

**Critical Review of Mobile Emissions from EPA
2011 NEI: Part Four –
Extended Idling and its Spatial Allocations**

**Georgia Department of
Natural Resources**

**Virginia Department of
Environmental Quality**

**MARAMA MOVES Workgroup Conference Call
March 3, 2014**

Background

■ Inventory MOVES

- **Extended idling emissions (EXT) based on diesel combination long haul trucks (all counties)**

■ USEPA 2011/2018 Modeling Platform

- **EPA OTAQ released a document describing their EXT methodology in February 2014**

■ Methodology

- **Total national long haul extended idle activity estimation based on long haul truck VMT**
 - **Temporal allocation: Long haul truck operating hours**
 - **Spatial allocation: Counties with interstates along with state demand for truck parking**

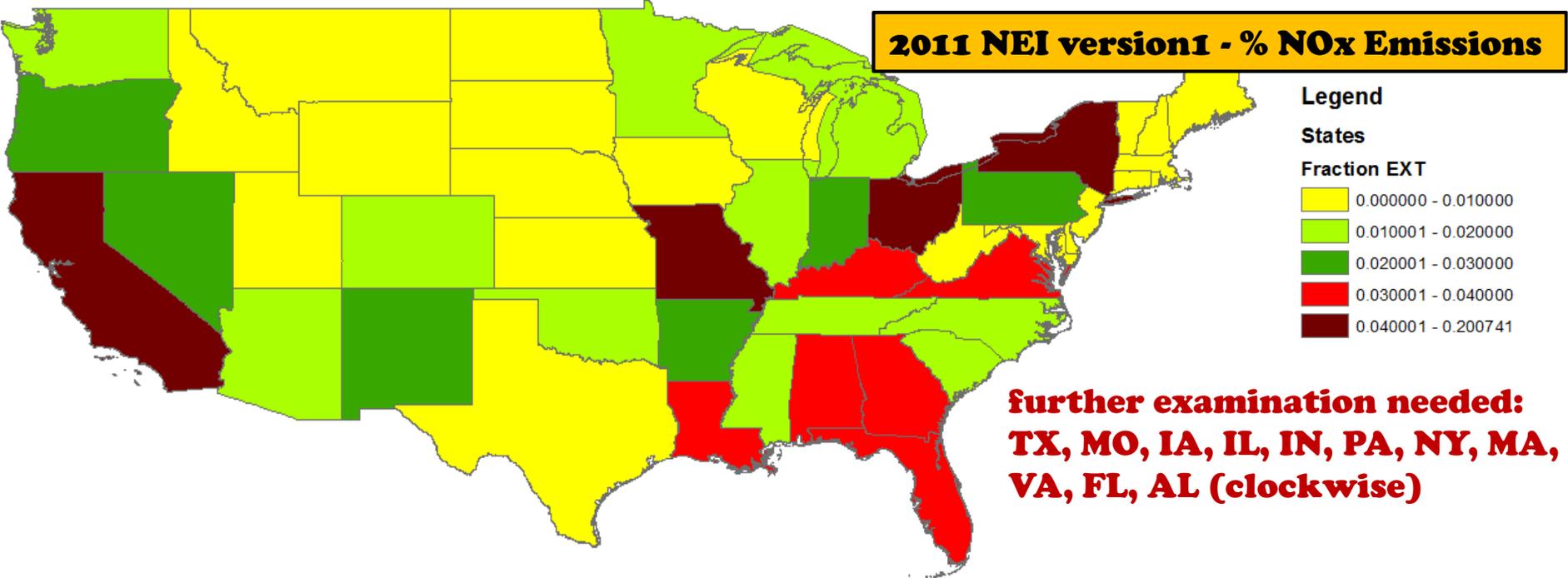
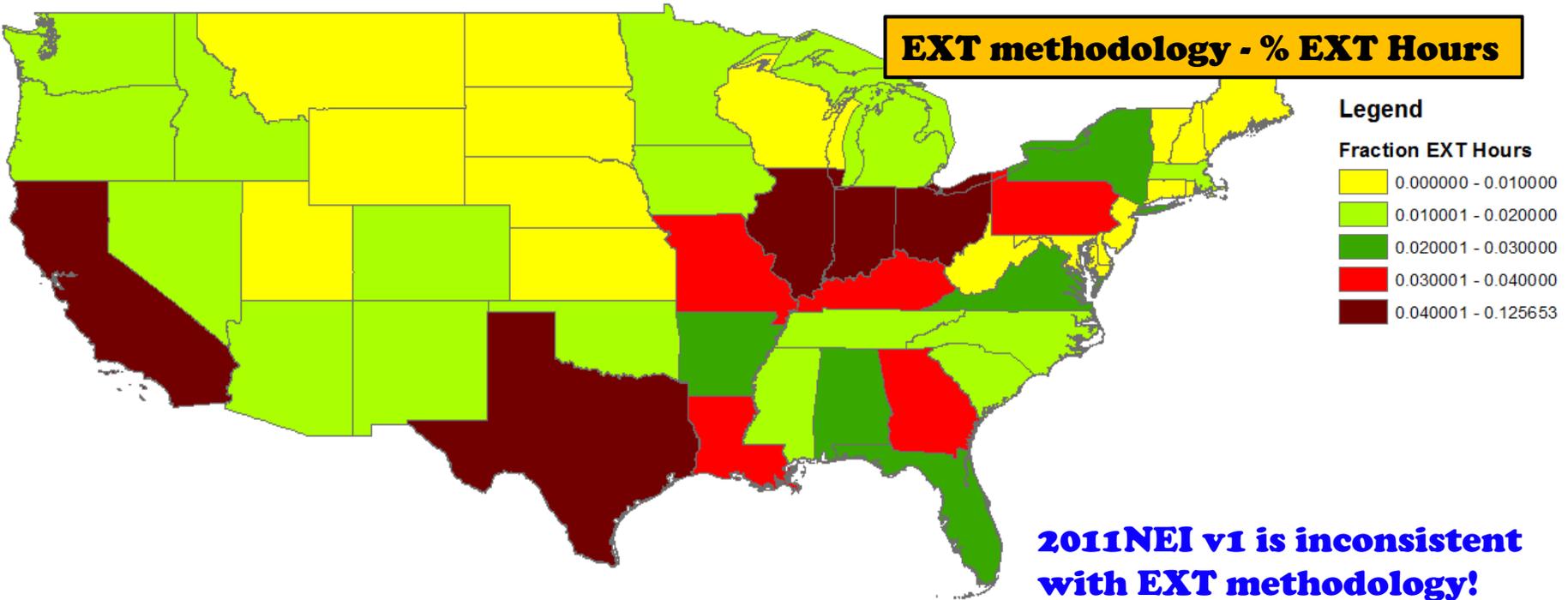
Spatial Allocations

- **National EXT activity must be allocated spatially to calculate emissions for use in air quality models (such as CMAQ):**
 - **Allocation to state -- SMOKE-MOVES EXT methodology**
 - **Allocation to county -- SMOKE-MOVES EXT methodology**
 - **Allocation to model grid cell – SMOKE surrogates**

Allocation to States

- **The table “Demand for Overnight Parking by State” in EPA’s EXT methodology lists distribution of national idle hours allocated to each state**
- **2011 NEI version1 contains EXT NO_x for each state**

