Improvement of Residential Wood Combustion Emissions in the Southeastern U.S.

Byeong-Uk Kim, Georgia EPD
Tracy Anderson, Alabama DEM
John Van Bruggen, TranSystems
Andrew Bollman, Alpine Geophysics

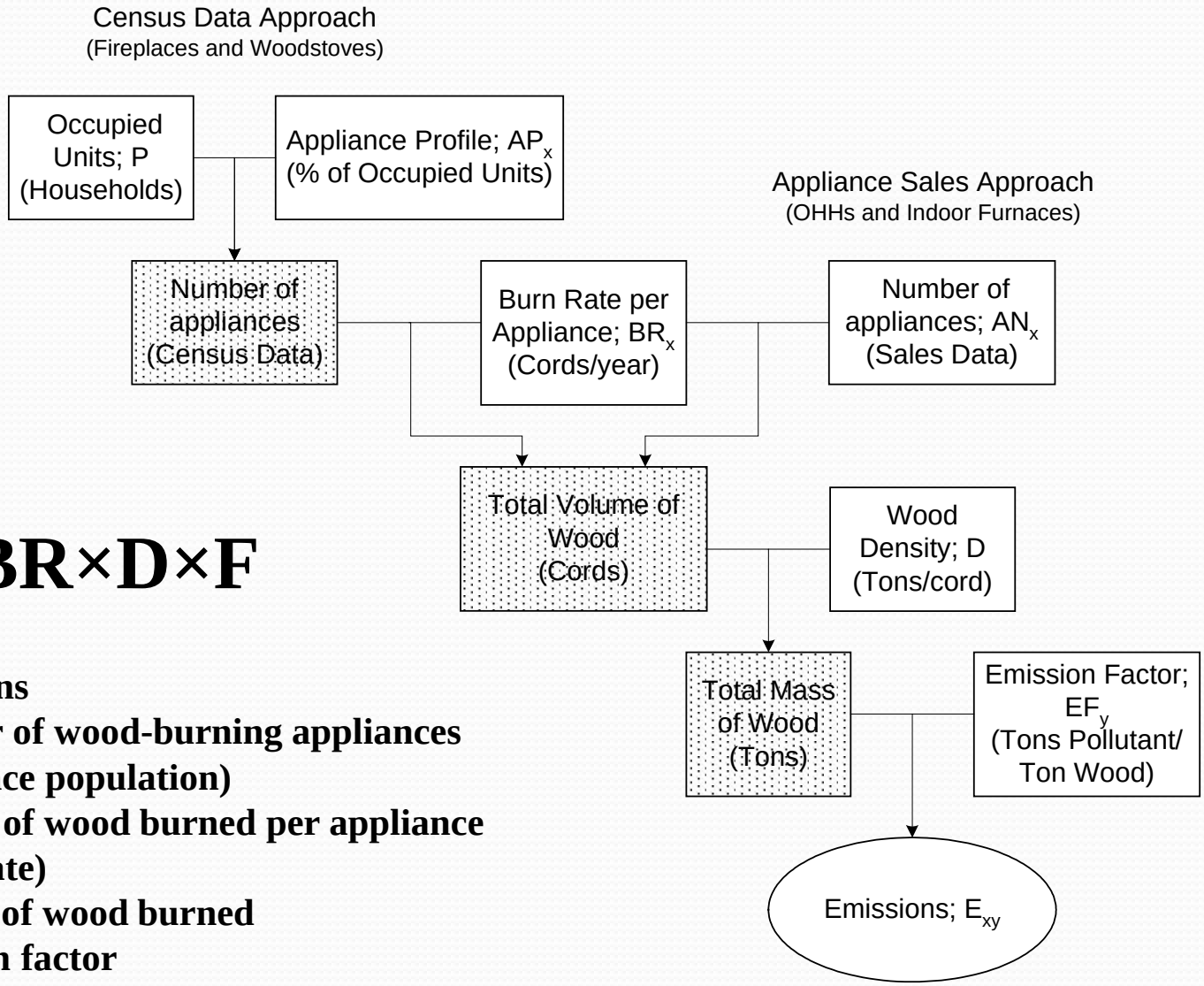
Outline

- Introduction
- Initial Results and Issues
- Revision to the EPA's RWC Tool
- Final Results

Residential Wood Combustion in Southeastern U.S.

