



# Farmers' decisions to adapt to climate change under various property rights: A case study of maize farming in northern Benin (West Africa)



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## ARTICLE INFO

### Article history:

Received 4 December 2012

Received in revised form 9 January 2013

Accepted 9 March 2013

### Keywords:

Farmers' decisions

Adaptation to climate change

Property rights

Multivariate Probit model

Benin

## ABSTRACT

Making the assumption that property rights might determine whether farmers adopt particular strategies, this study aims at modelling farmers' decisions to adapt to climate change by focusing on their property rights – declined as institutional arrangements on land and rights on land – as well as their socio-economic and demographic characteristics. The case study took place in northern Benin (West Africa). In this zone, 308 farmers producing maize and adapting to climate change were randomly sampled. The study was conducted by a survey method on respondents using structured interviews based on a questionnaire. A simultaneous modelling using a Multivariate Probit (MVP) model highlighted that socio-economic and demographic characteristics, institutional arrangements on land, and rights on land determine the farmers' decisions to adapt to climate change. The land ownership has a positive effect on the decision to adopt any adaptation strategy. Subsequently, securing farmers' property rights would help to enhance their capacity to adapt to climate change.

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## Introduction

Defined as fluctuations in the patterns of climate over long periods (Ngaira, 2007), climate change is one of the most serious threats which weigh down on the sustainability of natural resources. Moreover, agriculture which mainly relies on environmental factors in developing countries will be one of the most vulnerable sectors of the global economy to climate change (Kurukulasuriya et al., 2006).

In West Africa, many studies predicted either increases (Haarsmaa et al., 2005) or decreases (Held et al., 2005) in rainfall for coming years. In Benin, studies revealed that rainfall will stay more or less stable (−0.2%) in the southern part, but will reduce about 13–15% in the northern part by 2100 (MEHU, 2011). At the same time, simulations also predicted a temperature increase between +2.6 °C and +3.2 °C in 2100 for the whole country (MEHU, 2011). These changes are expected to have differential impacts on agricultural productivity, food security, and agricultural livelihoods (Dixon et al., 2001; Dinar et al., 2008). In Benin, climate change is already

acting negatively on yields and production (Aho et al., 2006), predicted to decrease about 5–20% (Paeth et al., 2008).

To sustain their livelihoods in this context of climate change, farmers have developed and implemented adaptation strategies. Indeed, throughout the literature, various adaptation strategies to climate change are reported and the most common are: use of new crop varieties and livestock species that are more suited to drier conditions, irrigation, crop diversification, mixed crop livestock farming systems, changing planting dates, diversifying from farm to non-farm activity, increased use of water and soil conservation techniques, changed use of capital and labour and shading and sheltering/tree planting (Bradshaw et al., 2004; Maddison, 2006; Nhemachena and Hassan, 2007; Deressa et al., 2009; Till et al., 2010; Hisali et al., 2011).

Many studies explored the key determinants of farmers' choices in term of adaptation to climate change. But, very few papers have highlighted the role of property rights in the process of adaptation to climate change. Running a Heckman's sample selection model for understanding why farmers fail to respond to climate change, Maddison (2006) used among other explanatory variables the proportions of land owned, rented out, under sharecropping, under community ownership, rented, and borrowed. Even if this study stated that land tenure has little impact on the propensity of farmers to adapt, it has also reported that when the proportion of land

