



# Household Air Pollution: Local and Global Environmental Impacts

Sumi Mehta, MPH, PhD  
[smehta@cleancookstoves.org](mailto:smehta@cleancookstoves.org)



# A GLOBAL PROBLEM



NEARLY

**3 BILLION**

people rely on open fires and simple stoves that burn solid fuels like wood, animal dung, and coal to cook their food.

**4.3 MILLION**

people die prematurely from illnesses attributable to the household air pollution from cooking with solid fuels every year.

UP TO

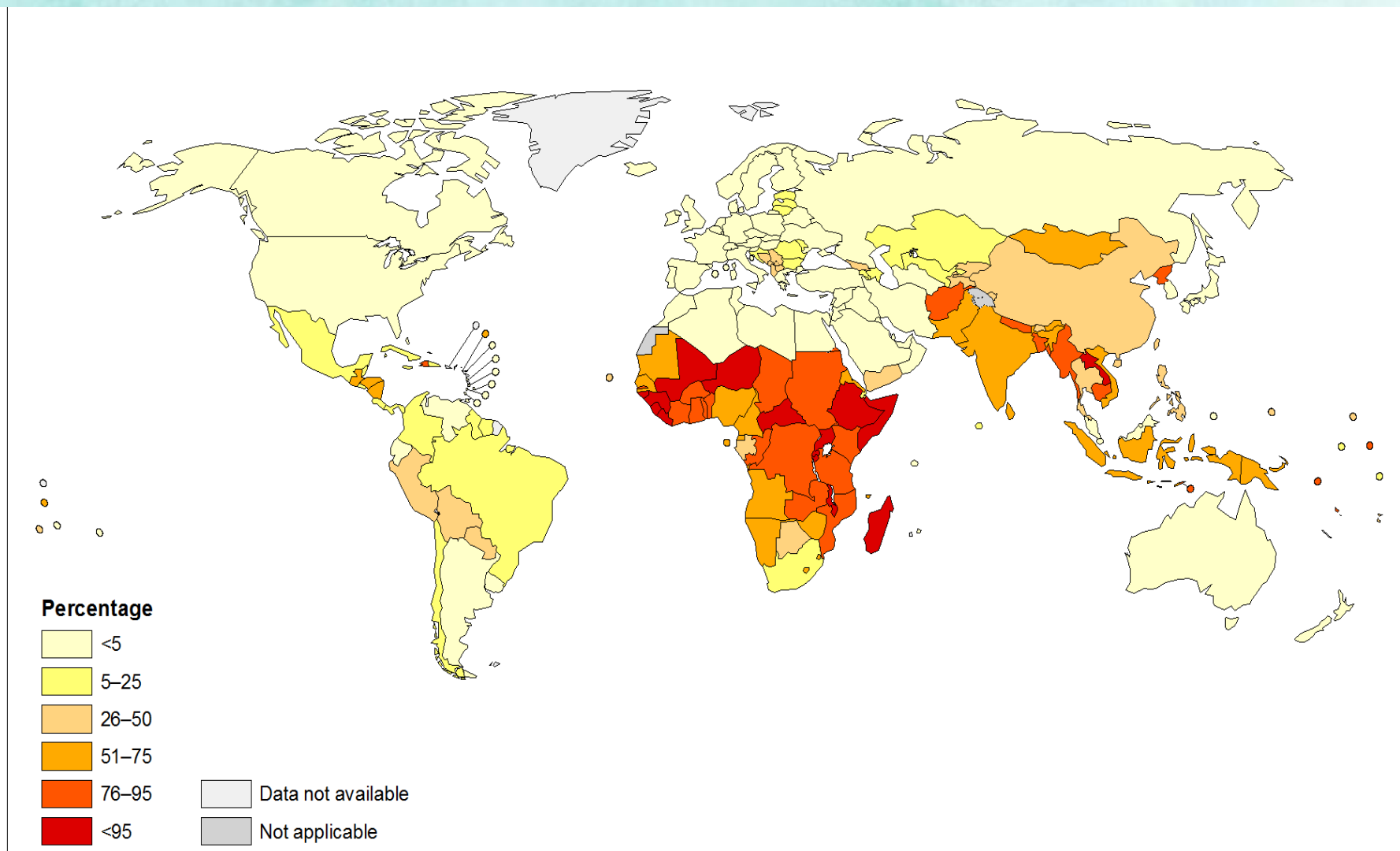
**25 PERCENT**

of black carbon emissions come from burning solid fuels for household energy needs.

