

# Thwarting social conflicts regarding water resources access in climate change context: cattle pastoralists' schemes in northern Benin

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## Abstract

Animal production plays a crucial role in the economy of West African countries. However, in the context of climate change, the scarcity of water resources due to drought and high spatio-temporal variability of precipitations, influences considerably pastoral activities. This has driven conflicts among herders in most arid and semi-arid areas especially in the Fourth Transhumance Corridor of ECOWAS (Economic Community of West-African States). The study investigates the adaptation strategies of cattle herders to spatio-temporal variability of water resources in Benin. The results of this analysis aims ultimately at proposing through multi-agents simulations, a better adaptation strategy for decision making about environment conservation policies and reducing the vulnerability of actors and productions. The data were collected with 30 flocks' keepers in northern Benin. Results reveal that three categories of herders utilize natural resources in divergent manner based on their perception, their programmed and moved distance, the abundance and the condition of the water resources. An increasing transhumant way permits to balance the number of the used water resources during pastoral season and to reduce the number of conflicts among actors varying from 165 in normal season to 120 in disturbed season. The findings suggest an actor-oriented policy and local resources planning to control the movement of herbivorous livestock in open range and also enhance adaptation to climate change within the context of indigenous animal system in West Africa.

**Key words:** Climate change, Water resources, Pastoralism, ECOWAS transhumance corridor in Benin, Adaptation.

## 1 Introduction

Stretched between the Gulf of Benin and the valley of Niger ( $6^{\circ}17$  to  $12^{\circ}04$  North latitude), Benin Republic integrates an abrupt climatically induced rain forest fragmentation known as Dahomey gap, a forest relic characterized by a decline in annual precipitation, a reduction of sea and air surface temperatures causing climate anomaly (Bokonon-Ganta, 1987; Hayward and Oguntoyinbo, 1987; Salzmann and Hoelzmann, 2005). The country is influenced by the climate change since 1970 with strong spatio-temporal rainfall variability. The consequences are soil degradation, desertification, deterioration of grasslands and water resources (Parry et al. 2007). The worrisome aspect is glaring with respect to water resources which are life-blood of the economies of West African countries (Kunstmann and Junge, 2005). Crop production and animal husbandry, the main economic activities have a hard coexistence due to intense competition making the interactions and exchanges more difficult between actors (De Haan et al. 1990; McCarthy et al. 2001; Morton, 2006). In the northern Benin, which receives each year a numerous foreign livestock from bordering countries like Niger, Burkina Faso and Nigeria, several bloody conflicts have been recorded not only between the two groups, but within each group. This paper outlines how the socio-technical knowledge used by herders to gain access water resources is at the same time a factor for reducing the recurring clashes between them.



*Fig.1. Department of Alibori in Benin*  
 Source: ANCB, 2013

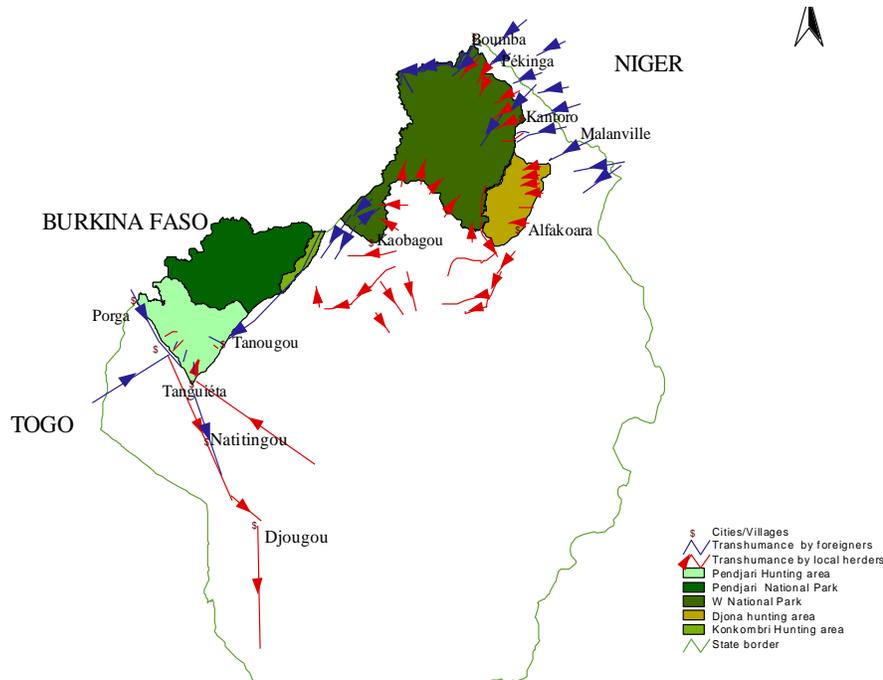


Fig 2. Herds' movements in the study area (Department of Alibori)  
Source: RIPIECISA 2009 in Djohy 2010