- Major emission source in the southeastern U.S
  - 77,501 tons per year of primary PM2.5 emissions (VISTAS 2002)
  - 15 % of the total anthropogenic non-point source PM2.5 emissions in the region
- EPA's Residential Wood Combustion (RWC) Tool for 2008 NEI
  - Tool for SEMAP 2007 Emission Inventory
  - Sets of tables and queries in MS Access DB

EPA's RWC Tool



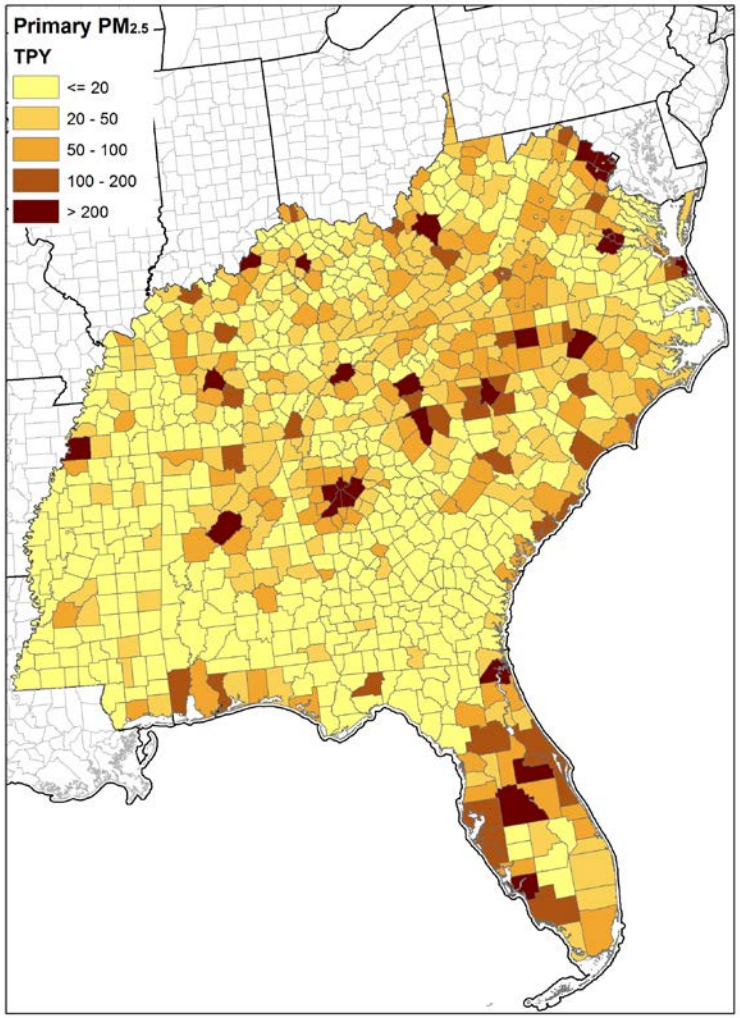
$$E = N \times BR \times D \times F$$

Where,

- **E = Emissions**
- **N = Number of wood-burning appliances (i.e., appliance population)**
- **BR = Cords of wood burned per appliance (i.e., burn rate)**
- **D = Density of wood burned**
- **F = Emission factor**

Initial Results and Issues

- Results with 2007 activity data
- High emissions from urban/sub-urban areas
- High emissions from warm areas such as Southern FL
- Potential overestimation of annual RWC emissions based on a past modeling study (Di, et al., 2009)