**\$123 BILLION**

in annual costs to health, environment, and economies in the developing world because of solid fuel use for cooking.

# Population Using Solid Fuels, 2010



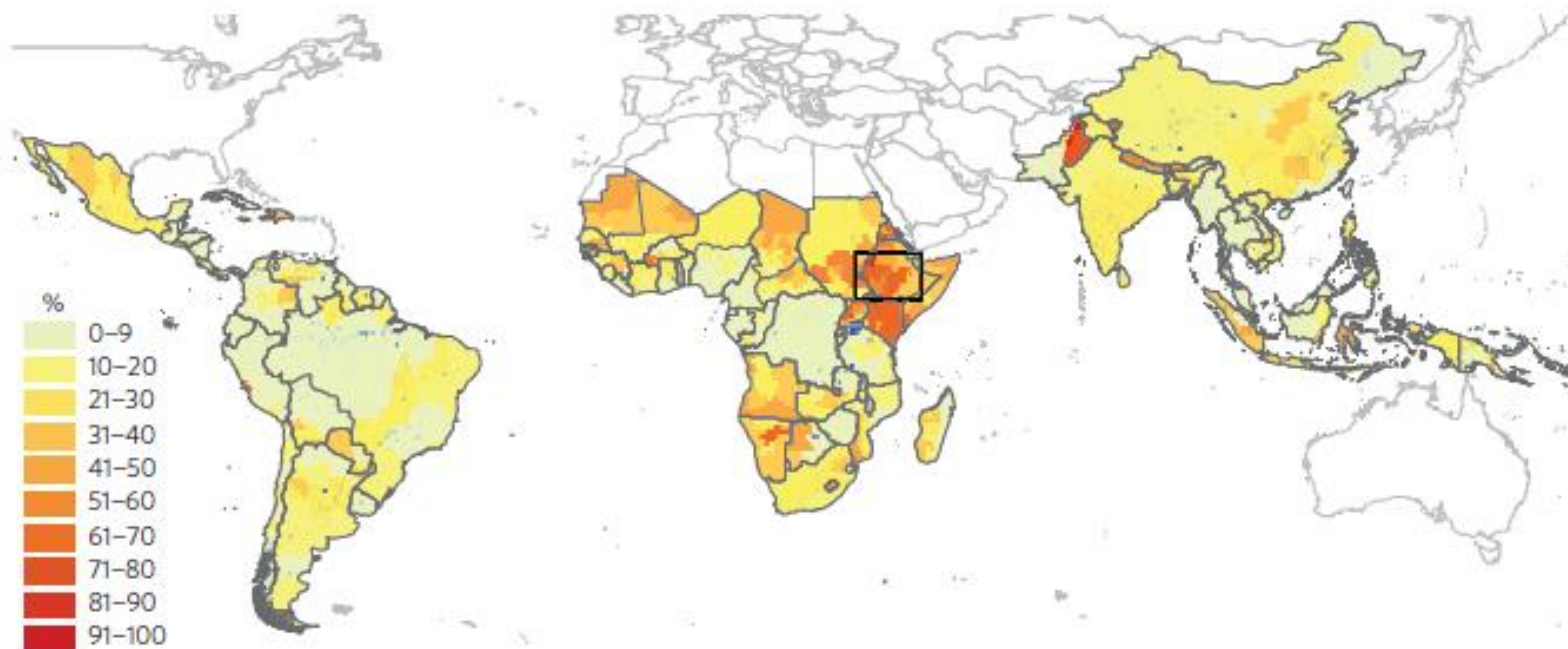
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Data Source: World Health Organization  
Map Production: Public Health Information  
and Geographic Information Systems (GIS)  
World Health Organization



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# 276 Million Rural People Experience Scarcity of Subsistence Energy



**Figure 2 | Pan-tropical expected fNRB<sub>B2</sub>.** Shading indicates the percentage fNRB estimated in sub-national units resulting from direct woodfuel harvesting (Scenario B2). The rectangle shows the region illustrated in Fig. 1.