## 2 Theoretical and Methodological frameworks

Our socio-anthropological research was referred to action theories to provide conceptual and methodological framework for understanding actors' logic and mechanisms in coping with climate change. Fieldworks were conducted in Alibori in the north Benin (Fig. 1), which has 692,210 out of 2,058,000 of the national bovine herd (FAO, 2013)<sup>1</sup>. It's also a predilection area for foreign herders from Burkina Faso, Niger and Nigeria. Data were supplied through semi-directed interviews and focus group by thirty herders partially followed along the fourth animal route of Economic Community of West-African States (ECOWAS) (Fig. 2). The sample included five large scale herds ( $\geq 100$ ), fourteen medium scale herds ( $20 \leq \text{Herd} < 100$ ) and eleven small scale herds ( $1 \leq \text{Herd} < 20$ ). Through CORMAS<sup>2</sup> and StarUML<sup>3</sup>, *SimWater* model was built and two scenarios were compared in access to water in normal (NCS) and abnormal (VCS) seasons during 210 days of mobility. Herds move by daily time according to water scarcity and the strategy of the shepherds. The conflict is defining in the model as the meeting of two or more herds around the same restricted water resource.

## 3 Results

### 3.1 Actors and resources

#### 3.1.1 Different Herders with specific water resources

The endogenous typology made with actors reveals that herders make a difference among them and between the water resources they use to feed animals (table1). Three classes of herders exploit three types of watering sources: "Dianpoui" available all the seasons; "Dianseeda" whose half of the number disappears after two abnormal dry months and "Dianpete" which completely dry up after an additional month of normal dry season.

<sup>1</sup> CountrySTAT is a web-based information technology system developed by the FAO, <http://www.countrystat.org>

<sup>2</sup> CORMAS is the Common Resources Management Agent-based System developed by CIRAD <http://cormas.cirad.fr/fr/outil/outil.htm>

<sup>3</sup> StarUML is an Open Source UML/MDA Platform, <http://staruml.sourceforge.net/en>

**Table 1. Actors and resources Characteristics**

Categories	Herd size & Fulbe names		Water size & Fulbe name	
Abundance sources	Herd $\geq 100$	Large Scale Herder (LSH) "Owoodinai"	Permanent rivers, large dams	Big Water Sources (Dpo) "Dianpoui"
Moderate sources	$20 \leq \text{Herd} < 100$	Medium Scale Herder (MSH) "Owoodiseeda"	Seasonal rivers, backwater, shadows, cascade, water collectors	Medium Water Sources (Dse) "Dianseeda"
Limited sources	$1 \leq \text{Herd} < 20$	Small Scale Herder (SSH) "Owooda"	Pastoral Tanks, artesian wells, creeks, overdigs	Small Water Sources (Dpe) "Dianpete"

Source : Djohy, 2010 & 2012

**3.1.2 Decision process for watering cattle herds**

The main factor of water resource choice varies according to the herders (Fig.1a). LSH are influenced by the natural abundant rangeland; MSH are affected by the possibility of crop residues and supplementation (Fig.1b) and SSH are affected by the access to livestock market (Fig.1c).

