

Land Use Change, Biomass Fuel Portfolios and Household Coping Strategies

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Abstract

Fuel and cooking technology choices in the developing world are garnering increased attention in the wake of new research about the health impacts of exposure to smoke from biomass fuels and the role of biomass smoke or “black carbon” in regional climate change. The Global Initiative for Clean Cookstoves is one example of a mechanism for increased public investment in addressing fuel use and cooking technology options in developing countries. While significant efforts aimed at distributing improved cookstoves are underway in South Asia, Central America and other critical regions, sub-Saharan Africa lags behind. The development of markets for modern fuels such as liquid petroleum gas and kerosene is slow, and the marketing and distribution of improved stoves is getting limited attention. At the same time, rapid land use and demographic change suggest that the supply of high quality biomass fuels is declining at the same time as demand is increasing. Changes in the supply of locally available biomass fuels have implications for the portfolio of fuels households are using, and in turn the exposure of women and children to harmful gasses and particulate matter. Given that widespread adoption of modern fuels and cooking technologies in sub-Saharan Africa is likely to be achieved over the very long-run, information on appropriate health and environmental policies to reduce household exposure smoke from biomass fuels is needed.

This study addresses the question: How does rapid land use change affect biomass fuel portfolios? A fuel portfolio is a description of the relative share of different types of fuels that households consume including crop residues, dung, fuel wood, charcoal and modern fuels. Modern fuels and denser biomass fuels such as charcoal generally have lower exposure levels, whereas crop residues, dung, and low-quality fuel wood have higher exposure levels due to both fuel composition, quantity used, and length of exposure time. A main objective of this study is to explain heterogeneity in fuel use portfolios. We test the hypothesis that relatively well-off households are switching to biomass fuels that have lower exposure levels. We also characterize and explain heterogeneity in household coping strategies, including reductions in number of meals cooked, changes in time to collect biomass fuels, adoption of improved technologies etc.

We use a panel fixed effects regression model for a sample of 160 households in western Uganda. Our dataset has detailed information about the types, quantities and qualities of biomass fuels consumed, and how they have changed over time. We also have data about coping strategies for dealing with reductions in the quantity and quality of biomass. Data for the first wave of the panel was collected in 2003. The second wave of the panel was collected in 2007, and a third wave of the panel was collected in 2011. During this time frame there has been rapid deforestation and considerable demographic change (i.e. in-migration and population growth) in the region. In addition to household level variables, we include village (N=6) and sub-county fixed effects (N=4) in our model. Enforcement of land use and forestry policies, extent of deforestation and degradation, and local government policies on charcoal production are hypothesized to influence fuel choices.

We find that there have been large changes in household biomass fuel portfolios between 2003 and 2011 for households that do not own forested land. Households with their own forests are able to harvest high quality fuel wood. Charcoal production in the region has become much more common; charcoal is produced as a by-product of the land clearing process. While most of the charcoal produced is sold to traders; some charcoal is retained in local communities. The use of charcoal as a cooking fuel is much more common, though is primarily used by relatively well off households, and households that live in trading centers or close to roads. Relatively poor households have higher shares of crop residues and low quality fuel wood, and rarely use charcoal for cooking. The total time households are devoting to the collection of biomass fuels has increased significantly for all households, and per capita consumption of fuel wood has declined, especially for relatively poor households. The main coping strategies households use to deal with changes in biomass availability include: increased collection time; planting trees; increased use of agricultural residues as fuel; and more conservative use of fuel wood for cooking.

These findings point to important opportunities for health and environmental policy interventions. Assuming that the distribution and adoption of modern fuel and cooking technologies in the region will continue to be very slow, there is an urgent need for policies to promote the use of higher quality biomass fuels. Interventions aimed at providing information to households about the differential health impacts of biomass fuels, increasing the use of charcoal in very poor households, and supporting extension and subsidies for planting trees that produce high quality fuel wood are likely to result in health and socioeconomic gains for rural households in the short to medium-term.