*Bailis et al, Nature Climate Change 2015*

# What Do We Mean By Household Air Pollution (HAP)?

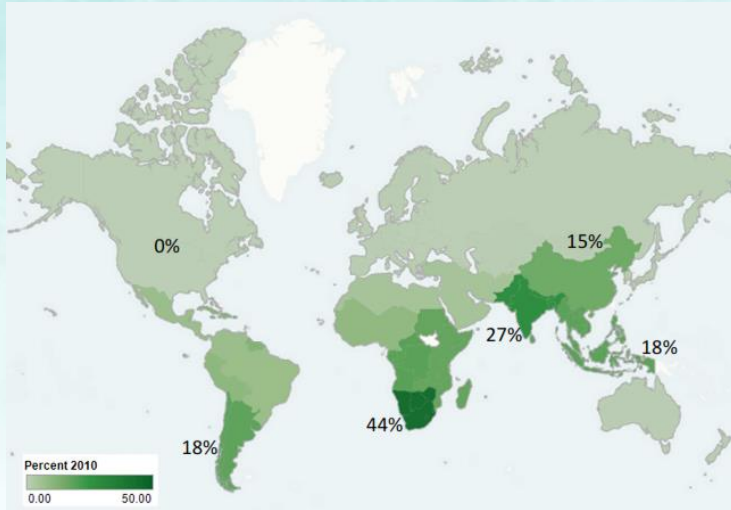
- Incomplete Combustion → complex mix of health damaging pollutants:
  - respirable particles, carbon monoxide, oxides of nitrogen and sulfur, benzene, formaldehyde, 1,3-butadiene, and polycyclic aromatic compounds, such as benzo(a)pyrene (Smith 1987)



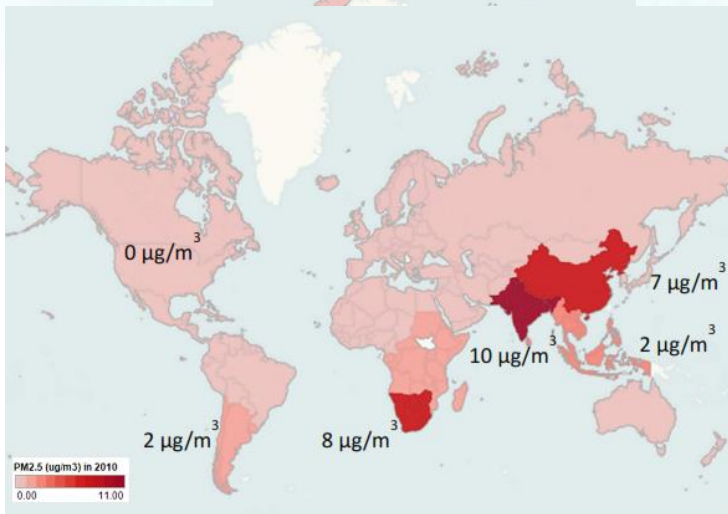
Note: not just  
'indoor' air  
pollution!