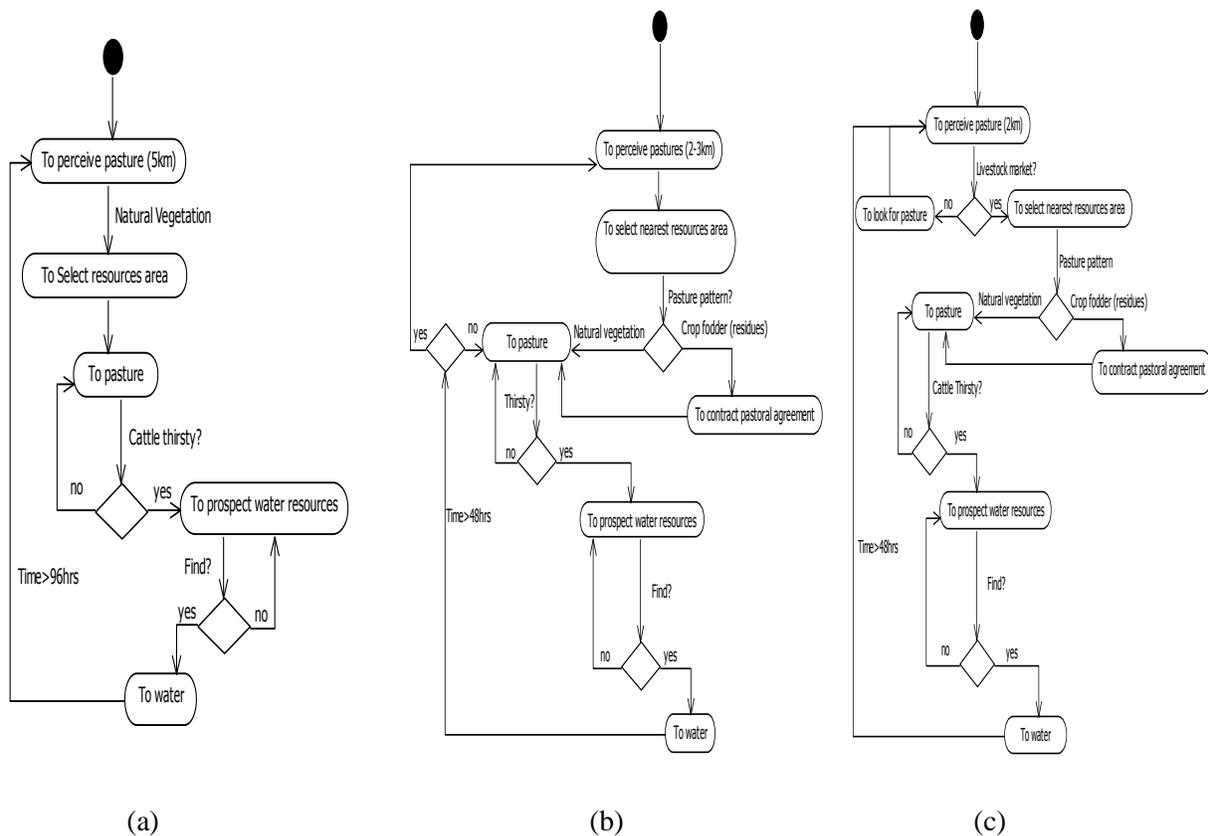


Fig.3. Herders’ decision process for water resources access

**3.2 Water resources access and intra-professional conflicts**

Three strategies were developed according to each type of herders (Table2). Large Scale Herders’(LSH) watering strategy.

### 3.2.1 Large Scale Herders' watering strategy

Owoodinaï herders' movements are based on observation and assumption of water availability and access to it. This group of herders has the capability to trek long distances by choice. One LSH could observe and move up to 5 kilometers (km), select abundant grazing area and water points sufficient to cover the needs of his big flock (Fig. 4). When the LSH realises his animals' watering need they will first look for an abundant water source. They operate a dual mode of choice depending of resources availability. Between the three categories of water points, they prefer the big and the medium water points respectively. Once they find such water points, they water animals and then continue in search of new grazing area. When resources are abundant in one area, they stay for maximum of four days to prevent probable risks related to long stay. No matter the appetency level of the animals toward some type of fodder, the lack of water reduces their grazing duration. Thus they undertake transhumance over long distances along route N°4 and follow some secondary pathways in the forests or particular zones.



Fig 4. Large Scale Herd and Herders round a "Dianpoui" water resource in Alibori  
Source: Djohy, 2012

### 3.2.2 Medium Scale Herders' (MSH) watering strategy

The MSH strategy is a combination of natural spaces and farm harvest residues (rice and other cereals, groundnut and gardens residues) for optimal satisfaction of the herds. All guidance system of the animals toward fodder and water resources are in a dialectics of timely returning back to their semi-permanent residential huts in their communities to watch over the family and get ready for the upcoming farming season. Therefore, a typical MSH does not move beyond 2 km and selects the nearest pasture and water points. In case of natural pasture, animals are left to graze adequately to meet their needs, and he determines their water need by their behavior and decides to let them continue grazing or not. He stays for a maximum of three days in the same zone, for animal grazing and watering. If the rangeland is artificial (harvest residues), he contracts with farmers by paying them money (pecuniary contract) or temporary stationery so that the animals can feed on crop land (manure contract), and alternatively waters the flock.