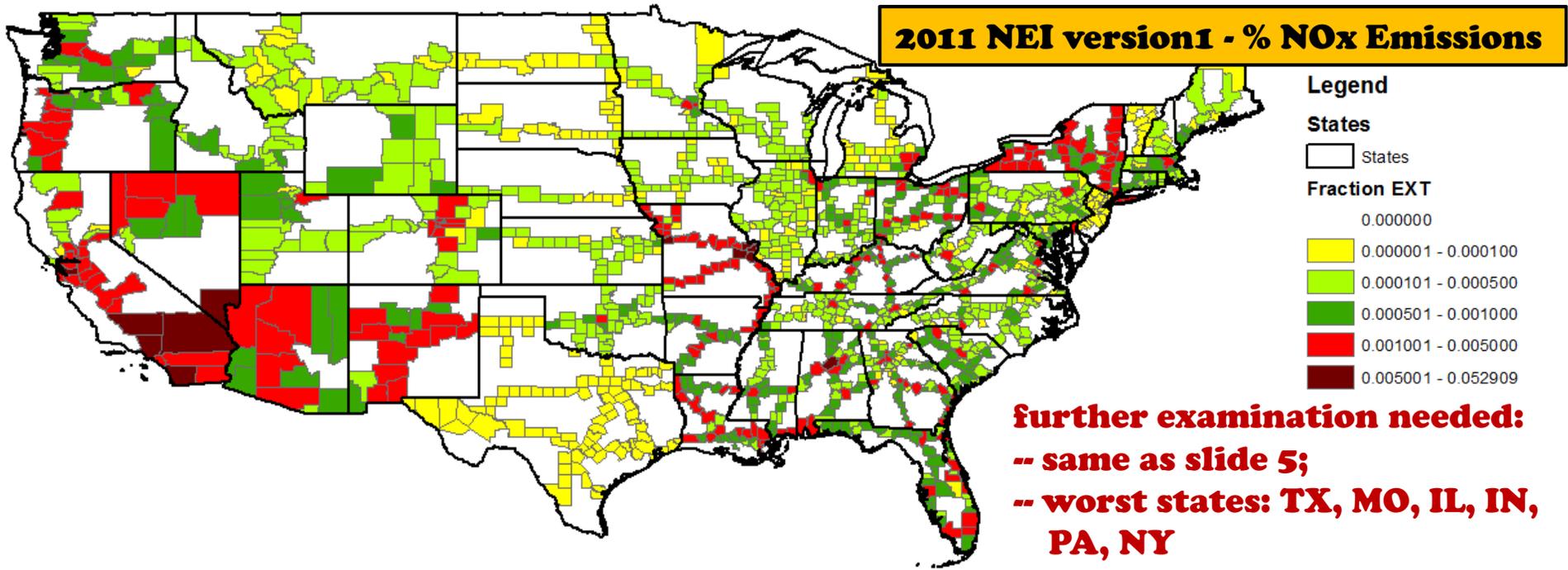
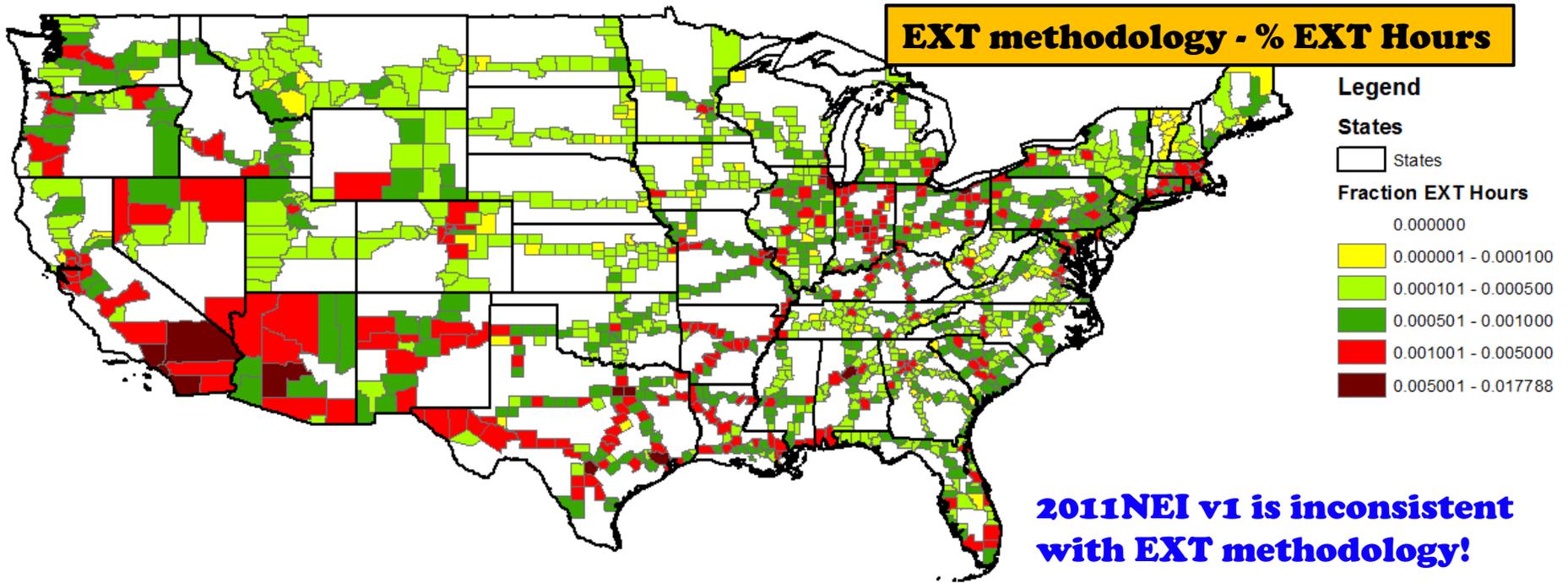
Evaluation: Compare fractional EXT idle hours from EPA’s EXT methodology with fractional NO_x in 2011 NEI version1

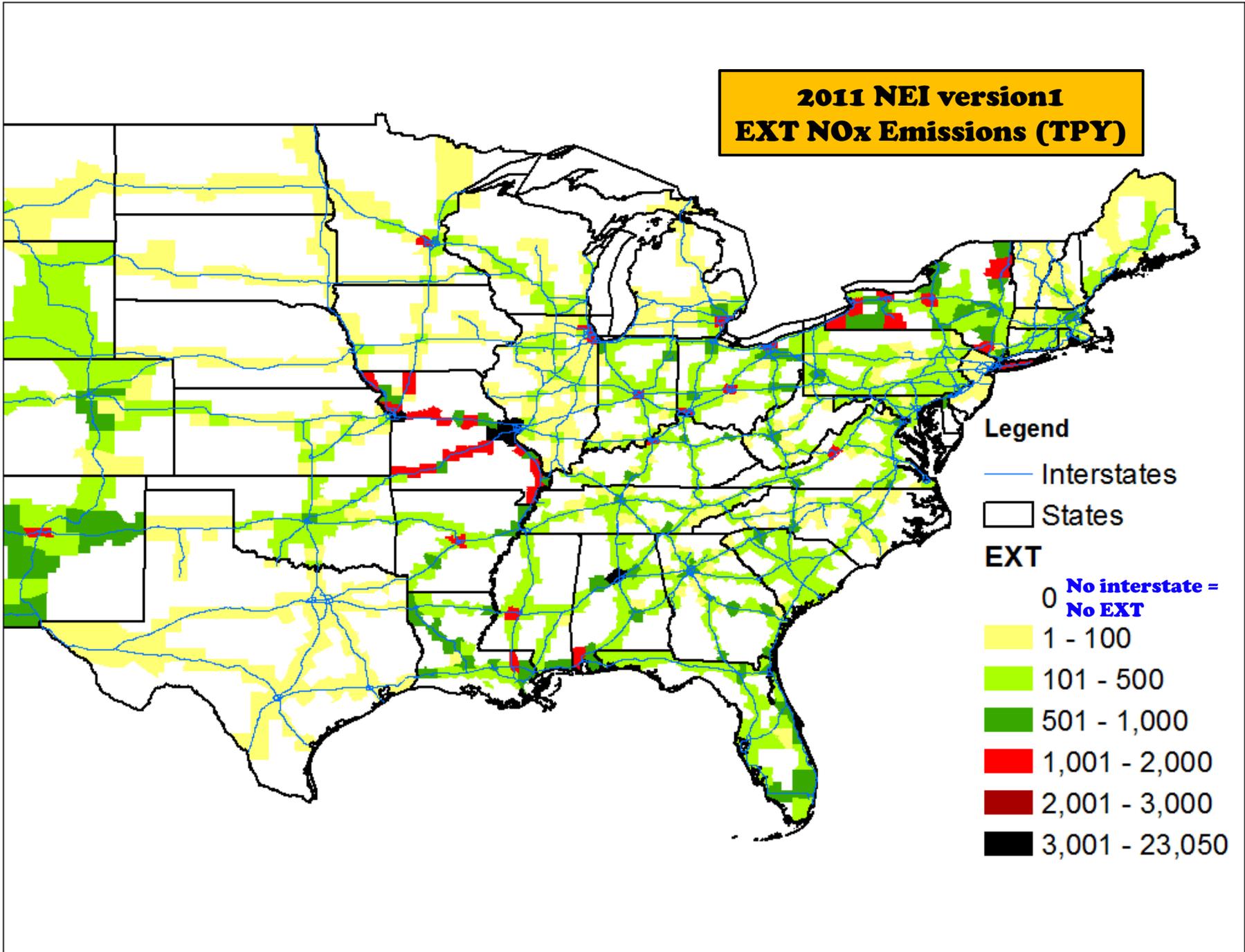


Allocation to Counties

- **According to EPA's EXT methodology, allocation factors used to assign national idle hours to each county are stored in idleAllocFactor**
- **2011 NEI version1 contains EXT NOx for each county**

Evaluation: Compare fractional idle hours in MOVES Zone table of default database (movesdb20121030) with fractional EXT NOx in 2011 NEI version1