(b) EC and OM performance statistics

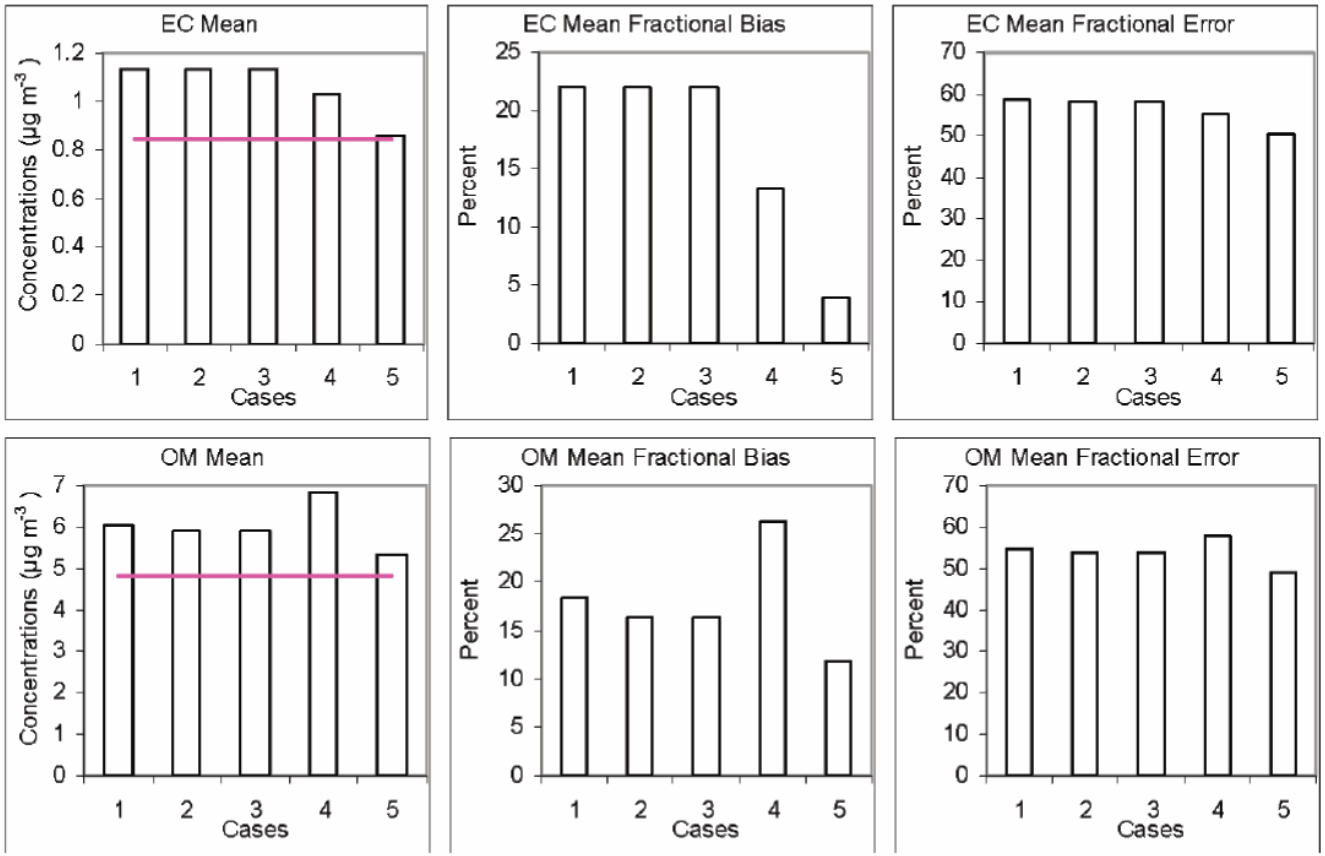