**Table 2. Herdes' watering strategies**

<i>Herders</i>	<i>LSH</i>	<i>MSH</i>	<i>SSH</i>
Strategy	Extensive	Semi-extensive	Market oriented
Move factors	Natural abundant resources position	Harvest pasturing resources position	Proximate Livestock Market position
Searching radius	5 km	2-3 km	2 km
Stay duration	Four days	Three days	One day
Preferred resources	Dpo+Dse+Dpe=Dpo Dpo+Dse=Dpo Dpo+Dpe=Dpo Dse+Dpe=Dse Dpo=Dpo Dse=Dse Dpe=Dpe	Water resources (big-Dpo, medium-Dse or small-Dpe) near harvest residues	Water resources (Dpo, Dse or Dpe) near livestock market

*LSH- Large Scale Herders'; MSH- Medium Scale Herders'; SSH- Small Scale Herders';*

### 3.2.3 Small Scale Herders' (SSH) watering strategy

A key coping strategy of the SSH is to explore the possibility of combining the sale of cattle with search for pasture and water during the transhumance journeys. Many herders in this category have few herds due to effects of

successive epizooties, climatic crises and unfavourable inheritance conditions. They restrict their movement to less than 2 km for grazing areas close to livestock markets. If the nearest pasture is close to a zone of harvest, he engages in a contract of pasture and chooses some cattle not necessarily for selling, but especially as mediator for the merchandising of livestock. They could dig some water points for their cattle (Fig. 5). When a SSH finds a livestock market, he will enter into a contract with farmers, leave the flock and goes to market (Fig. 6). He stays for a day and then continues to prospect for resources and market opportunities.



Fig.5. Small Scale Herd watering round a overdigged “Dianpete” water resources in Alibori  
Source: Djohy, 2012



Fig.6. A teenager watering an entrusted Small Scale Herd round a “Dianseeda” water resource in Alibori  
Source: Djohy, 2012

### 3.2.4 Maintaining watering sources from normal to changed season

To satisfy their herd’s need for water under NCS, the LSH go through 42 watering sources during the entire pastoral season, while the MSH and SSH visited 53 and 70 sources respectively. These numbers remained fairly the same under VCS (Figure 7 a and b). The number of browsed water points is not very different in the two scenarios, in spite of the growth of the distance in dry season. This can be explained by the fact that in terminal areas, the herders overdig some dried water points and stay much longer than they would normally have. The SSH undertake livestock trade in Gogounou district which is known as the biggest livestock market in Alibori Department. The LSH would either stabilize in the valleys of permanent rivers or deviate from the formal route N°4 of ECOWAS. It can be concluded that the increasing of travelled distance is not proportional to an increase in the observed watering sources.

### 3.2.5 Reducing of conflict prevalence around water resources

Herders’ strategies bring down the number of intra-professional conflicts (herders against herders) during the transhumance in changing season. Under the two scenarios, the curves of conflicts for 210 days of migration reveal that the increase in the number of conflicts is a function of the number of day of transhumance, but keeping in the moved water resources permit to decrease from 165 in NCS to 120 in VCS (Fig. 4, a and b).

## 4 Discussion

Pastoralism in indigenous communities is important to properly achieve the Millennium Development Goals of the United Nations in 2015 (Cordone et al. 2009). If water is a great challenge for extensive animal production systems (Abdullaev et al. 2009; Martius et al. 2009, Winckler et al. 2012), pastoralists have to look at the future and execute a good adaptation strategy. The presence of animals in grassland around villages permits them to put up with the available resources to limit or to avoid the risk on the next viewing kilometers during their mobility. However, it

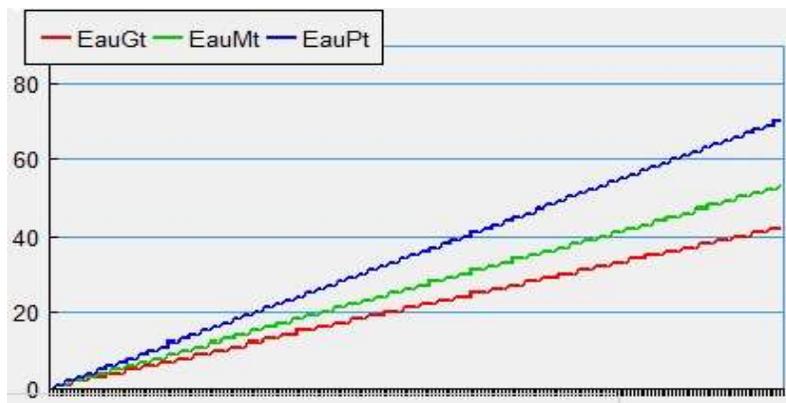
is for a relatively short period because herders for reason of distrust think indispensable not to get used to a territory to undergo other tragedies as the flight of livestock, the poisoning of the livestock and other teasings. The careful management of the staying days is the technical measure for countering the crisis of trust between farmers and them. The existence of livestock markets along the route is an important factor for small scale herders' adaptation to water resources access. Regarding the precarious conditions of SSH, this new form of access to the market as "Intermediate seller" or "Intermediate purchaser" is an endogenous adaptation measure by pastoralists in the context of climate scarcity along route N°4.