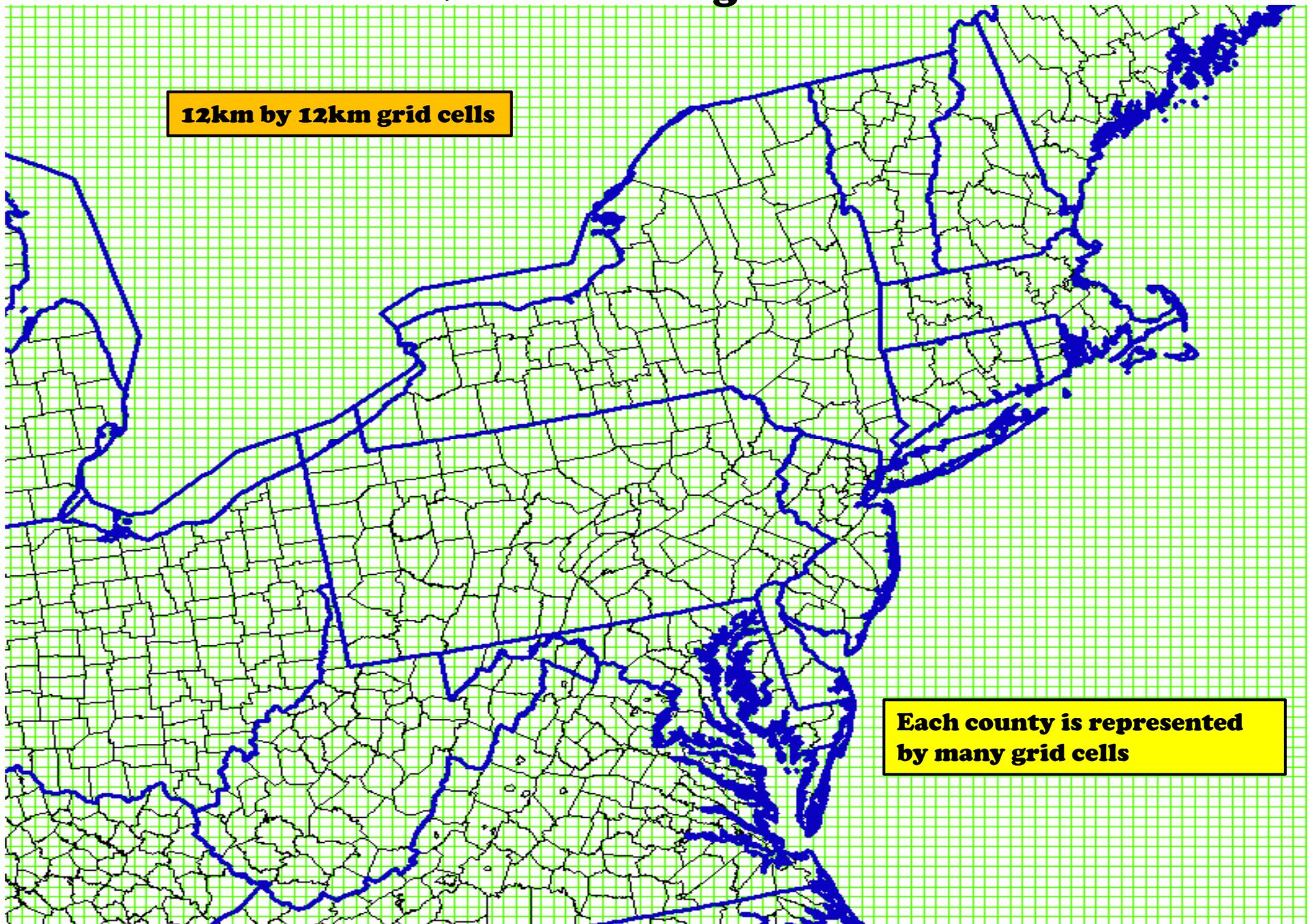
Allocation to Grid Cells

- **Allocation to grid cells is implemented in SMOKE-MOVES by use of “surrogates”**

Model	EXT
SMOKE-MOVES	Human population (HPOP) is used to allocate county-level EXT to grid cells

Issue: Parameters affecting EXT are inconsistent among the models (MOVES and SMOKE-MOVES)!

12km Modeling Grids

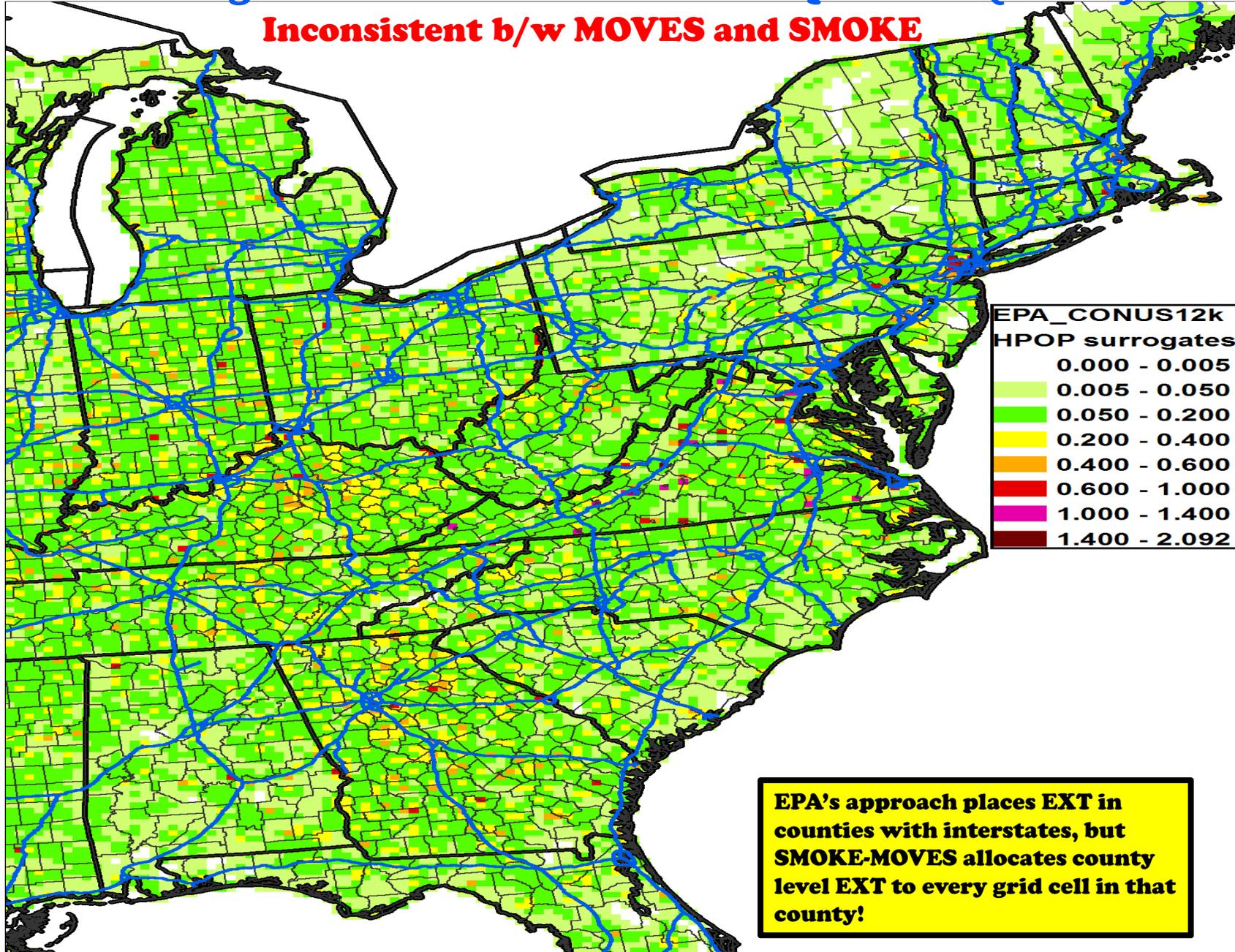


12km by 12km grid cells

Each county is represented by many grid cells

EXT Surrogates in 2011NEI -- Human Population (HPOP)

