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Variability of household fuelwood consumption in a rural Sudano-Sahelian context in Burkina Faso

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ABSTRACT

Over 90% of the rural population in sub-Saharan Africa still relies on fuelwood as their primary source of household energy. In this context, recent robust data on fuelwood consumption in rural areas are needed to conceive and implement appropriate energy policies. This paper identifies the factors that determine fuelwood consumption variability in two villages in Burkina Faso, based on a two-year survey of 60 rural households of different size and wealth status. The women who made up the panel were surveyed at five-day intervals over a period of three months in the rainy season, one month in the cold dry season and one month in the hot dry season. Our results corroborate some fuelwood consumption patterns in rural SSA: fuelwood consumption per adult equivalent decreases both with the size of the household and with local wood scarcity. Conversely, it challenges the idea that the level of consumption is correlated with the level of household wealth. Finally, the most important result is that the scarcity of wood resources leads people to buy fuelwood from outside and adopt strategies to reduce their consumption by reducing the number of cooking cycles and certainly by wasting less energy, whatever the level of household wealth.

Introduction

Given the increasing urban and rural populations in sub-Saharan Africa (SSA) in the 1970s and 1980s, which were considered to be the main drivers of woody resource depletion in savannah regions, some authors predicted that cities in SSA would have to face severe shortages of fuelwood at the beginning of the 2000s (Barnes, 1990; Eckholm, 1975; E. R. Eckholm, Foley, Barnard, & Timberlake, 1984). These predictions were a matter of controversy particularly concerning rural areas (Benjaminsen, 1993, 1997; R.A. Cline-Cole, Main, and Nichol, 1990; Fairhead & Leach, 1998; Leach & Fairhead, 2000). However, discourse on the impact of wood extraction on deforestation still dominates today and has led to the implementation of household energy projects aimed at reducing the consumption of fuelwood in the cities and at organizing the exploitation of woodlands in a more participatory and sustainable way in the countryside. Despite these projects, 'fuelwood', the term used here to cover fuelwood and charcoal, continues to dominate the household energy sector (Sola et al., 2017). Over 70% of the population in SSA is estimated to rely on fuelwood as their primary source of household energy (IEA, 2014), and the ratio is even higher in rural areas where >95% of households report using fuelwood and around 85% for cooking (Adkins, Oppelstrup, & Modi, 2012). The energy transition from wood to "modern" fuels has not yet taken place in SSA and fuelwood can be considered as a solution rather than a problem for the household energy supply in SSA (Gazull & Gautier, 2015; J. Schure, Ingram, Marien, Nasi, & Dubiez, 2011). In this context, recent robust data on fuelwood consumption are needed to design and implement appropriate energy policies. However, collecting and processing fuelwood consumption statistics is complex because of the diversity of consumption patterns, the different types of biomass, variations in the units of measure used and the absence of regular surveys (IEA, 2007). In addition, most studies on fuelwood consumption in SSA have focused on analyzing and assessing consumption by urban populations (R. Brouwer & Falcão, 2004; R.A. Cline-Cole, 1984; R.A. Cline-Cole, Falola, et al., 1990; Mwampamba, 2007; J. M. Schure et al., 2013; van der Plas & Abdel-Hamid, 2005). While some recent studies attempt to understand fuelwood consumption in rural areas of West Africa (Johnson & Bryden, 2012), household energy patterns and the factors affecting them are still poorly understood (Kowsari & Zerriffi, 2011).

Although there have been some studies of rural wood consumption in SSA (Banks, Griffin, Shackleton, Shackleton, & Mavrandonis, 1996; Bonnet-Madin, Joffre, Montagne, & Strasfogel, 1983; Ernst, 1978; Kituyi et al., 2001; Mangue, 2000; Mulombwa, 1998; Mung'ala

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& Openshaw, 1984), consistent data for rural fuelwood consumption in the Sudano-Sahelian region are still lacking (Ozer 2004). The results of existing studies are very different even within the same region. These results are usually based on estimations rather than on rigorous measurements and are made only over short periods that do not allow for seasonal variations and household wealth. In addition, very few studies analyzed the factors that affect variability of consumption. In their review of energy studies over the last three decades, Kowsari and Zerriffi (2011) summarized the factors determining household energy consumption patterns in two categories: *endogenous factors* directly linked to household characteristics including income, land ownership, size, age or gender; and *exogenous factors* including the physical environment, markets, supply factors and appliance specificity.

Considering that the International Energy Agency (IEA) predicts that in SSA fuelwood will remain the main source of energy in rural areas for the next 20 years (IEA, 2014), it is crucial for policy makers and practitioners to understand the links between demand and household characteristics or the relative abundance of supplies, as well as how consumption could change in parallel with changes in supplies or policies. This paper describes the factors that determine fuelwood consumption variability based on the monitoring of consumption by rural households in two villages in Burkina Faso located close to one another but that have different characteristics. Consumption was monitored over two rainy and two dry seasons.