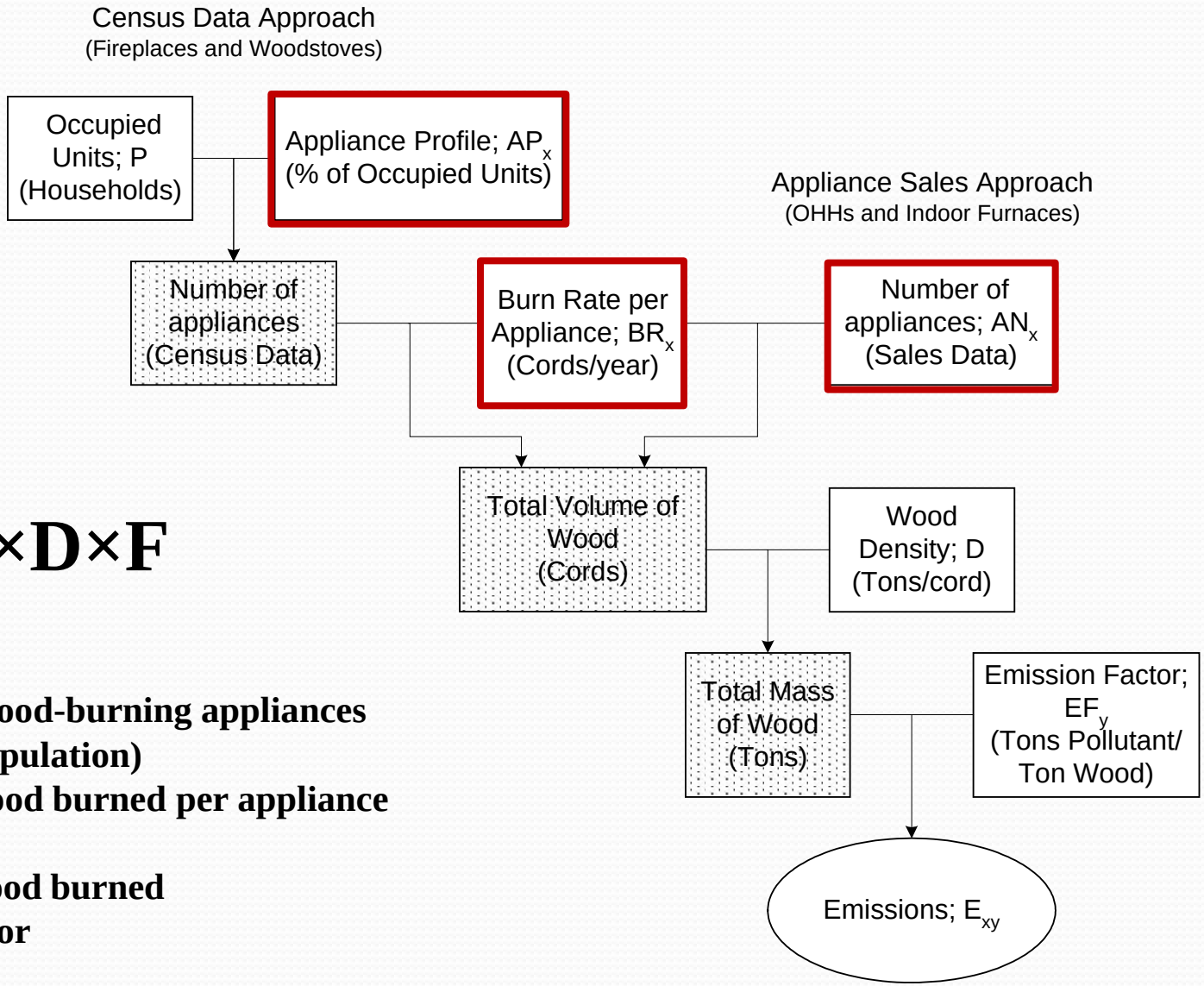