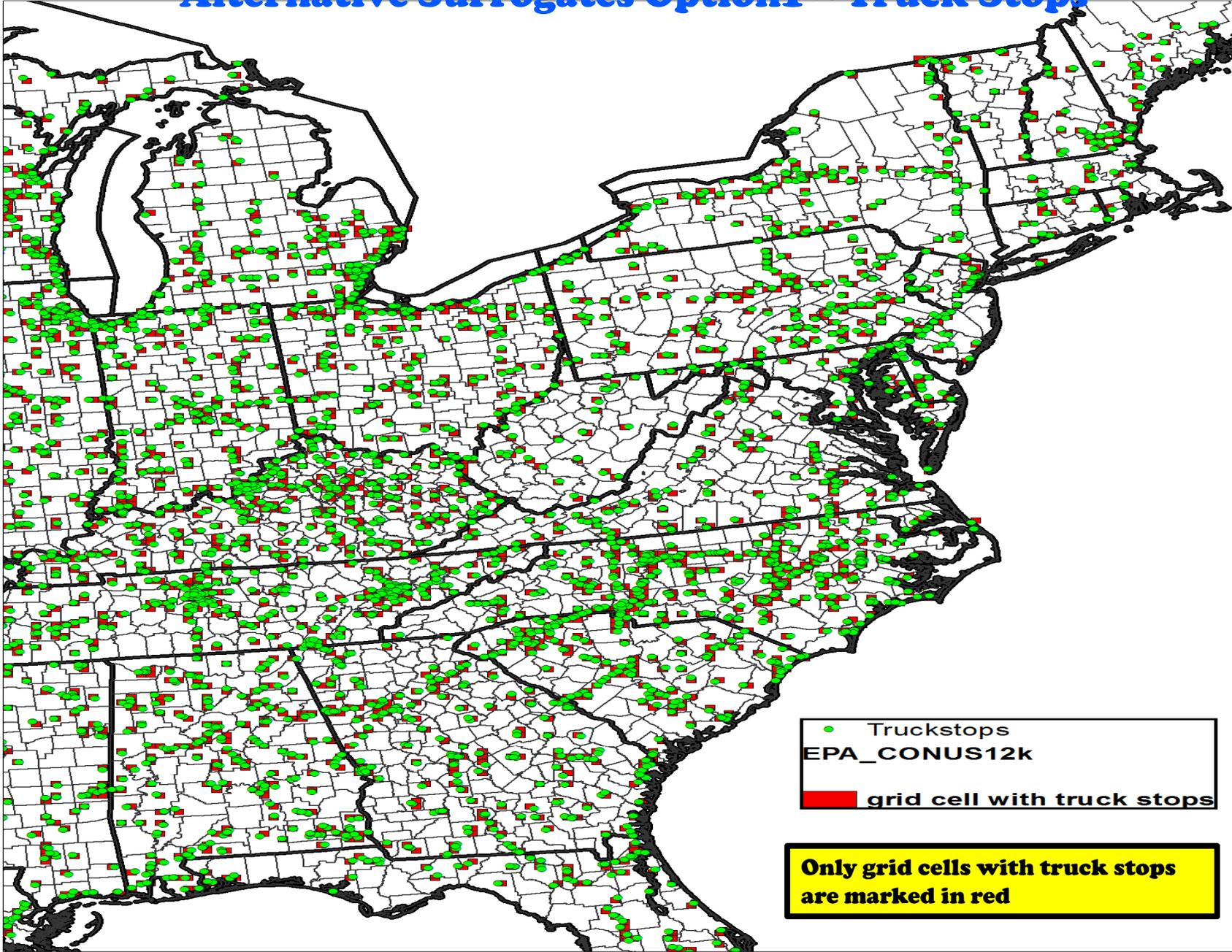
Inconsistent b/w MOVES and SMOKE



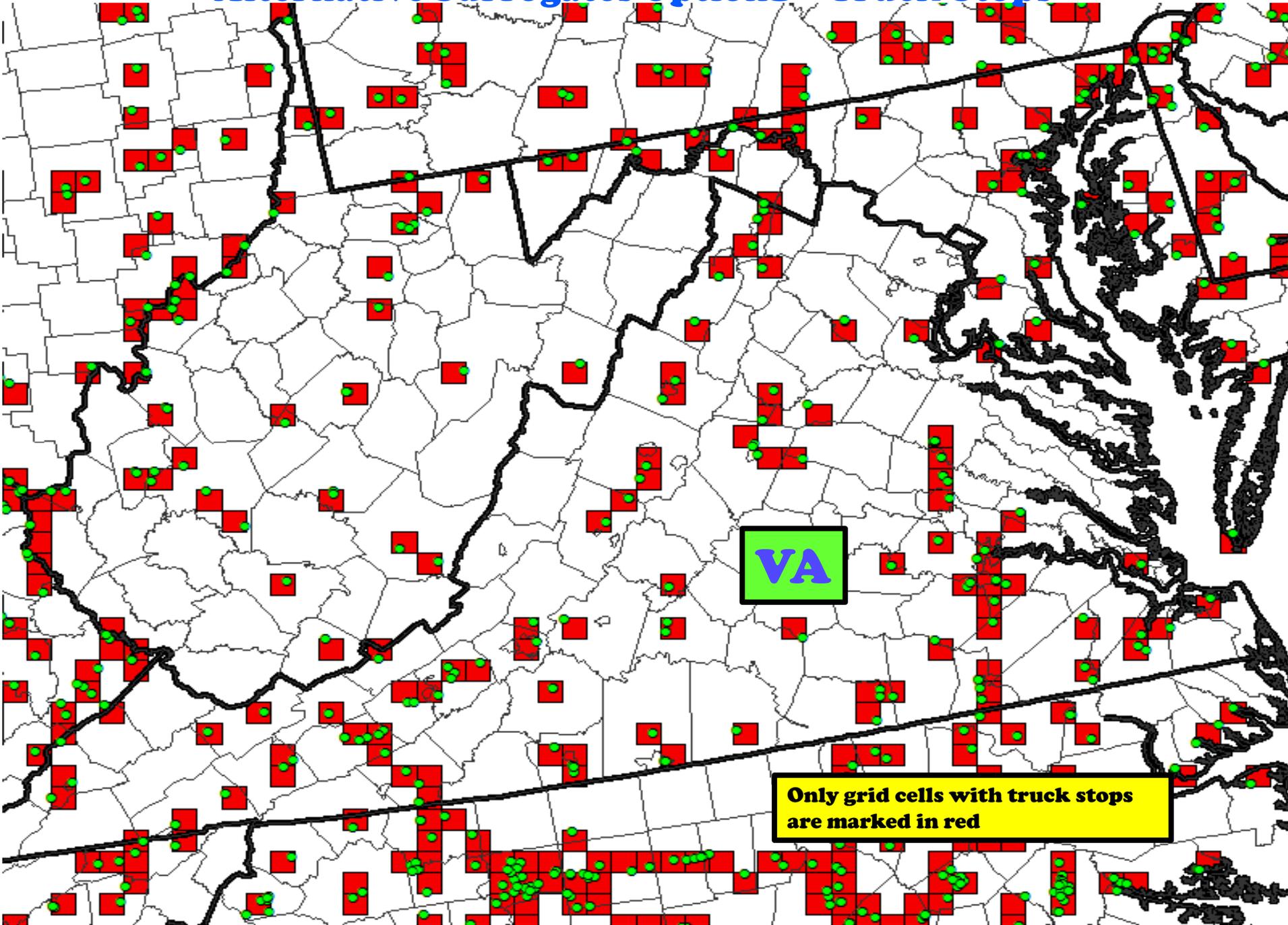
Alternative Surrogates

- **If we allow EXT emissions in counties that do not have interstates, we are proposing the following surrogate:**
 - **Option1: truck stops**
- **If we follow the EPA EXT methodology (only allow EXT emissions in counties that have interstates), we are proposing two alternative surrogate options:**
 - **Option2: interstates**
 - **Option3: truck stops on interstates**