Material and methods

Study area

The study was conducted in Balé province, in the Sudano-Sahelian region of southwest Burkina Faso between July 2012 and May 2014. Two villages were selected for the study, Kalembouly and Sorobouly (Fig. 1). Both villages are mainly populated by Winnien, who originate from the same mother village. The villages are located about 12 km apart and have a similar climate (annual rainfall 925 ± 157 mm between 1990 and 2011) and similar cultural and social conditions, but different landscapes.

The most remote village, Sorobouly, has a population of 609 (RGPH 2006) for a village territory covering 25.3 km^2 (24 inhabitants per km^2). Its landscape is dominated by a matrix of woodland and fallows. The other village, Kalembouly, has a population of 1471 (RGPH 2006) for a village territory covering 21.3 km^2 (69 inhabitants per km^2). Its landscape is dominated by a matrix of fields and parkland.

In Sorobouly, woodland and fallows account for 51% of the village territory (16% woodland and 35% fallows) (Fig. 2). Fields including agroforestry parkland account for 49% of the village territory. In Kalembouly, fields including parkland account for 71% of the village territory, while fallows account for only 2%. The remaining area is covered by woodland (27%). This part of the village territory is rocky terrain that can no longer be used for agriculture.

A preliminary participatory workshop with representatives of the two villages allowed us to characterize the main features of the rural systems and livelihoods in the two villages. Agriculture is the main livelihood activity in both villages. The main cropping system is triennial rotation of cotton, maize and millet. Groundnuts can be grown on sandy soils, and sesame is increasingly cultivated. These rainfed crops are cultivated during the rainy season that usually lasts from May to October. Livestock ranks second among Winnien livelihood activities. The Winniens usually raise cattle, small ruminants, pigs and poultry at home, and some households invest part of their income in livestock (mostly cattle). These two activities mainly occupy the men. Women rely on gathering and processing of shea (*Vitellaria paradoxa*) and néré (*Parkia biglobosa*), brewing and selling sorghum beer and making and selling charcoal for their livelihoods. Winniens who own livestock entrust its care to the Fulani, whose main activity is raising livestock. Both villages include a compound with 8 to 10 Fulani households at the edge of the village. As the Fulani have different patterns of fuelwood consumption (Benjaminsen, 1993), we considered them to be too specific in their diet and cooking behavior to be included in our sample.

Methods

In this study, two types of data analysis were used. The first was descriptive to characterize general patterns of per capita household fuelwood consumption. Tables and graphs are used to describe trends of household energy consumption across various exogenous and endogenous variables. The second was multivariate regression analysis. A specific model was developed to formalize and quantify the weighting of the different factors explaining energy consumption, all other things being equal.

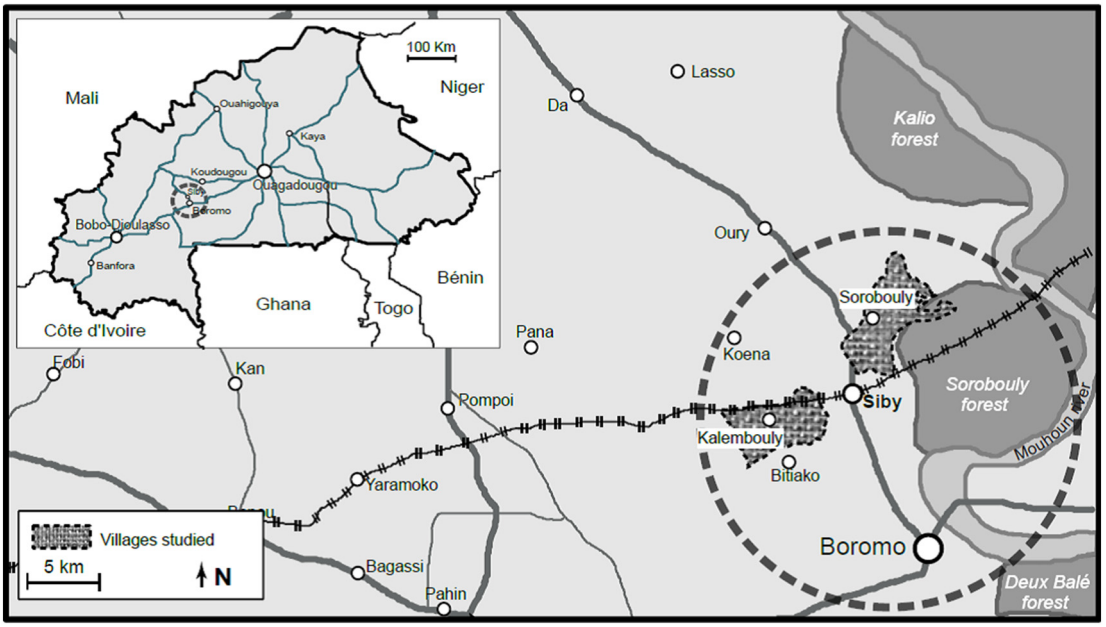

Fig. 1. Map showing the location of the two study areas.