

A spatial analysis of indoor air pollution from biomass fuel use in Kenya

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(1) **Motivation:** Indoor air pollution has become a serious health and environmental issue in Kenya due to continued use of biomass fuel mainly firewood for cooking and lighting. The country lost 310kha of tree cover from 2001 to 2017, a 9.3% decrease since 2000 (Global Forest Watch) and 14, 300 deaths yearly due to indoor air pollution, with pneumonia as the biggest killer associated with air pollution (WHO, 2009). In this research, we try to estimate the gridded spatial distribution of PM_{2.5} in Kenya.

(2) **Method:** The target area is Kenya. Using household sources of energy data and gridded population count data, we created a firewood usage map (Figure 1(b)) and a gridded population count map (Figure 2). Due to inadequate data on indoor air pollution, we used a reference mean PM_{2.5} of 0.126 (WHO, 2011). Finally, we estimated the gridded mean PM_{2.5} emission using the product of reference mean, number of population in the mth grid and % firewood use.

(3) **Results:** Biomass use is more predominant in rural areas (95.6%) than in urban areas. Majority of households using biomass fuels are located in the northern and western parts of Kenya as shown in Figure 1(b). It is found that the population count is directly related to the concentration of PM_{2.5} emission. Regions with a high population count (such as western and central) have a high concentration of PM_{2.5} emission, while regions with low population count (northern part) have low emission (Figure 2 and Figure 3).

(4) **Data used:** “Household Source of Cooking Fuel by County and District”, Kenya Population and Housing Census 2009 (Kenya National Bureau of Statistics (KNBS), 2017). “Population Count (2000, 2005, 2010, 2015, 2020)”, Gridded Population of the World, v4 (Center for International Earth Science Information Network - CIESIN - Columbia University. 2017. Gridded Population of the World, Version 4 (GPWv4): Population Count, Revision 10. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).

“Mean PM_{2.5}”, Combined household water treatment and indoor air pollution projects in urban Mambanda, Cameroon and rural Nyanza, Kenya, (WHO, 2011)

(5) **References:** Global Forest Watch, Tree Cover Loss in Kenya. World Health Organization (2009) Country profile of Environmental Burden of Disease: Kenya.

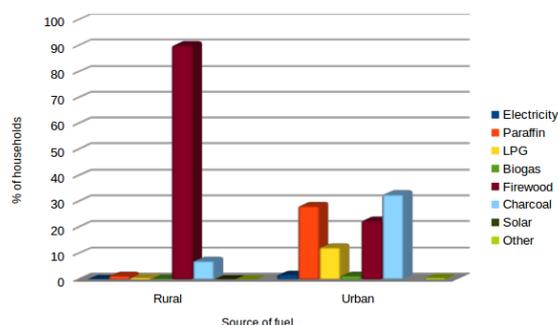


Figure 1 (a): Source of fuel in rural and urban regions in % of households

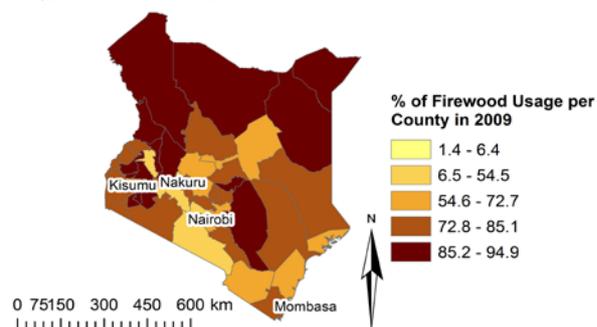


Figure 1 (b): % of firewood usage per county in 2009 in Kenya

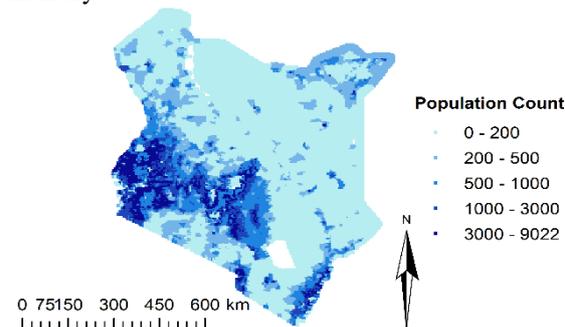


Figure 2: Kenya: Gridded population count

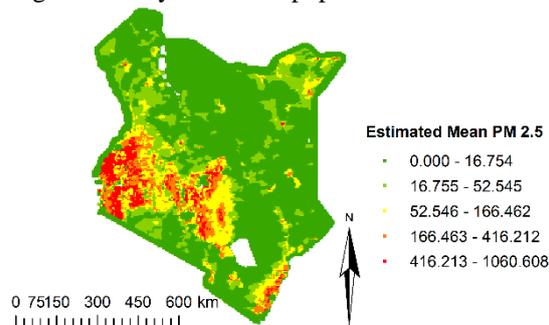


Figure 3: Gridded distribution of PM_{2.5}: the green region indicates low emission while the red region indicates high emission.