## 5 Conclusion

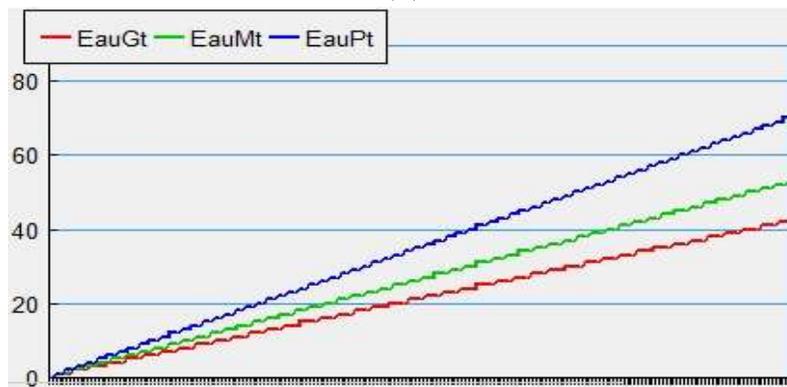
Through this study we understand that the ways of thinking and acting by migratory animal herders are premised on a "make-or-break" or "do-or-die" logic. They mobilise all strategies to develop their activities and save their herds which eventually will be bequeathed to their children. Government support to pastoralists would reinforce the significance of animal husbandry in national economies. Therefore, improvement in natural resources and the enhancement of the infrastructure in animal markets must be a given priority.

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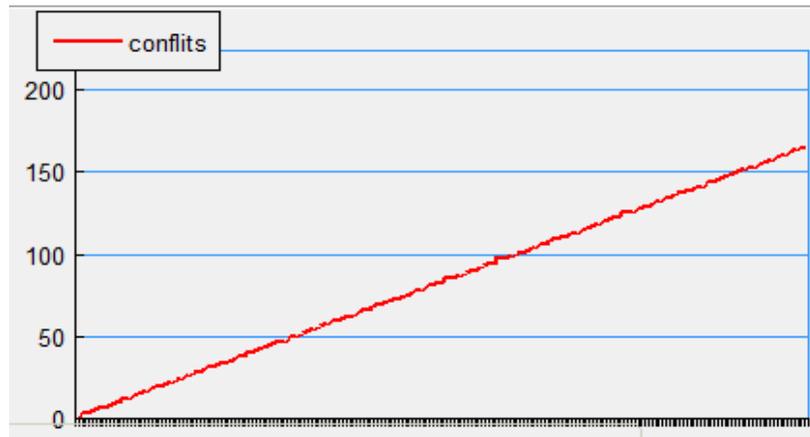


(a)

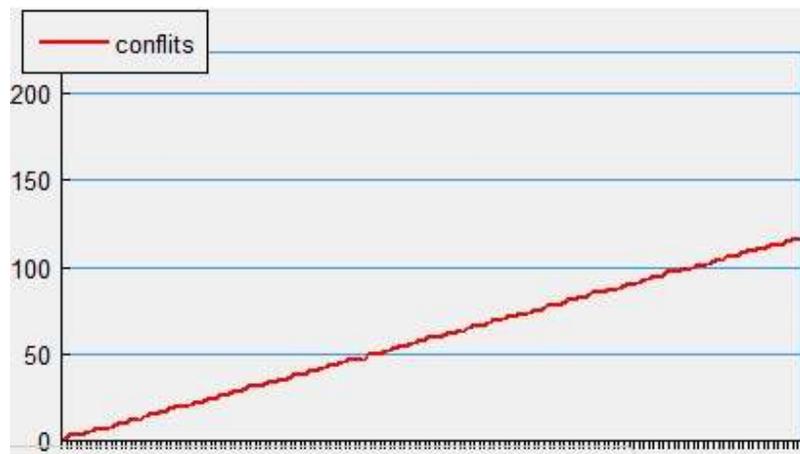


(b)

Fig. 7: Number of water points under normal (NCS)(a) and abnormal (VCS) (b) seasons



(a)



(b)

Fig. 3: Number of conflict under normal (NCS)(a) and abnormal (VCS) (b) seasons

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