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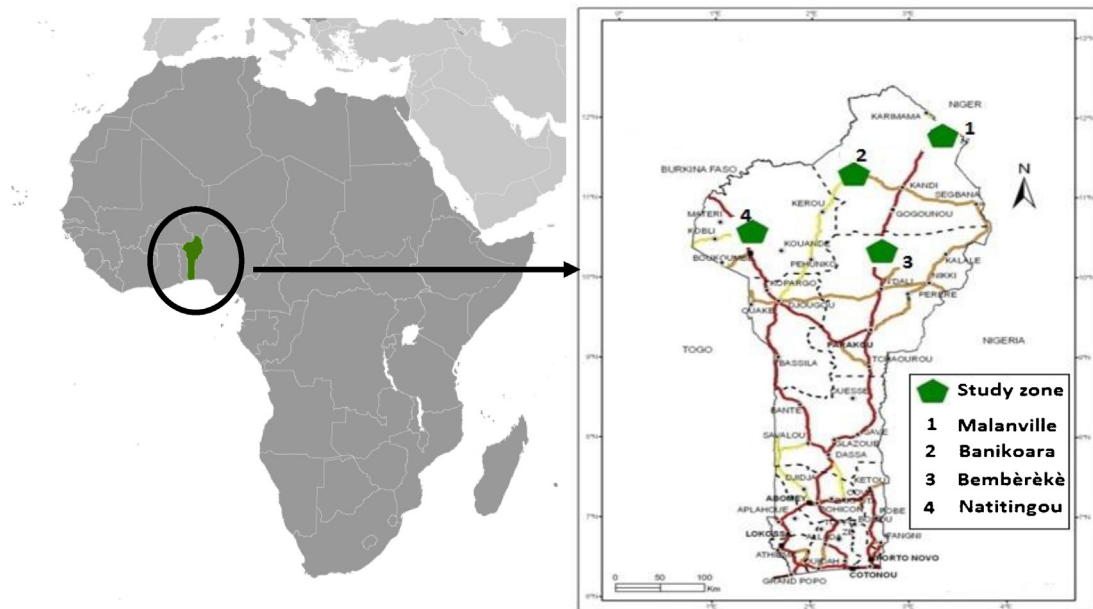


Fig. 1. Study area.

borrowed increases, the probability of no adaptation measure being taken by farmers also increases, raising the issue of property rights and adaptation to climate change. Making the assumption that property rights might determine whether farmers adopt particular strategies, this study aims at modelling the farmers' adaptations to climate change by focusing on their property rights in northern Benin (West Africa).

## Materials and methods

### Study zone and database

The study took place in northern Benin. Out of the 8 agro-ecological zones in Benin (cf. PANA, 2007: 17), this region covers four zones and 73% of the whole country. It is located between 8°30' and 12°20' North latitude, and 1°00' and 3°90' East longitude. Besides, the area is considered as the basket of food and cash crops, implying the major role of agriculture in the livelihoods of population in the study zone. The study took into account 4 municipalities (one per agro-ecological zone): Malanville, Banikoara, Bembèrèkè, and Natitingou (Fig. 1). In each municipality, two representative villages were selected after preliminary interviews with key informants (local leaders, heads of farmers' organisations) and according

to the perception of climate change, the importance of maize production, and the accessibility to the village. The villages selection was done with the support of agricultural extension officers of CeCPA (Centre Communal de Promotion Agricole).

The research units were farmers adapting to climate change. Because maize is predicted to be more affected by climate change (MEHU, 2011), we focus only on maize farms. Thus, after a rapid census survey of all maize producers in each selected village, 308 farmers producing maize and adapting to climate change were randomly sampled using the table of random numbers. Table 1 shows the sample structure. The data collected were about the farmers' socio-economic and demographic characteristics (gender, level of schooling, etc.), the adaptation strategies to climate change, and the property rights. The study was conducted by survey methods on respondents using structured interviews based on a questionnaire. Data were analysed with STATA 11.

### Modelling farmers' adaptations to climate change

There is a growing interest in the literature on climate change adaptation for understanding the reasons underlying the farmers' responses (adaptation strategies). For farmers, adaptation to climate change requires to make choices among a set of adaptation

**Table 1**  
Sample structure.

Zone	Municipality	Village	Village's households <sup>a</sup>	Sample size	Sampling rate (%)
1	Malanville	Koara-tédji	359	43	11.98
		Issene	182	38	20.88
2	Banikoara	Bonhanrou	523	39	7.46
		Ounet	222	39	17.57
3	Bembèrèkè	Guéré	252	37	14.68
		Pédarou	165	40	24.24
4	Natitingou	Takonta	141	30	21.28
		Pam-Pam	167	42	25.15
Study zone	–	–	2011	308	15.32

Source: Authors' compilation.

<sup>a</sup> Source: INSAE: Cahiers des villages et quartiers de ville: Départements de l'Alibori, de l'Atacora et de la Donga. Institut National de la Statistique et de l'Analyse Economique. Direction des Etudes Démographiques. National Report, Cotonou, 2004.

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