Alternative Surrogates Option1 - Truck Stops

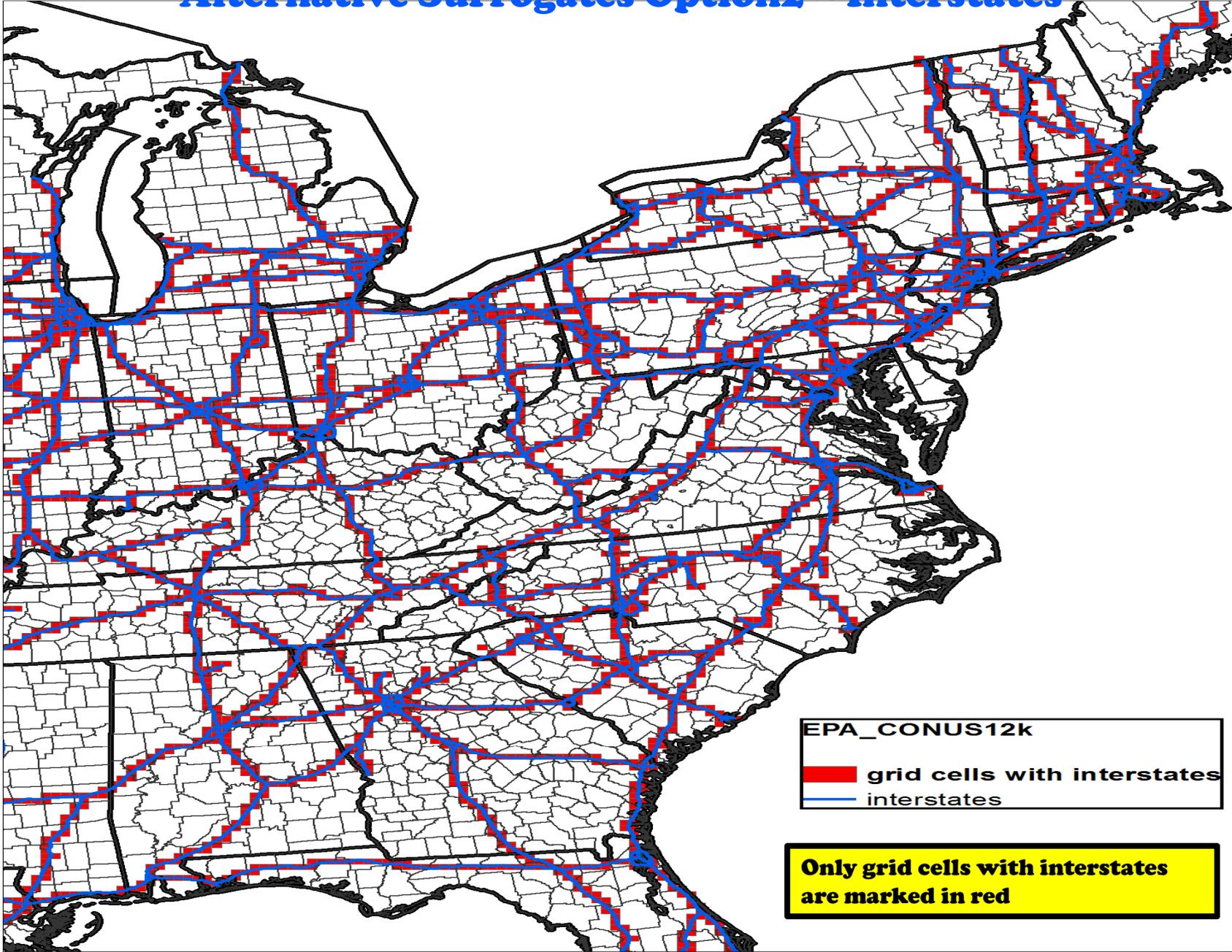


Alternative Surrogates Option1 - Truck Stops



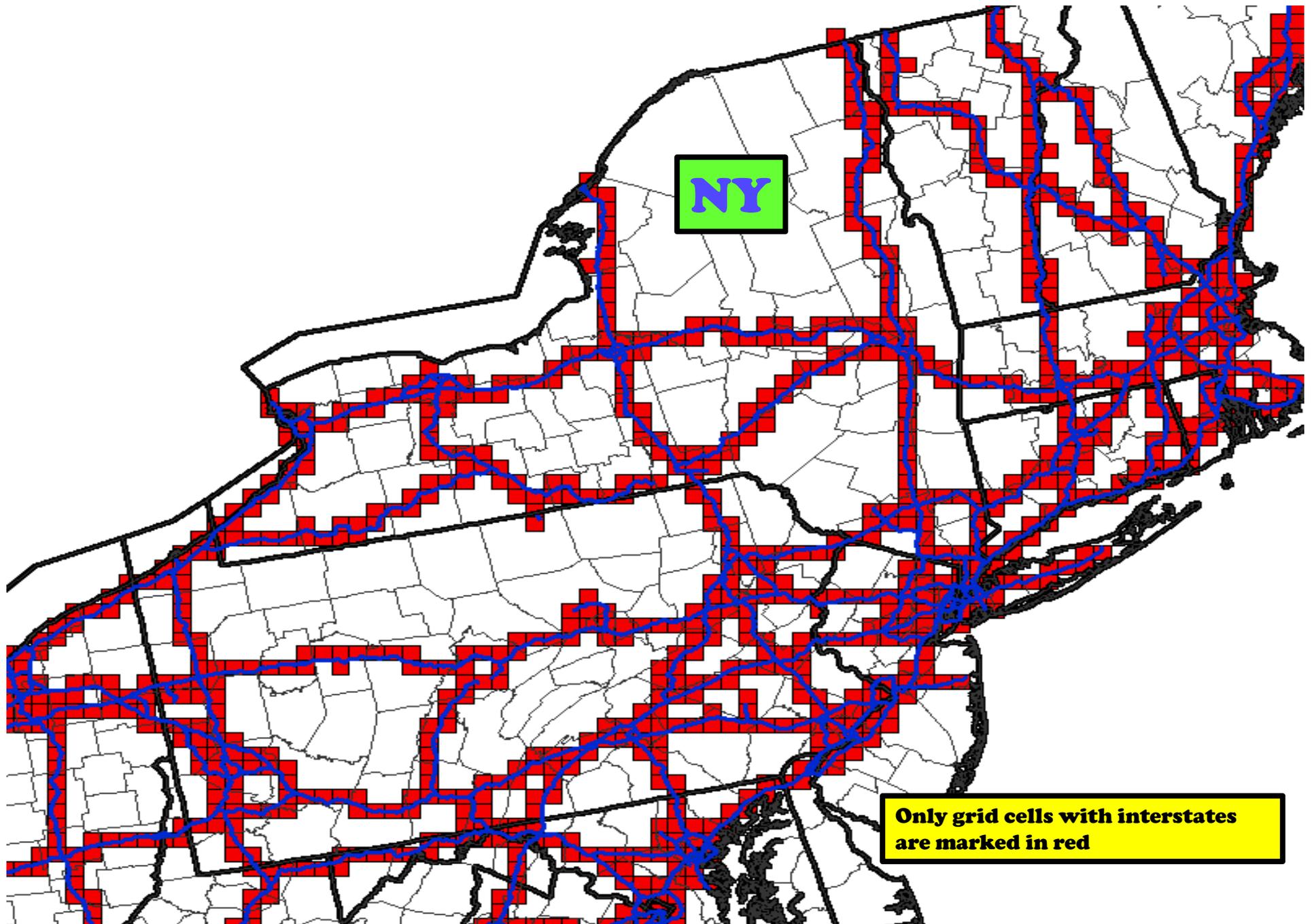
Only grid cells with truck stops are marked in red

Alternative Surrogates Option2 - Interstates



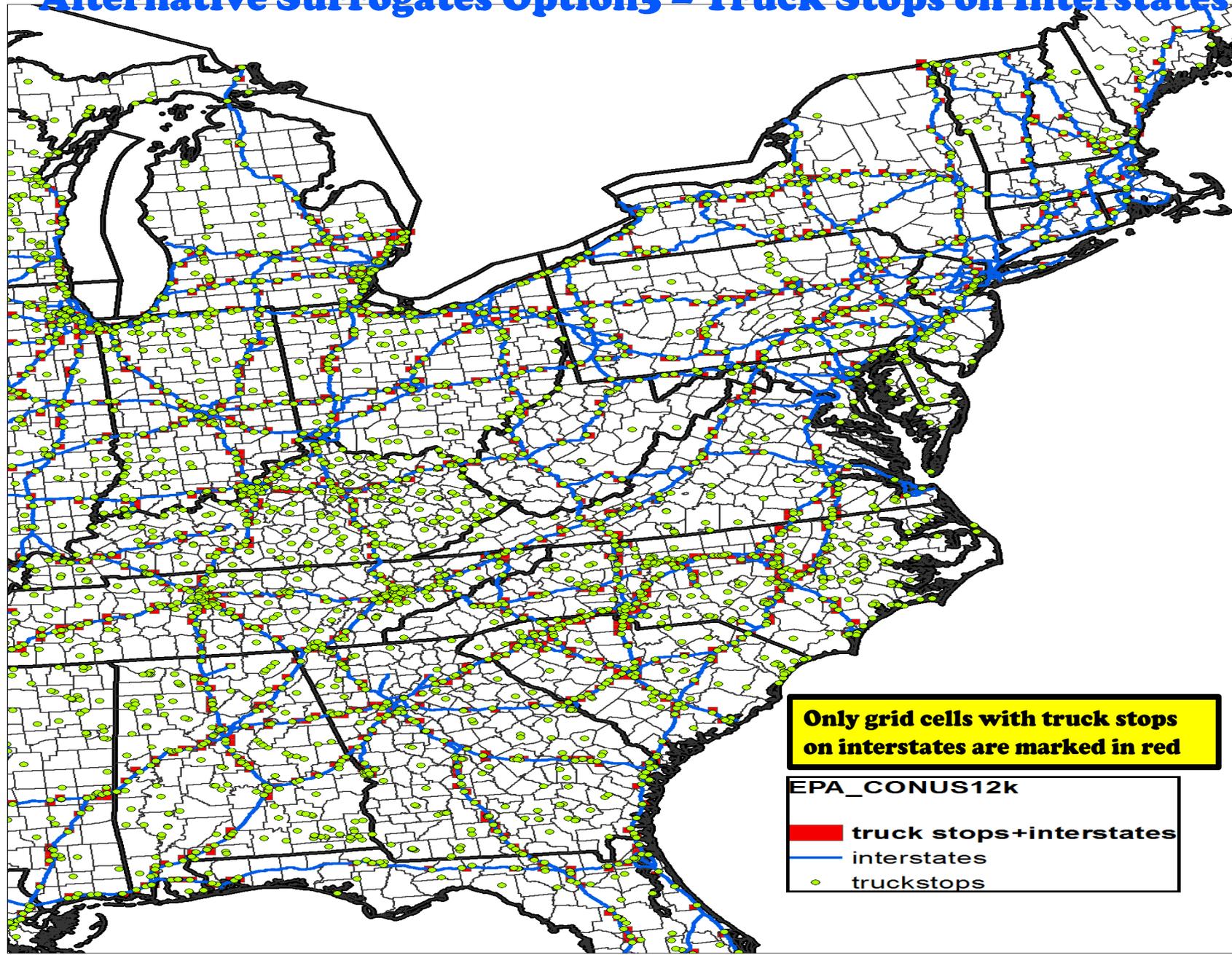
Alternative Surrogates Option2 - Interstates

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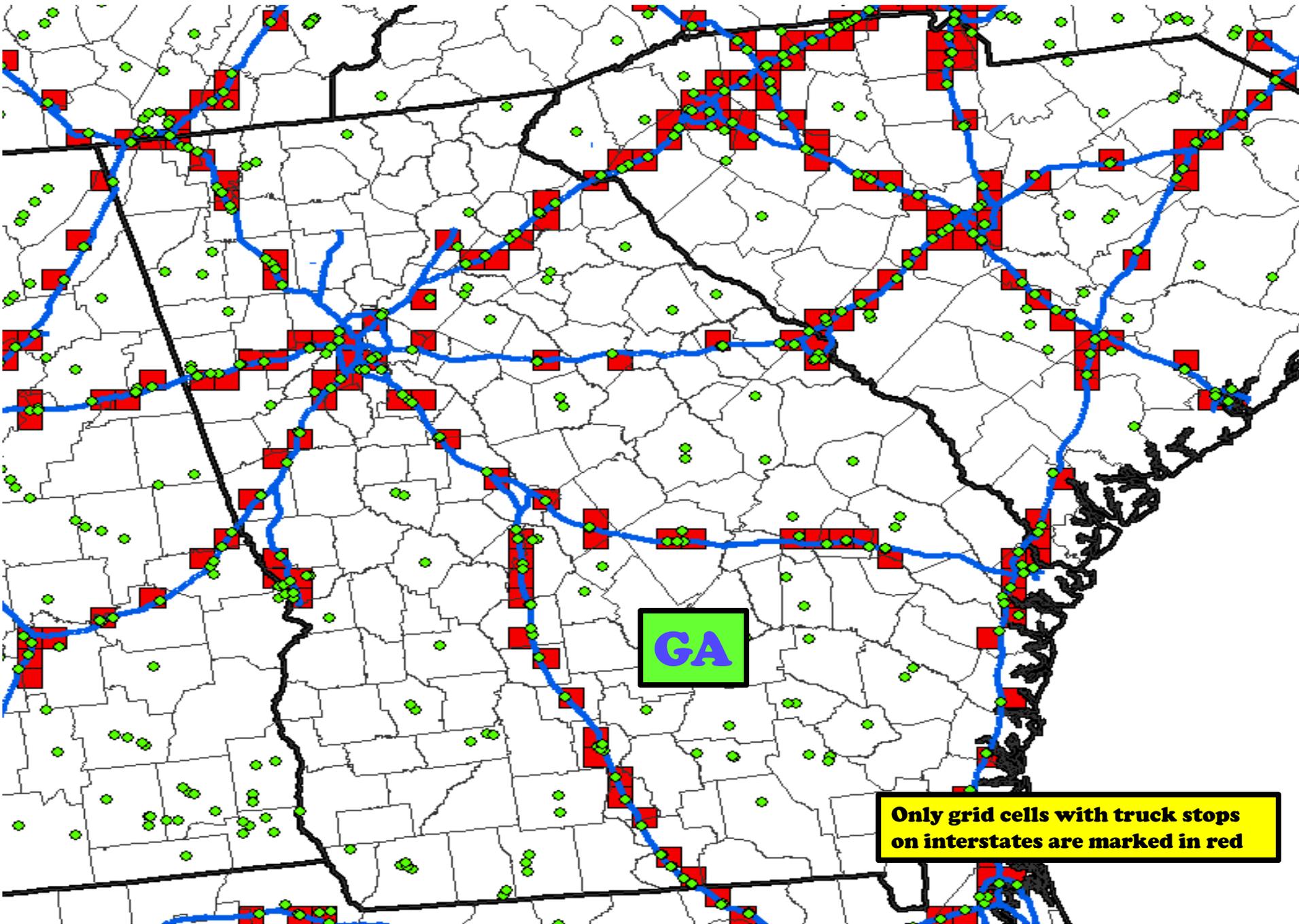


