conduct to the grazing of the animals is taken by the herd's manager.

The White Fulani, M'bororo, Goudali and mixed breeds (White Fulani or M'bororo x Gudali) dominated in this type of herd with a moderately high (80 ± 28) head. The inheritance, buying and confiding followed the purchase and inheritance were mainly the patterns of herd formation of this type.

Lack of forage was the main reason for their entry into Djidja. These herds mainly frequent fallows and crop residues, followed by fallows, crop residues and the edges of rivers. Herbaceous and ligneous fodders followed by supplementation in salt by some breeders are used in these farms and the watering of the animals is done at the level of the water reservoirs and the river Zou.

Type 3 (19 herds or 31.15% of the sample)

These herds have been encountered in all boroughs that host transhumant herders in the Municipality. The herds manager are breeders and agro-breeders mainly Beninese who reside in Djidja. The herdsmen are mostly related to the herdsmen. The number of herdsmen guarding herds of this type was from 1 to 2 cattlemen. They are all of the socio-cultural group Fulani and having on average 25 ± 3 years. They go through several administrative subdivisions during the dry and rainy season; the decision for the conduct of these animals is more assured by the herd manager.

The average number of herds of this type was 53 ± 24 head. These herds were mainly made up of inheritance and purchase, followed by a combination of purchase, inheritance and trust. The Borgu breed was the most encountered, followed by the Zebu (White Fulani and Goudali) in this type of herd. The herds have been staying in Djidja for most of the time during the year for breeders and agro-pastoralists that have come to transhumance in Djidja and have not returned to their home zone for more than a year. Breeders of this type

of herds still do not use protected areas. The search for fodder and water were the main reasons for their entry into Djidja. The herdsmen of these herds frequent fallows, crop residues and the edges of rivers in the dry and rainy seasons.

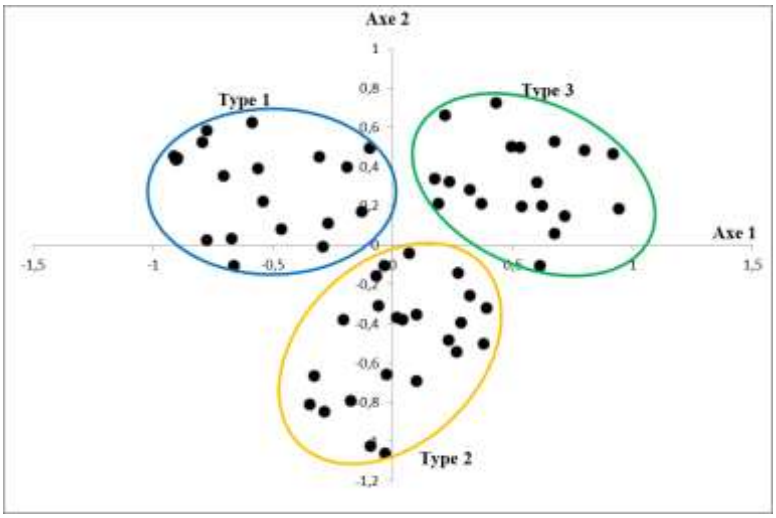

Fig-3: Projection of cattle herds surveyed on the factorial axes 1 and 2

DISCUSSION

The municipality of Djidja is moving from the area's most favorable to livestock in South Benin; this is why transhumant live there. Of the three types of cattle breeding identified in the Municipality of Djidja, type 3 is the most uniformly distributed in all the boroughs that host the transhumant breeders of the Municipality. Similar observations on the geographical distribution of cattle farms have been made by some authors [9, 13, 16]. This could be explained by the availability of pastures in these different districts.

In Djidja, the transhumant breeding of cattle is mainly practiced by the Fulani. These results are similar to those obtained by Alkoiret et *al*. [9] and Youssao et *al*. [8] when studying the typology of Borgou cattle breeding in the Municipality of Gogounou and the diversity of the Borgou cattle breeding systems in the Sudanian zone of Benin. The work done by Somda *et al*. [17] in Guinea-Bissau also confirmed the importance of the Fulani in cattle breeding with 96.2% of the cattle breeders. On the other hand, the results of our study are contrary to those obtained by Assogba and Alkoiret [7] with regard to the lagoon cattle farms in the Oueme valley. Their study showed that breeding of lagoon taurins is mainly practiced by the indigenous lake populations represented by the Goun and related relatives and then the Toffins.