FIGURE 2. $PM_{2.5}$ simulations with different biomass burning emission inventories. (a) Monthly average POA emissions (upper row, g/s) and simulated concentrations (lower row, μg m^{-3}) using three different biomass burning emission inventories during January 2002. Monthly average values are used since allocation of emissions from prescribed burning, agriculture field burning, and land clearing are not day-dependent by default in SMOKE. (b) Mean, mean fractional bias, and error for EC and OM with different emission inventories and speciation methods during January 2002: case 1, simulations with the EPA2001 emission inventory; case 2, simulations with the VISTAS2002 emission inventories; case 3, simulations with the MONTHLY emission inventory; case 4, simulations with the MONTHLY emission inventory and updated speciation profiles; and case 5, simulation with the MONTHLY emission inventory and updated speciation profiles, as well as 90% reduction in RWC emissions. The horizontal lines are the mean of EC and OM observations.

Di, et al. (2009)

Updates to EPA's RWC Tool



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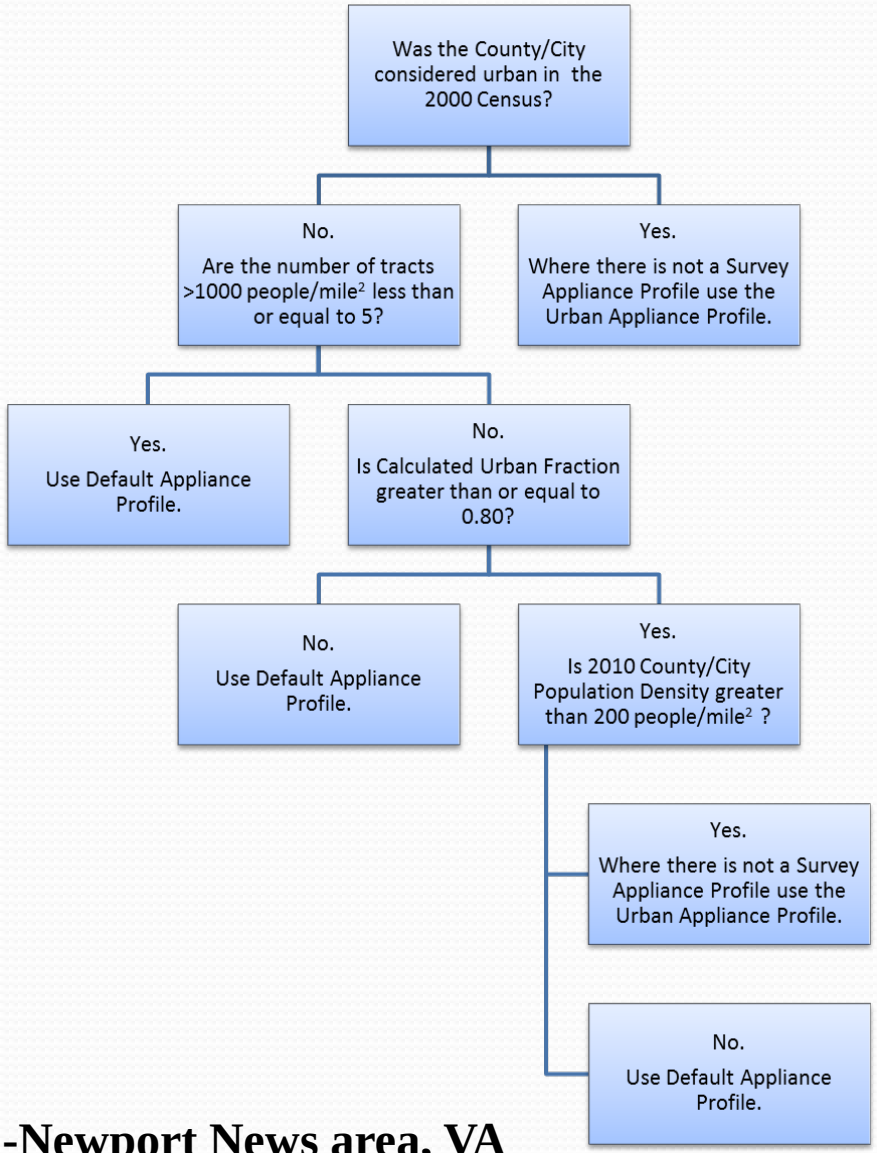
Appliance Population Updates

- Revising the occupied unit calculations
- Incorporating region-specific appliance profile adjustments based on the estimated proportion of Main Heating and Other Heating appliances that do not burn wood
- Integrating "sub-MSA" area profiles for the 11 MSAs
- Including a default urban appliance profile based on national urban values reported by the 2005 AHS for urbanized areas without survey data such as Greensboro, NC
- Revising estimated pellet stove, indoor furnace, and hydronic heater counts based on the updated woodstove counts developed in the revised Tool

Revised Appliance Profile



Sub-MSA specific profiles:

- **Birmingham, AL**
- **Miami-Dade County, FL**
- **Urban Atlanta, GA**
- **Kenton County, KY**
- **De Soto County, MS**
- **Gaston County, NC**
- **Mecklenburg County, NC**
- **York County, SC**
- **Shelby County, TN**
- **Fairfax County, VA**
- **Urban Norfolk-Virginia Beach-Newport News area, VA**

