

**MASTER's THESIS - Master of Science in Natural Resources  
Management and Development**

TH Köln (University of Applied Sciences)

ITT- Institute for Technology and Resources Management in the Tropics and Subtropics

**AN INVESTIGATION OF BIOMASS MANAGEMENT POTENTIALS WITHIN THE  
NEXUS BETWEEN ENERGY AND FOOD PRODUCTION (NEF) FOR CLIMATE  
RESILIENCE OF RURAL SUBSISTENCE FARMING HOUSEHOLDS IN WEST NILE  
REGION, UGANDA**

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**TH Köln**

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## Abstract

Alarming! is the response given by Arua district agricultural officer when asked to comment on the energy security situation of West Nile region. This is one of the poorest regions in Uganda that lags far behind the achievement of any of the seventeen UN Sustainable Development Goals (SDGs) and for which climate change has already demonstrated its impact on subsistence agriculture which is the mainstay of over 80% of its residents. Going through major demographic changes, the region has received millions of refugees fleeing neighboring countries of South Sudan and Democratic Republic of the Congo (DRC) in the recent years, a phenomenon that has had a great influence on the way natural resources are defined, used, managed and disposed. To that end, observable environmental degradation and uncontrolled natural resource use are main challenges for which no clear strategies have been put in place by the government in planning the sustainable livelihoods of this growing and vulnerable population.

This research aimed to explore how the use biomass residues generated from subsistence farming activities could be optimized for sustainable food crop production as well as supplement household energy production targeted at increasing community resilience to climate change amidst all the current natural resource demand and use practices.

Taking the farming systems approach and using the resource nexus concept, the various components of the rural subsistence farm households' livelihoods were unpacked to identify the main characteristics and possible relationships between farming, food and energy resources at this local scale.

The study revealed that the basic characteristics of rural subsistence farmers are still not well known and not well documented by both government and most scientific studies due to them being mostly mixed crop oriented and based on households' urgent needs on the small plots as opposed to being commercial and covering large per capita areas that the governments are more interested in. This phenomenon only widens the gap for meeting the farmers' needs.

Subsistence farm households in the region generate diverse types of agricultural residues from their mixed crop farming practices however as opposed to popular anecdotal hypotheses, majority do not mention energy application for their residues, even in situations of severe fuel wood scarcity. They instead apply the residues to manure production for soil fertility promotion which they do in different ways including burying the residues in the soil during tilling, mulching and composting. Only maize stalks and cobs plus Cassava stems were used to supplement household cooking energy of which maize stalks now have a new market in the refugee camps used for replanting.

Land scarcity emerged as one of the threats to increasing food productivity. Households do not have enough food, and many eat only one meal a day which itself is not nutrient balanced. Being poverty stricken, they also have to sell part of their food to buy other household necessities such as soap. Limitations on land will also affect production of biomass residues in the future and this is a result of the government allocating land from families to refugee settlements and large-scale commercial crop companies. In addition, former forest reserves which were free sources of firewood have been habited by refugees. However, the refugee influx has increased off-farm business opportunities and many farmers.

Modern energy access for the region stands at only 3.3%. The household therefore meet their cooking and lighting energy needs using fuelwood and charcoal and Kerosene and Pico solar lanterns respectively. In addition, all the households that participated in the interview cooked on traditional three open fire stoves which exacerbate the environmental and health problems associated with poor biomass combustion. The study also came across a surprising finding whereby household burn crop residues to produce a filtrate salt used in cooking and that is believed to reduce cooking time and energy requirements, contributing to energy and food security.

At the end of assessment, a conceptual framework was developed displaying the main connections for food and energy security of all the identified farm household system and resource management elements at this local scale.

Strengthening farmer knowledge on the role of crop residues as important soil fertility management agents and primary energy carriers as well as building their capacity to allocate optimum qualities for either application coupled with improving the efficiency of existing stoves or switching to new improved stoves would relieve the pressure on the use of biomass resources.

Finally, the study recognizes that this research effort generated much information on the complexity of the rural farm household with regard to the position of agricultural biomass for energy and food security and acknowledges that much of this information requires additional through and quantitative studies which was not possible this time. Suggested further in-depth studies are on (i) role of biomass crop ash filtrate in relieving the household energy burden and promoting food security, - (ii) quantification of productivity for the rural subsistence farm households with the aim of modeling to future scenarios to aid planning.

**Key words:** Rural subsistence farming, farm household, agricultural crop residues, biomass, food security, energy security, farming systems, nexus, rural sustainable development goals, resilience, climate change.