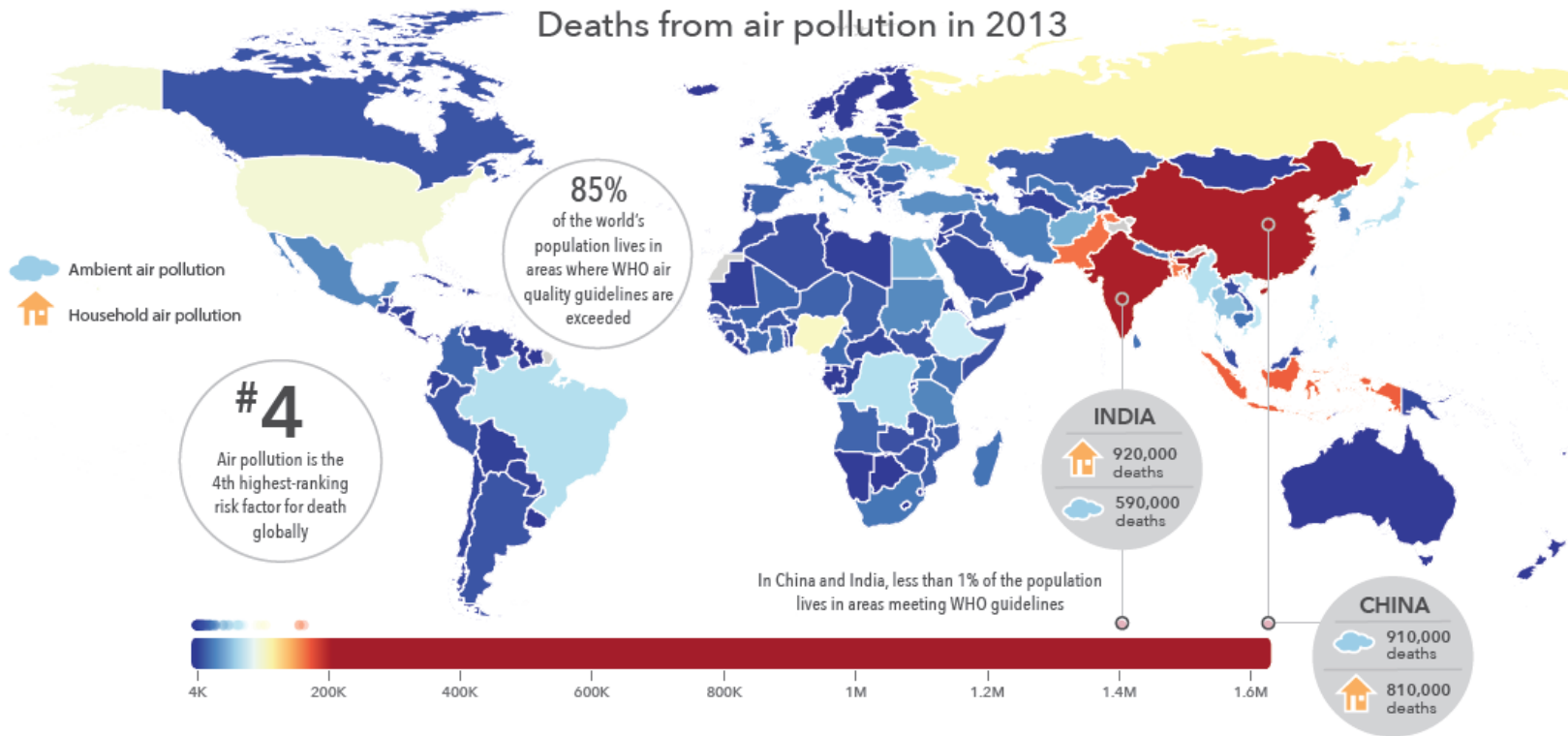
# HAP solid fuel emissions are a major source of ambient (outdoor) air pollution, particularly in India and China



- Household emissions contribute ~12% (4  $\mu\text{g}/\text{m}^3$ ) of global PM emissions
- In 3 regions (with ~4 billion people) the contribution ranges from 7-10  $\mu\text{g}/\text{m}^3$
- Contributes 27% of OAP in India
- Contributes 15% of OAP in China
- Residential woodsmoke is a major source of air pollution in North America and Europe
- Household emissions must be addressed along with other sources in order to meet ambient air quality standards