Only grid cells with interstates are marked in red

Alternative Surrogates Option3 – Truck Stops on Interstates



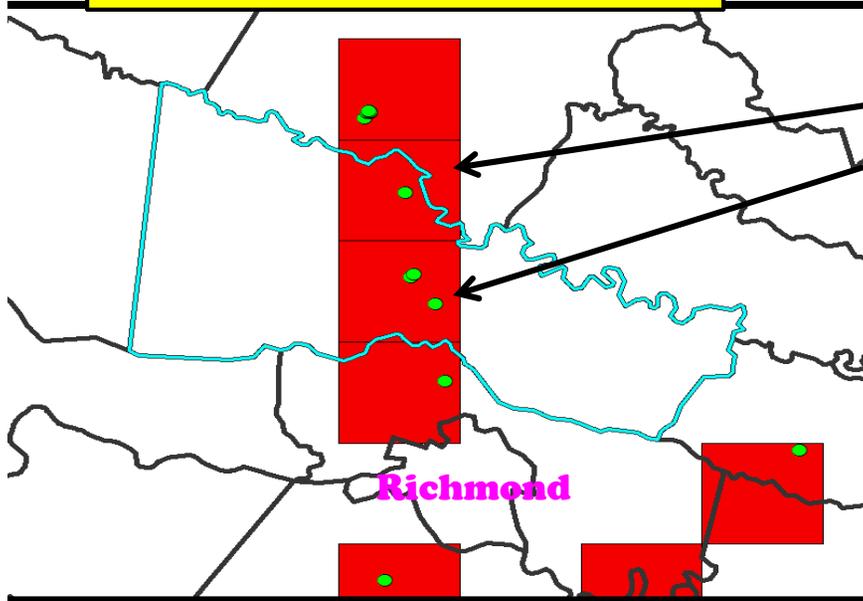
Alternative Surrogates Option3 – Truck stops on Interstates



Only grid cells with truck stops on interstates are marked in red

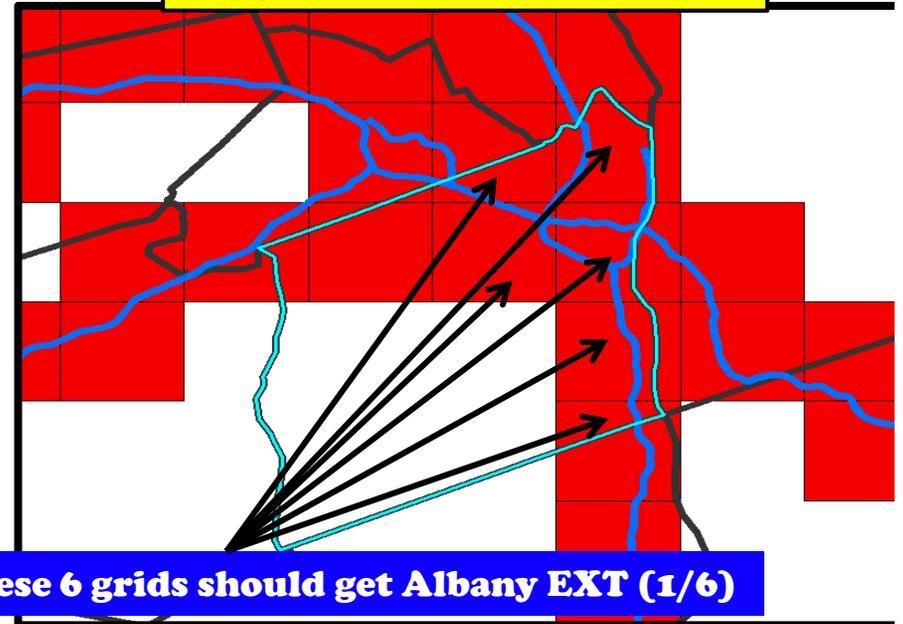
Surrogate Values at Grid Cells

Option1 example: Hanover, VA



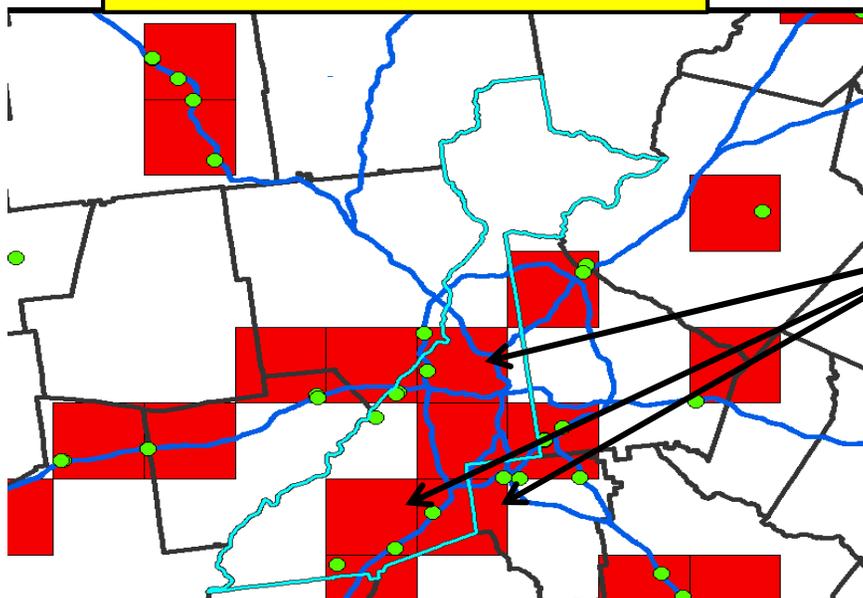
These 2 grids should get Hanover EXT (1/4, 3/4)

Option2 example: Albany, NY



These 6 grids should get Albany EXT (1/6)

Option3 example: Fulton, GA



These 3 grids should get Fulton EXT (1/3, 1/3, 1/3)

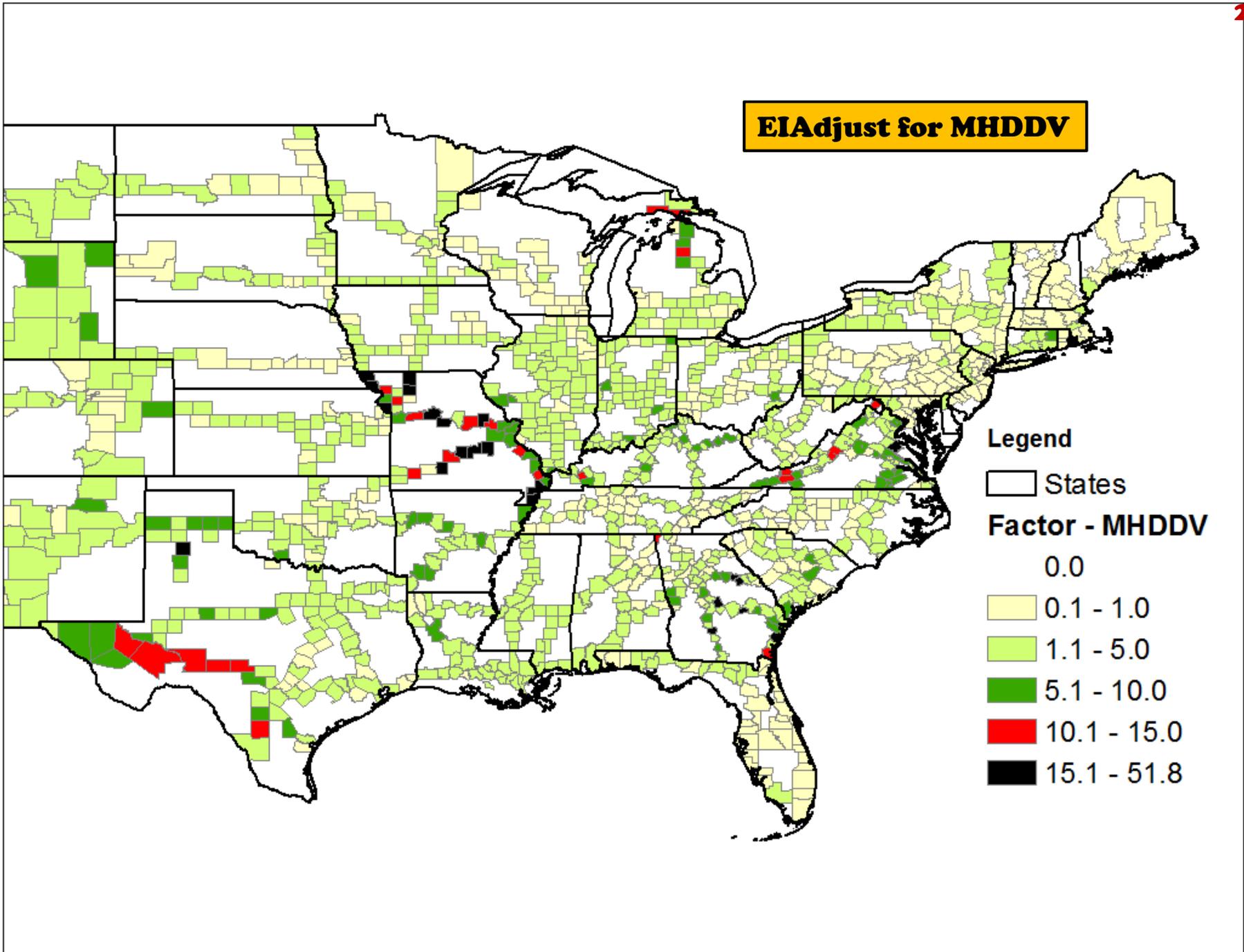
The process can get very complicated. For example, surrogate values at each grid for Option2 could account for the "amount" of freeway in the county. Option 1 and 3 could account for number of parking spots at each truck stop. Also, emissions from other counties in the same interstate grid cell must be added together.