Decision-making for the conduct of animals is more assured by the herd manager type 2 and 3. By contrast the herdsmen of type 1 herds make decisions with the herd manager for the conduct of animals. This same observation was made by Assani et *al*. [6] in Nord-Benin on transhumant herds entering the classified forest of Alibori Superior. Cross-border transhumants have the largest numbers of animals, an average of 102 ± 33 head of cattle per herd. Our results are similar to those of Houinato, [18], who found a headcount of at least 100 head of cattle per transhumant transboundary herd in the Kouffè mountains. Sogbohossou, [19], found a cattle population of 107 in the Pendjari hunting area (ZCP).

On the other hand, the average number of herds of type 3 (53 ± 24 head) is consistent with that of the traditional flocks. Similarly, Dehoux and Hounsou-Ve, [20] recorded sedentary and transhumant cattle herds of 56 and 70 heads east of the Borgou department. Alkoiret et *al*. [9] distinguished 3 types of cattle breeding in the municipality of Gogounou with an average number of 30, 52 and 152 head.

The high cattle breeds are not the same according to the types of breeding identified. Thus, type 3 herds are predominantly Borgou breeds. This can be explained by the places of origin of these herds. On the other hand, the type 1 and 2 farms are made up mainly of zebu (White Fulani, M'bororo, Gudali) and the crossbreds. This is similar to that reported by Assani *et al*. [6] in the Upper Alibori classified forest for non-riparian livestock producers, mostly from the municipalities of Malanville and Karimama.

Two main types of transhumance are observed in the Municipality of Djidja: national transhumance and cross-border transhumance. National transhumance results in the displacement of Beninese herdsmen with their animals in Djidja. There are two kinds of national transhumance: the small transhumance from May to July to keep the animals away from the crop areas and the great transhumance that covers the period from November to February. National herders (Type 2 and 3) move when herd numbers exceed 50 and food resources in the home area cannot satisfy animals during the dry season. As far as cross-border transhumance is

concerned, it is a practice of breeders from foreign countries who meet in Djidja (Type 1). The two forms of transhumance (national and transboundary) have already been observed in Benin by Houinato and Sinsin, [21] in the Pendjari Biosphere Reserve by Assani et *al*. [6] in the Alibori Forest Superior and Togo by Sokemawu, [22] in the savannah region. The results of our surveys on transhumance cattle rearing systems in the municipality of Djidja are similar to those of Assani *et al*. [6] and Adjagnissode, [23] who have identified these two types of transhumance in the protected areas of North Benin.

In short, the different types of herds identified in the municipality of Djidja vary according to the geographical location of the herd, the decision-making process, the size and breed of herds and the transhumance practices adopted. The typology realized by Youssao *et al*. [8] in their study of the diversity of Borgou cattle breeding systems in the Sudanian zone of Benin reveals the existence of three types of extensive bovine breeding. These are groups of sedentary, semi-transhumant and transhumant. Similarly, Assani and Alkoiret [14] identified 3 types of Goudali breeding (large transhumant breeding, peri-urban sedentary breeding and pure transhumant breeding) in the Municipalities of Malanville and Karimama in the extreme north of Benin varying according to the method of breeding, the size of the herd and the age of the farmer. On the other hand, the work of Sougnabé and Grimaud, [24] identified 4 types of pastoral systems in the Chadian savannah, varying according to feeding behavior, herd breeds, agricultural practices and the residence of the breeder. Four groups were also identified by Assogba and Alkoiret [7] on lagoon taurins in the Oueme river valley in southern Benin.

CONCLUSION

Three types of transhumant herds were found in the municipality of Djidja in south-west Benin. These types of herds are differentiated by the geographical location of the herd, the number and breed of herds, the watering places and the period of entry. Inadequate food and water resources are the main constraints of transhumant cattle herders. This typology will be used to identify and reach out with these communities' realistic solutions for the sustainable management of pastoral resources and the improvement of production systems.

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