# Air Pollution was Responsible for 10% of All Deaths in 2013

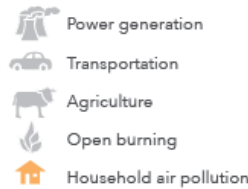


## Air pollution was responsible for 5.5 million deaths in 2013

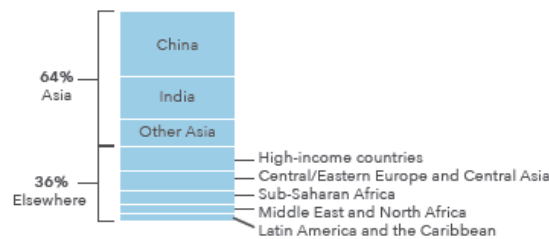
**Household air pollution**  
 Caused by burning solid fuels for heating and cooking, including:



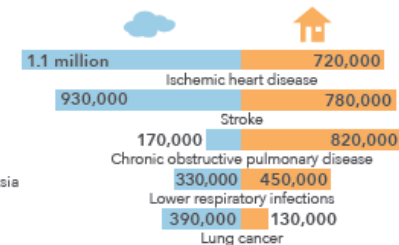
**Ambient air pollution**  
 Caused by emissions from things like:



2.9 million deaths from ambient air pollution in 2013



10% of all deaths were from air pollution in 2013



Source:

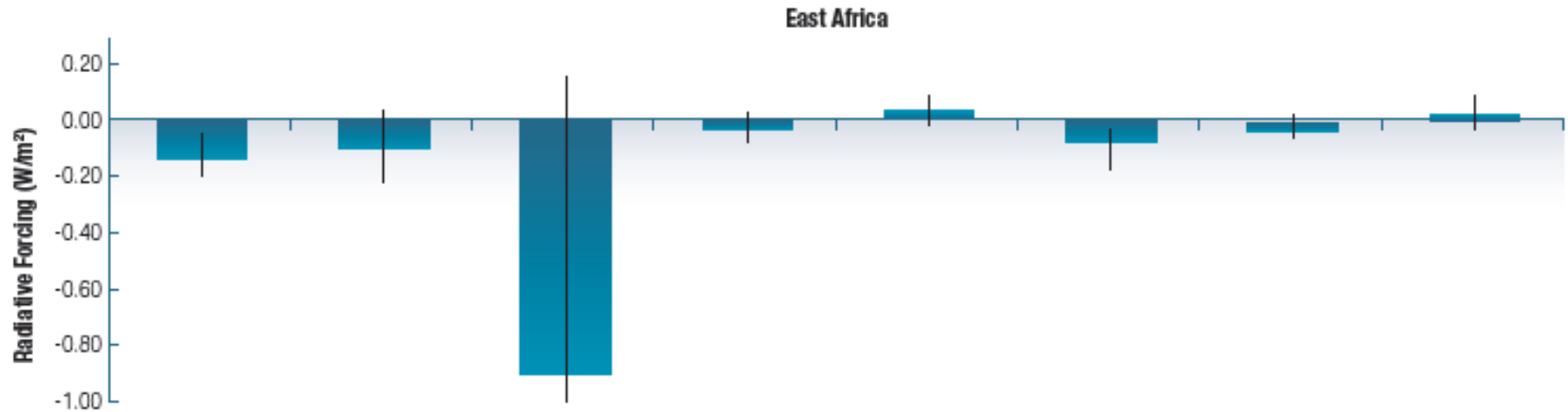
- Forouzanfar MH, et al. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2015 Dec 5;386(10010):2287-323.
- Brauer M, et al. Ambient air pollution exposure estimation for the Global Burden of Disease 2013. *Environmental Science & Technology*. 2016 Jan 5;50(1):79-88.