Summary on Spatial Surrogates

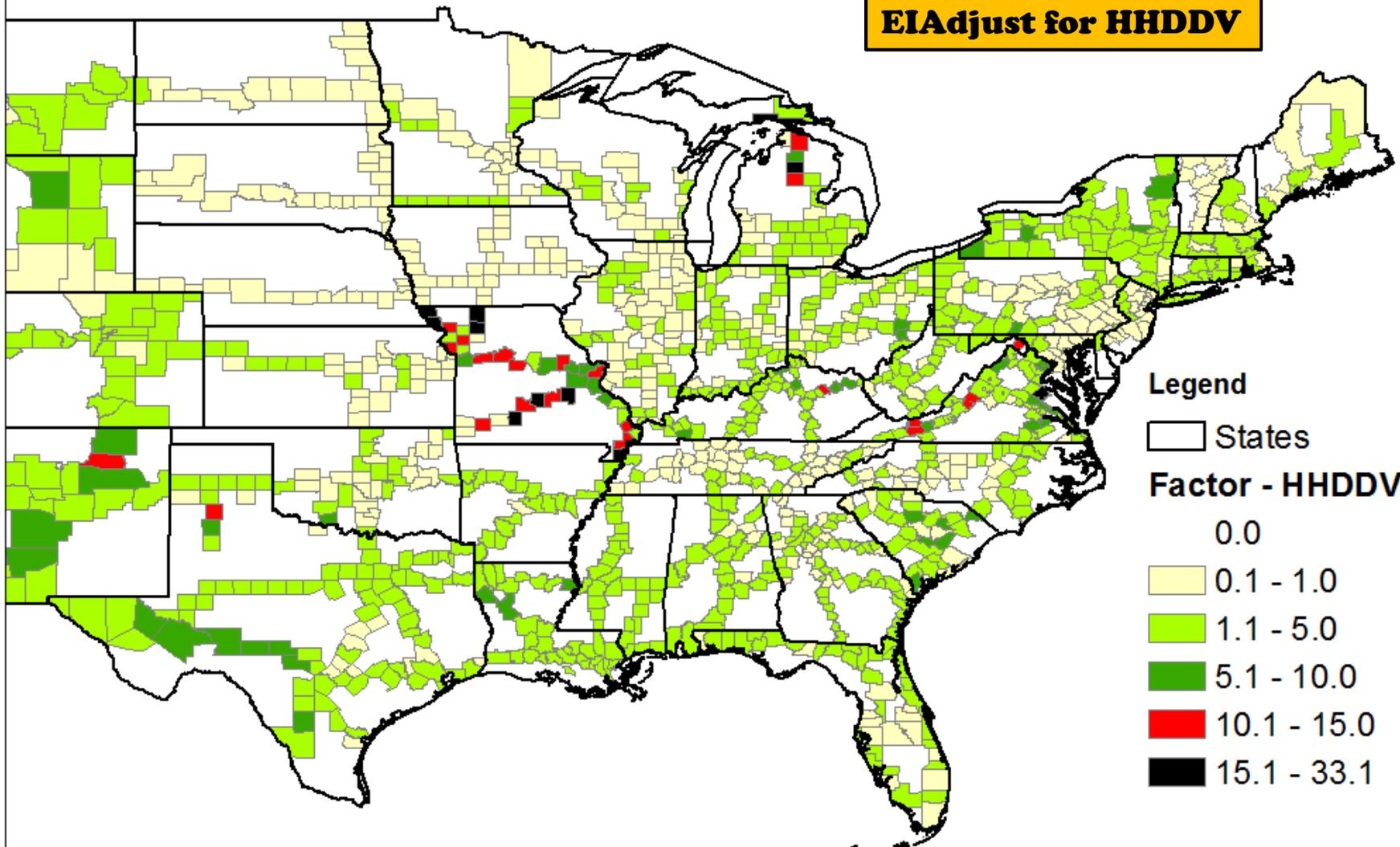
- **EXT surrogates implemented in SMOKE-MOVES (i.e., HPOP) are inconsistent with EXT methodology by EPA OTAQ**
- **Inconsistent surrogates place EXT emissions in incorrect grid cells, adversely affecting air quality modeling results**
- **Three alternative surrogate options are proposed:**
 - **truck stops**
 - **interstates**
 - **truck stops on interstates**
- **Whatever alternative is chosen for use in SMOKE-MOVES should be consistent with final MOVES design**

Allocating EXT Emissions in SMOKE-MOVES

- **idleAllocFactor=EXThours(county_i)/EXThours(nation)**
 - **Is EXThours(county_i) based on MOVES default VMT or state supplied VMT?**
 - **The numbers of rest stop and truck stops in “Demand for Overnight Parking by State” seem too high. Are the numbers actual stops, parking space, or some demand for facility?**
- **EIAdjust=[VPOP_N/VPOP(county_i)]*idleAllocFactor**
 - **EIAdjust=[VPOP_N/VPOP(county_i)]
* [EXThours(county_i)/EXThours(nation)]**
 - **Are the EXT adjustment factors used in SMOKE (cfpro) the same as “EIAdjust” in the EPA document?**
 - **Range: 0.0 to 51.8 (GA)**
 - **Values over 15.0: GA(6), ID(1), MI(2), MO(23), TX(1), VA(5), WA(2)**

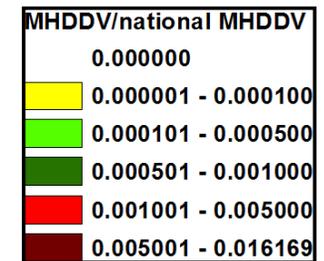
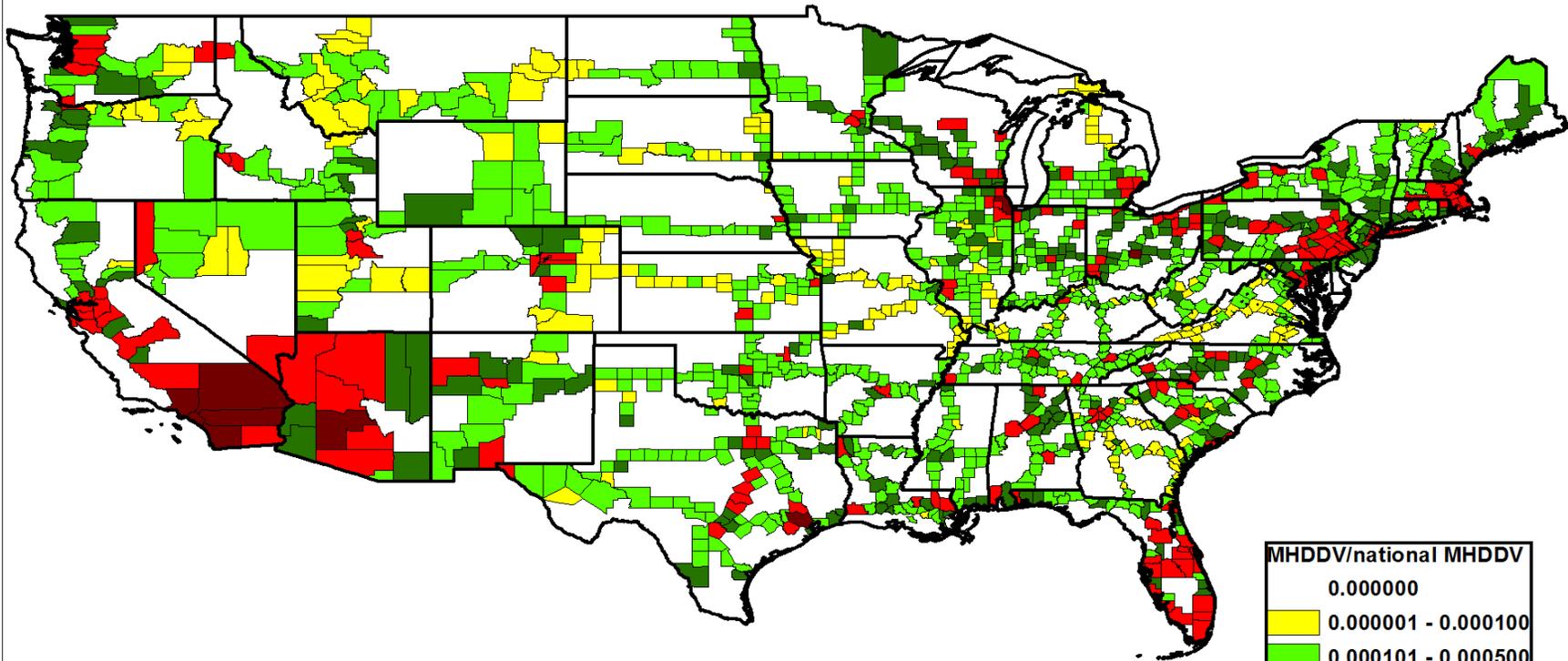


