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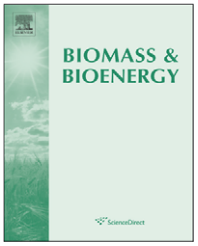

Can wood quality justify local preferences for firewood in an area of caatinga (dryland) vegetation?

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ABSTRACT

Studies have been undertaken in many parts of the world to evaluate the qualities of fuelwood, but rarely is this information associated with an examination of the preferences of the local populations. As such, the present study sought to address the question of whether local preferences for fuelwoods can be explained by the physical characteristics of the wood itself. To that end, the residents of 102 domiciles in a rural community in NE Brazil were interviewed and a list was compiled of all the plants used and preferred for domestic use. These woods were subsequently analyzed to determine their density, water content, and Fuel Value Index (FVI). Although a total of 67 species were identified by the residents, only 14 were described as being preferred—due to their great number of desirable attributes for cooking. The density, humidity, and FVI of 38 species used and/or preferred were determined. A significant relationship ($p<0.05$) was noted between plants with the highest FVIs and the most preferred fuelwood plants in the region, indicating that local preference could be explained by the physical properties that were examined.

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1. Introduction

Biofuels are still the principal energy source for a large proportion of the world's population, especially in rural areas of developing countries [1,2]. Socioeconomic factors are mainly responsible for this dependence on these natural resources as biofuels are available at low (or even zero) cost; commercial fuels, on the other hand, are often well beyond the acquisitive power of these people [3]. Wood has traditionally been the most important biomass source, being used in the form of either charcoal or firewood by approximately 70% of the population in underdeveloped countries, with an average per capita use estimated at 700 kg per year [4]. In Brazil, fuelwood is still largely used by the poorest members of that society [5]. As native forests are the principal sources of those biofuels, fuelwood harvesting has added to the problems of deforestation in that country [6].

As more authors have sought to evaluate the quality of fuelwood, the Fuel Value Index (FVI) has emerged as an important tool for classifying species according to the physical properties of their woods. The principal parameters used to construct this index include the caloric value of the wood, wood density, production of ashes, and the water content of the branches or trunk wood of each species [7]. Abbot and Lowore [2] indicated that ash production and the caloric values of different woods vary very little and therefore

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do not greatly influence the final FVI, such that the index becomes heavily weighted towards the relationship between density ($kg\,m^{-3}$) and water content (%).

Most of the research that has evaluated the physical properties of fuelwood species was undertaken in India and Africa [3,7–9]. However, it is still rare to find publications that associate the physical properties of the fuelwoods with the preferences of the local populations using them [2,9], in spite of the fact that domestic firewood use is known to be intimately linked to the preferences of the people who collect them [10,11].

In light of the paucity of information related to the use of fuelwoods in Brazil (in contrast to the extensive consumption of these resources within the country), we sought to identify the fuelwood species preferred by and used by a rural community located in the northeastern region of that country and to quantify the principal physical factors that influence the quality of that firewood. As such, the principal question that directed this research was: can the physical qualities of the different fuelwoods explain local preferences for them?

2. Materials and methods

2.1. Study area

Research was undertaken in the community of Riachão de Malhada de Pedra, located within the municipality of Caruaru, in the Pernambuco State, Brazil (Northeastern), at the approximate geographic coordinates 8°14′19″S × 35°55′17″W. The regional vegetation is known as *caatinga*, and it takes on a dry forest physiognomy in the study area (altitude approximately 550 m). The climate is hot and semi-arid, with an average annual temperature of 24 °C. Rainfall in the region is usually concentrated within the months of June and July, and the average annual precipitation is 609 mm [12]. The population of the municipality of Caruaru is 253,634, and 36,227 people live in rural areas [13]. In 2003 approximately 1800 m^3 of fuelwood were produced in the municipality, generating approximately US$7000 in revenues [14].

The Riachão de Malhada de Pedra community has approximately 123 households [15], and the principal local economic activity is subsistence agriculture [16]. The community studied is located near a fragment of hypoxerophytic arboreal caatinga covering an area of approximately 20 hectares that is owned and protected by the Empresa Pernambucana de Pesquisa Agropecuária (IPA). The major arboreal components of the forest include the families Mimosaceae, Euphorbiaceae, Cactaceae, Caesalpiniaceae, Capparaceae, and Rubiaceae [17].

2.2. Species selection for analysis

An ethnobotanical survey of the community was undertaken in order to identify the species reported as known for fuelwood, the plants used in the homes, and the plants preferred as firewood (independent of their being used at the time of the interview). It is important to note that the plants selected as the focus of this report are those cited as being preferred.

A complete survey of the plants used in this community was first undertaken in order to select the fuelwood species to be evaluated for their physical properties (see below). The preferred species were identified by direct interviews with each of the household heads. Additionally, the species were classified in regard to the ease with which they can be gathered, being considered either “restricted” or “non-restricted” in their distribution as follows: “restricted” species occurred only in the caatinga forest fragment and were difficult to find there (few individuals); “non-restricted” species occurred in other locations in addition to the forest fragment, and were easy to find in those places. The validity of this classification was based on interviews with informants and confirmed during field excursions in the company of a principal informant.

The first phase of the research was carried out between October 2005 and April 2006, when all of the occupied residences in the community were visited. A total of 102 household heads consented to participate in the interviews (52 men and 50 women). Semi-structured interviews were carried out [18] using standardized socioeconomic questionnaires that also solicited information concerning the types of fuels used in the house and the species of fuelwood known, used, and preferred by them. At a later moment, a second round of interviews was undertaken exclusively with household that actively used fuelwood ($n = 33$). Visits were made in order to evaluate the fuelwood stocks and to check for the presence of woody species that had not been cited in the interviews. Data were supplemented using other investigative ethnobotanical techniques, such as direct observation and walk-in-the-woods [18]. This latter technique entails undertaking field excursions with key informants in order to collect botanical material of the species cited in the interviews or encountered among the fuelwood stocks. The collected material was identified, mounted, and stored in the Professor Vasconcelos Sobrinho Herbarium (PEUFR) of the Federal Rural University of Pernambuco.

The plant species selected for physical analysis were chosen from the list of plants preferred and used as firewood. Within this criterion we had a final list based on the technical necessity of having species with trunk or branch diameters between 1.5 and 3.5 cm for the analysis of the physical properties of the wood.

2.3. Wood analysis

A total of 38 species were selected for analysis of their wood density and water content. The techniques used in the analysis were adapted from Bhatt and Tomar [3]. Initially, 40 cm lengths of wood were selected from four randomly chosen individuals of each species, and sub-divided into four 10 cm long sub-samples (totaling 16 sub-samples per species) that were marked in the field and weighed. The only exception was with *Eugenia* sp., as only one individual of this species was encountered.

In order to determine the water content of the wood samples, their fresh weight was noted and the samples were then placed in a drying oven at 100±5 °C for 48 h before weighing them again. This process was repeated until the sample weights stabilized [19].

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