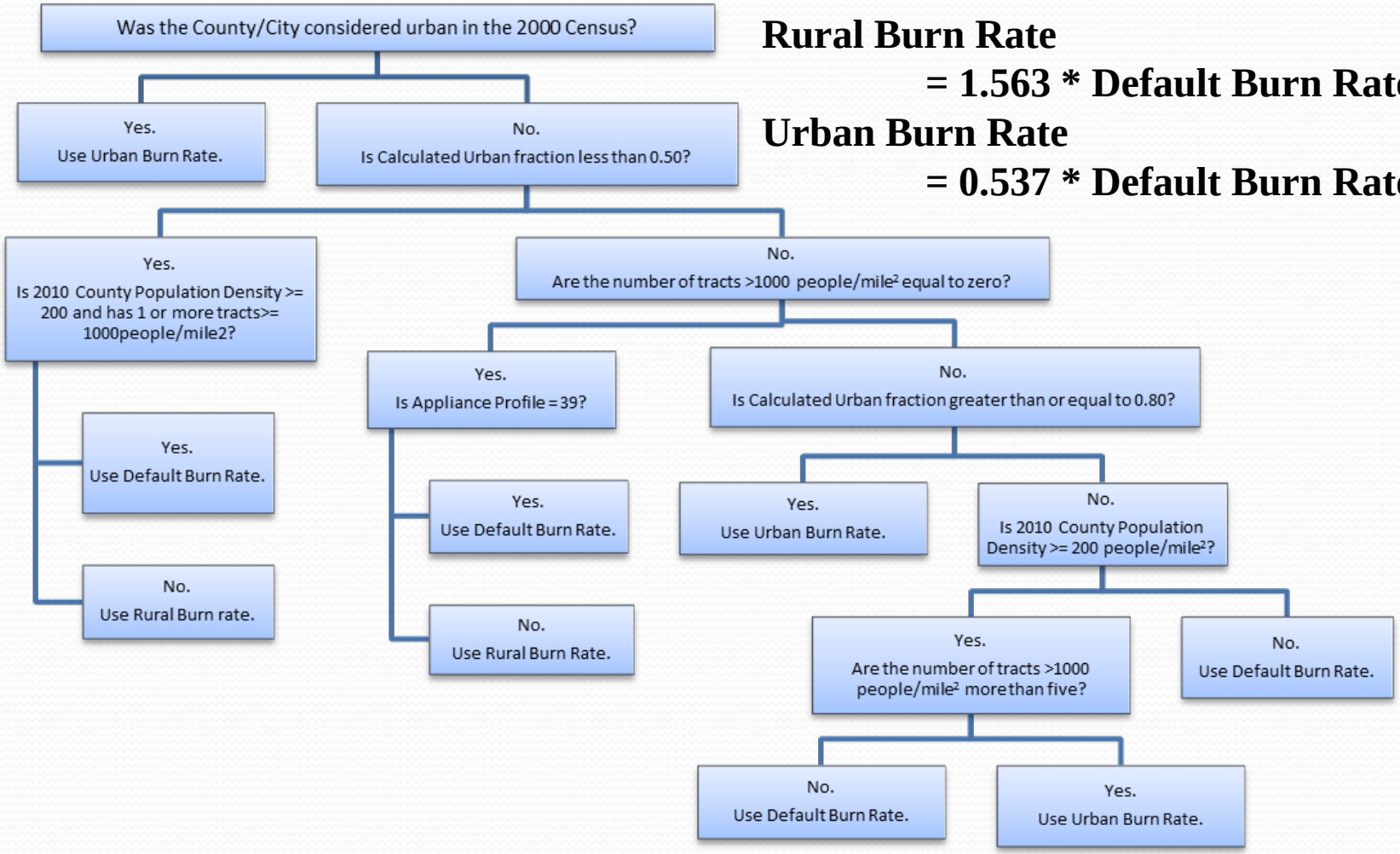
Revised Appliance Population

- Hard-coded appliance population in the Tool
  - Pellet stoves and Hydronic heaters (outdoor wood boilers)
  - Indoor furnaces
  - County-level woodstove population dependency to be consistent with the original Tool
- Pellet stoves and hydronic heaters
  - State-level appliance population from cumulative sales data
  - County-level population proportional to the updated woodstove population estimates
- Indoor furnaces
  - Applying EPA factor (0.53) to the updated woodstoves population

Burn Rate Updates

- Calculating two wood consumption per household ratios for Rural to Total (1.563) and Urban to Total (0.537)
- Revising the Tool's default burn rates profiles for the SEMAP region climate zones based on these ratios
- Identifying the criteria for assigning the Rural, Urban, and overall average burn rates (the original burn rate for a given climate zone) to each county within a climate zone.