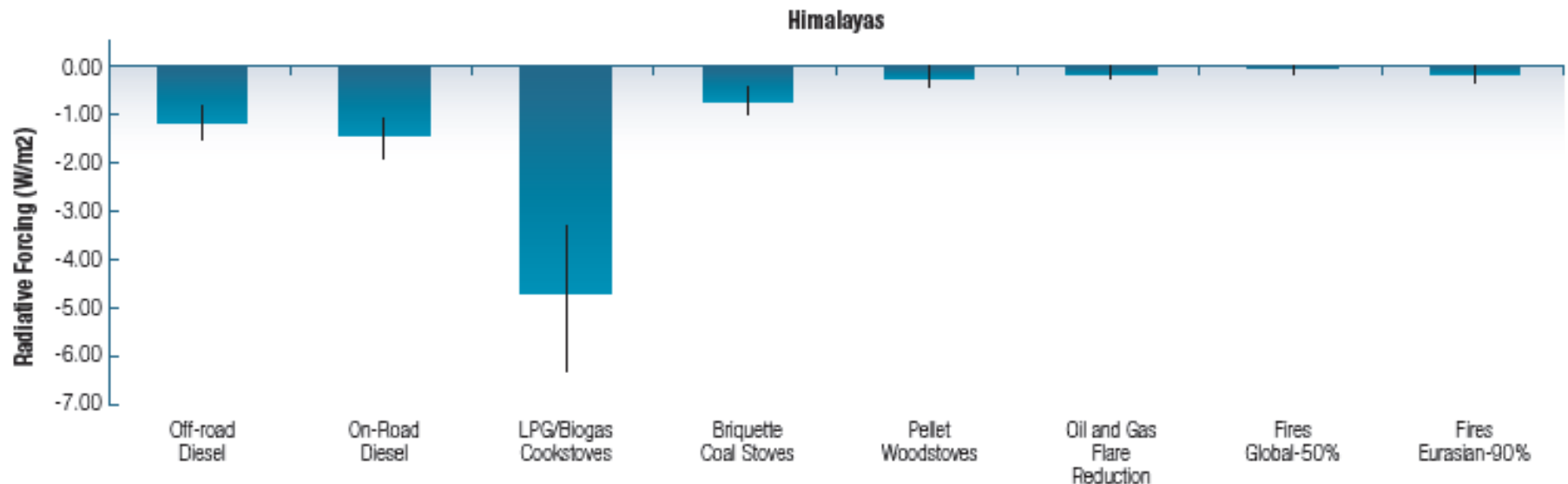
W UNIVERSITY of WASHINGTON

# Climate Impacts of HAP Emissions are Local and Regional

**Figure 8:** Average Radiative Forcing Estimates for East Africa from Black Carbon Emissions Reductions

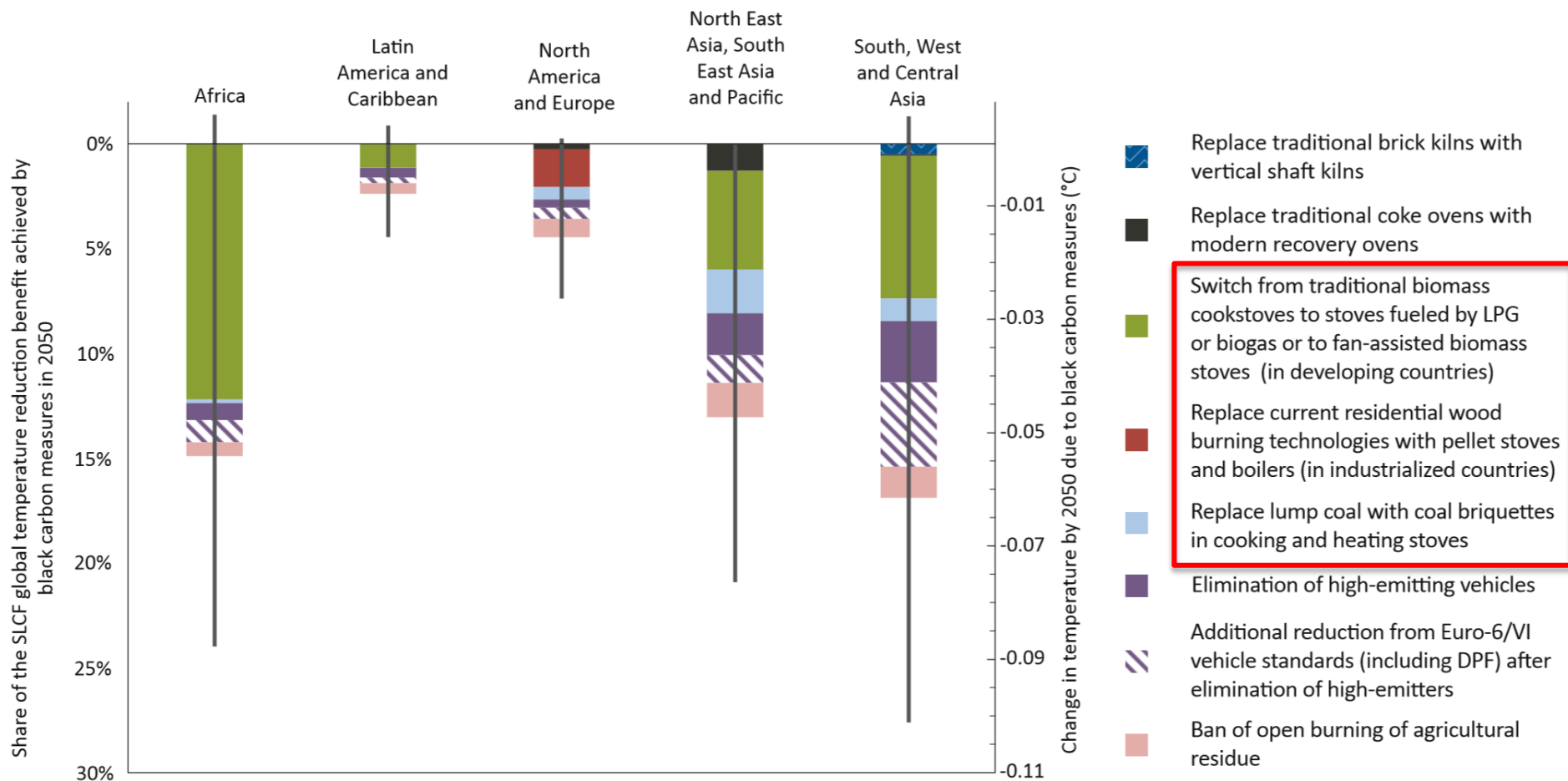


**Figure 6:** Average Radiative Forcing Estimates for the Himalayas for a Range of Potential Black Carbon Emissions Reductions





# HAP Interventions Can Reduce Warming from Black Carbon and Other SLCF



UNEP/WMO, 2011

# Clean Cooking Is Integral to Achieving Many Global Goals

1 NO POVERTY



Clean cooking is part of basic services necessary to lead a healthy and productive life and saves households time and money.

2 ZERO HUNGER



Efficient cookstoves reduce the amount of fuel needed to cook, thus reducing the burden on families who would otherwise have to collect it, buy it, or trade their food for it. **Emissions of short-lived climate pollutants from inefficient cooking also hamper agricultural productivity.**

3 GOOD HEALTH AND WELL-BEING



**Reducing smoke emissions from cooking decreases the burden of disease associated with household air pollution and improves well-being, especially for women and children.**

4 QUALITY EDUCATION



Children, especially girls, are often kept out of school so that they can contribute to household tasks, like cooking and collecting fuel.

5 GENDER EQUALITY



Unpaid work, including collecting fuel and inefficient cooking, remain a major cause of gender inequality.

7 AFFORDABLE AND CLEAN ENERGY



**Clean cooking is essential to addressing energy poverty and ensuring sustainable energy security for billions of people.**

8 DECENT WORK AND ECONOMIC GROWTH



Energy access enables enhanced productivity and inclusive economic growth. The clean cooking sector offers many job opportunities.

11 SUSTAINABLE CITIES AND COMMUNITIES



**Clean cooking addresses household and ambient air pollution, resource efficiency, and climate vulnerability.**

13 CLIMATE ACTION



Up to 25% of black carbon emissions come from burning solid fuels for household energy needs. **Clean cooking solutions address the most basic needs of the poor, while also delivering climate benefits.**

15 LIFE ON LAND



**Up to 34% of woodfuel harvested is unsustainable, contributing to forest degradation, deforestation, and climate change.**