Revised Burn Rate

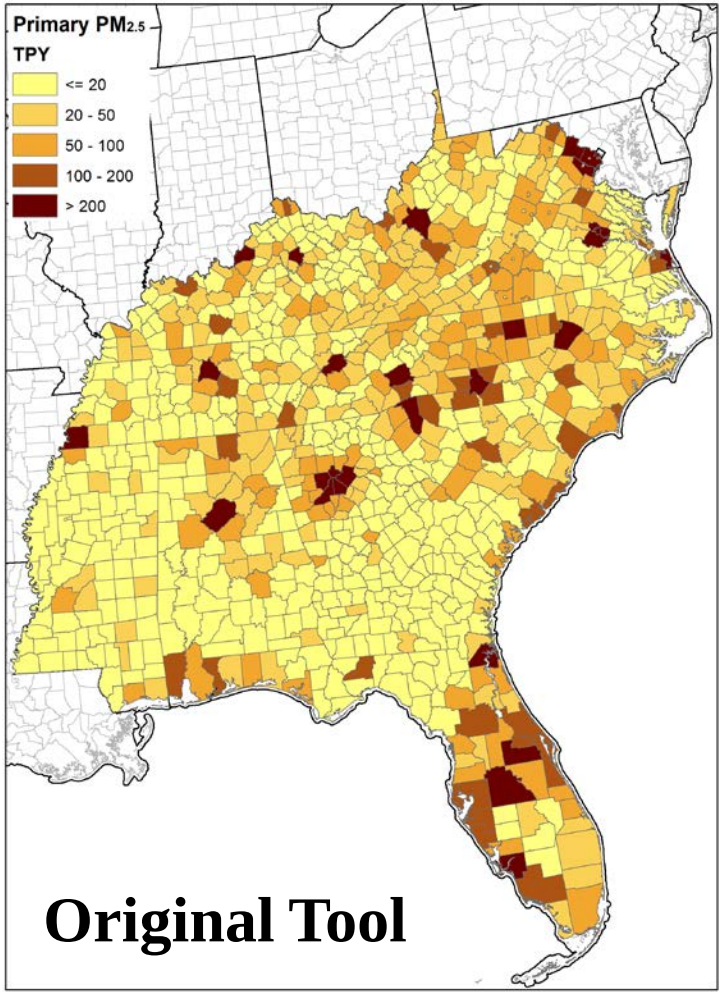


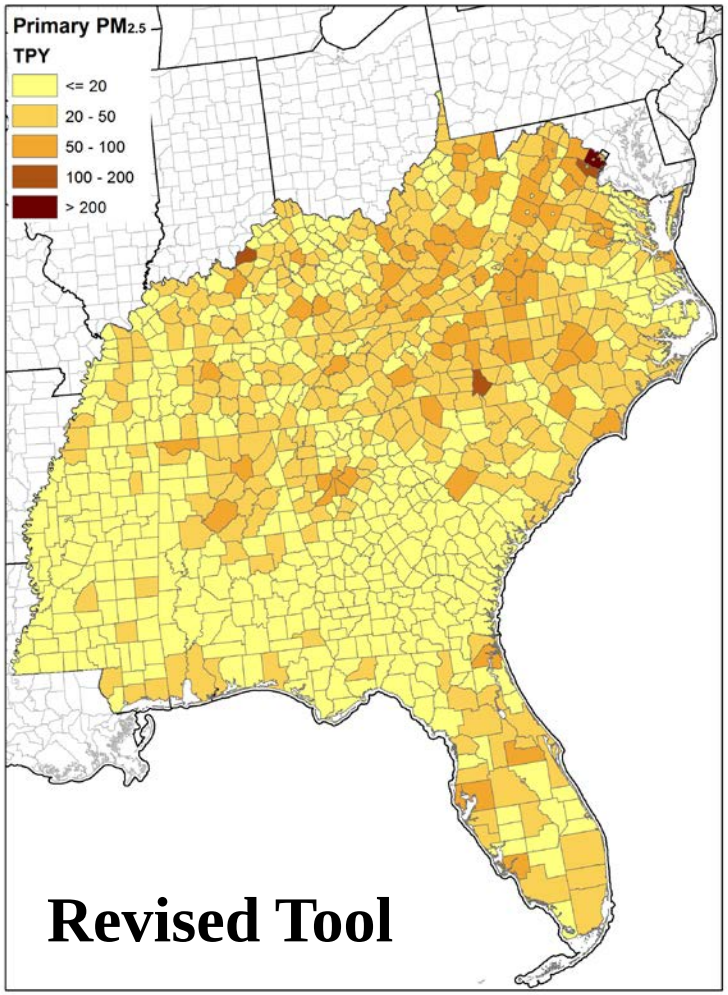
Rural Burn Rate
= 1.563 * Default Burn Rate

Urban Burn Rate
= 0.537 * Default Burn Rate

Results

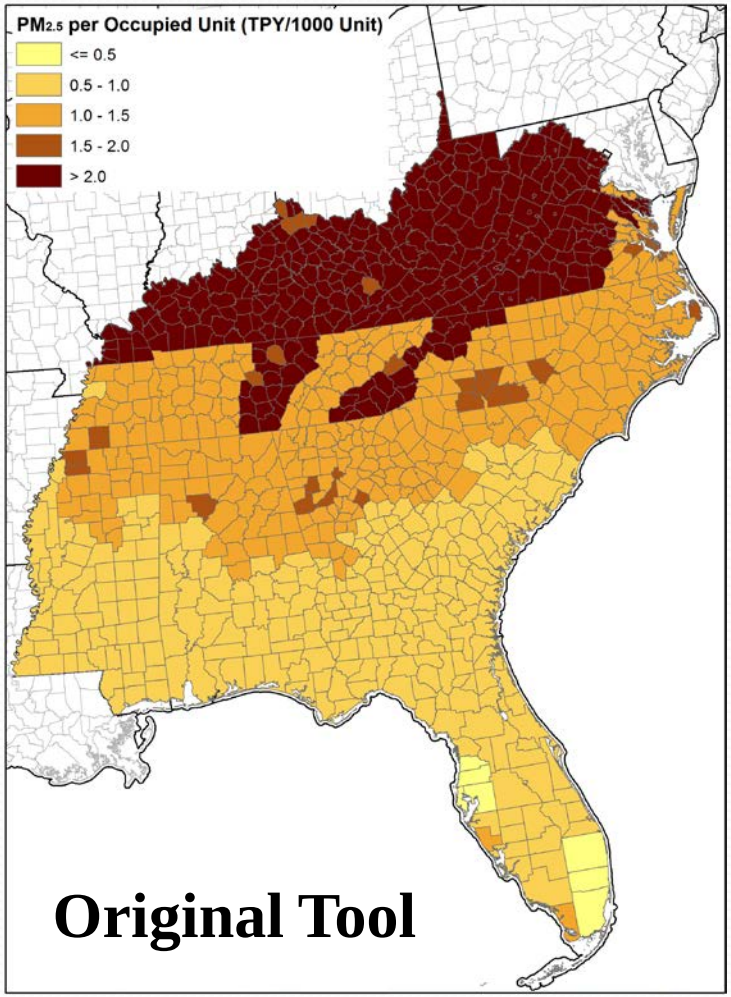
- 74 % reduction in NOx, 62 % reduction in VOCs, and 59 % reduction in Primary PM2.5

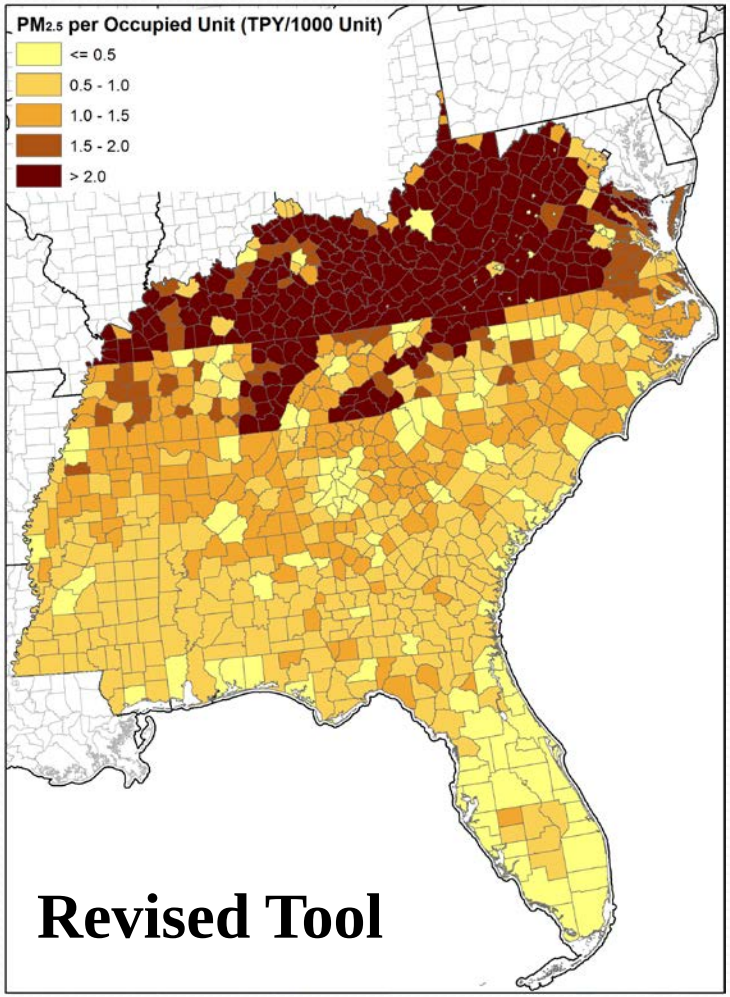




Results

- Great reduction of PM2.5 emissions per occupied units in urban areas and warm regions





Contact Information

Byeong-Uk Kim, Ph.D.
Georgia Dept. of Natural Resources
4244 International Parkway, Suite 120
Atlanta, GA 30354

Byeong.Kim@dnr.state.ga.us
404-362-2526