EIAdjust for HHDDV



$$\frac{\text{idleAllocationFactor}}{\text{EIAdjust}} = \frac{\text{VPOP}(\text{county}_i)}{\text{VPOP}_N}$$

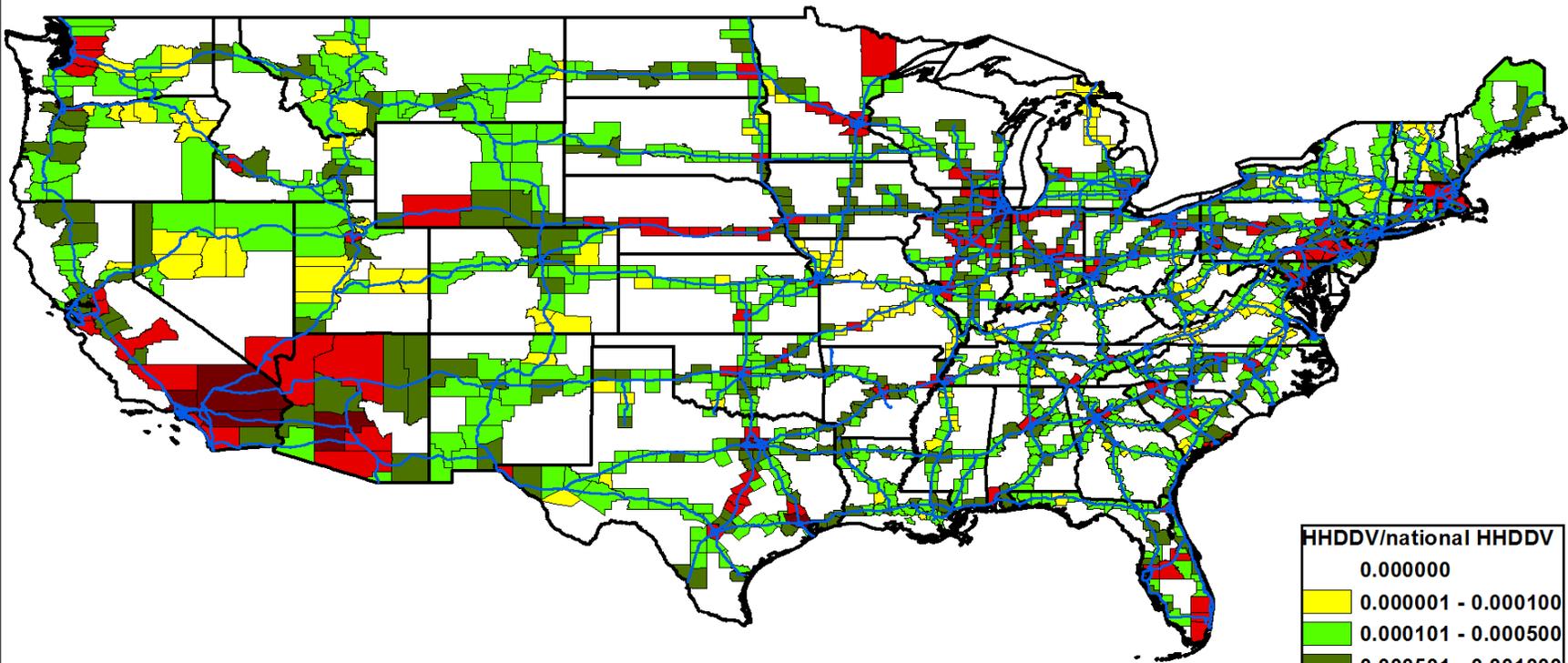
Fractional MHDDV



Fractions only sum up to 0.78, not 1.0

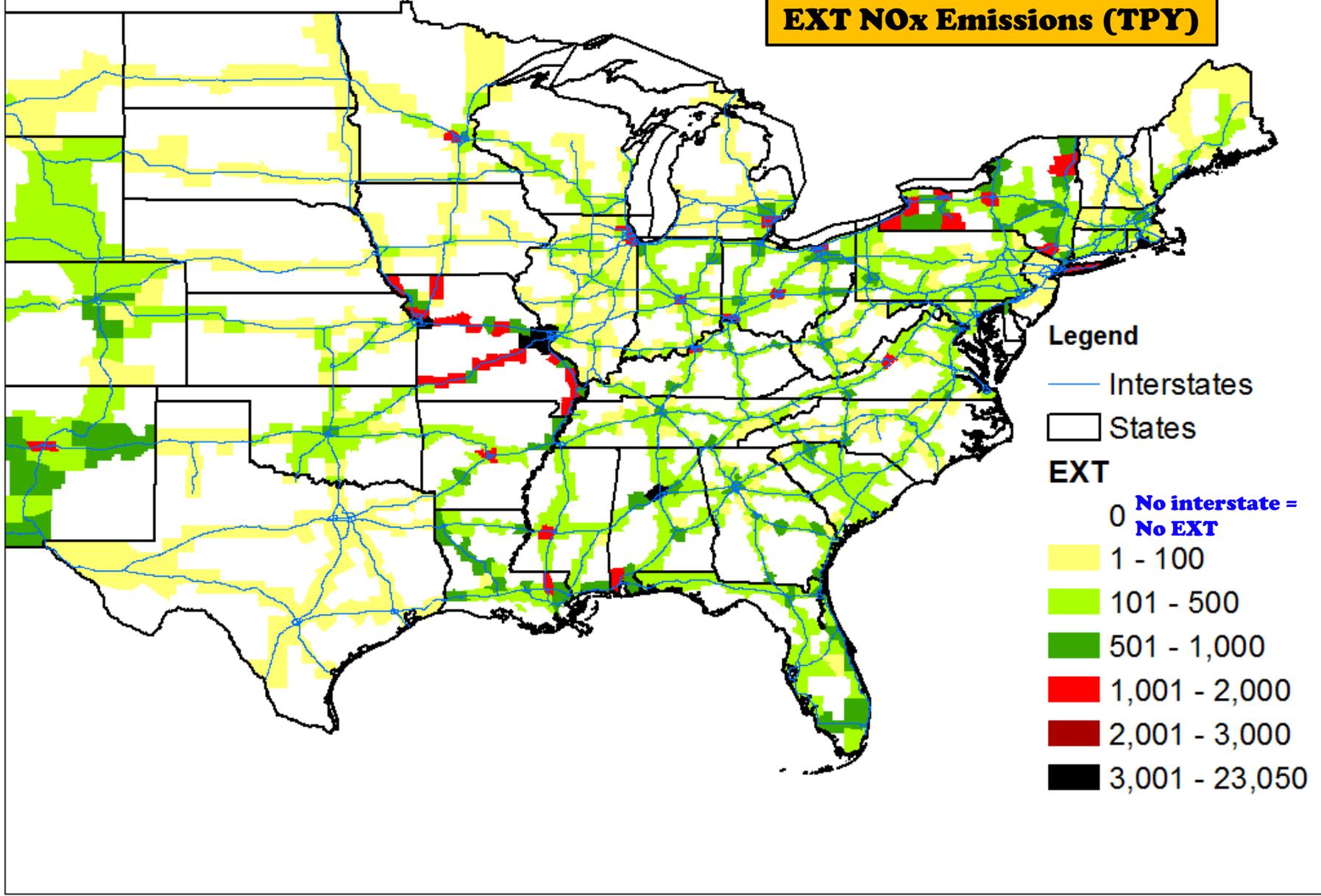
$$\frac{\text{idleAllocationFactor}}{\text{EIAdjust}} = \frac{\text{VPOP}(\text{county}_i)}{\text{VPOP}_N}$$

Fractional HHDDV

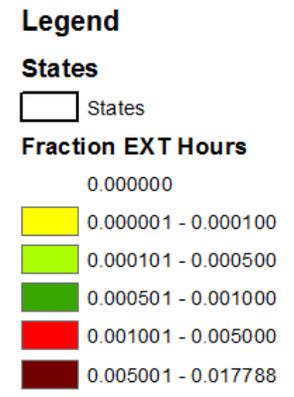
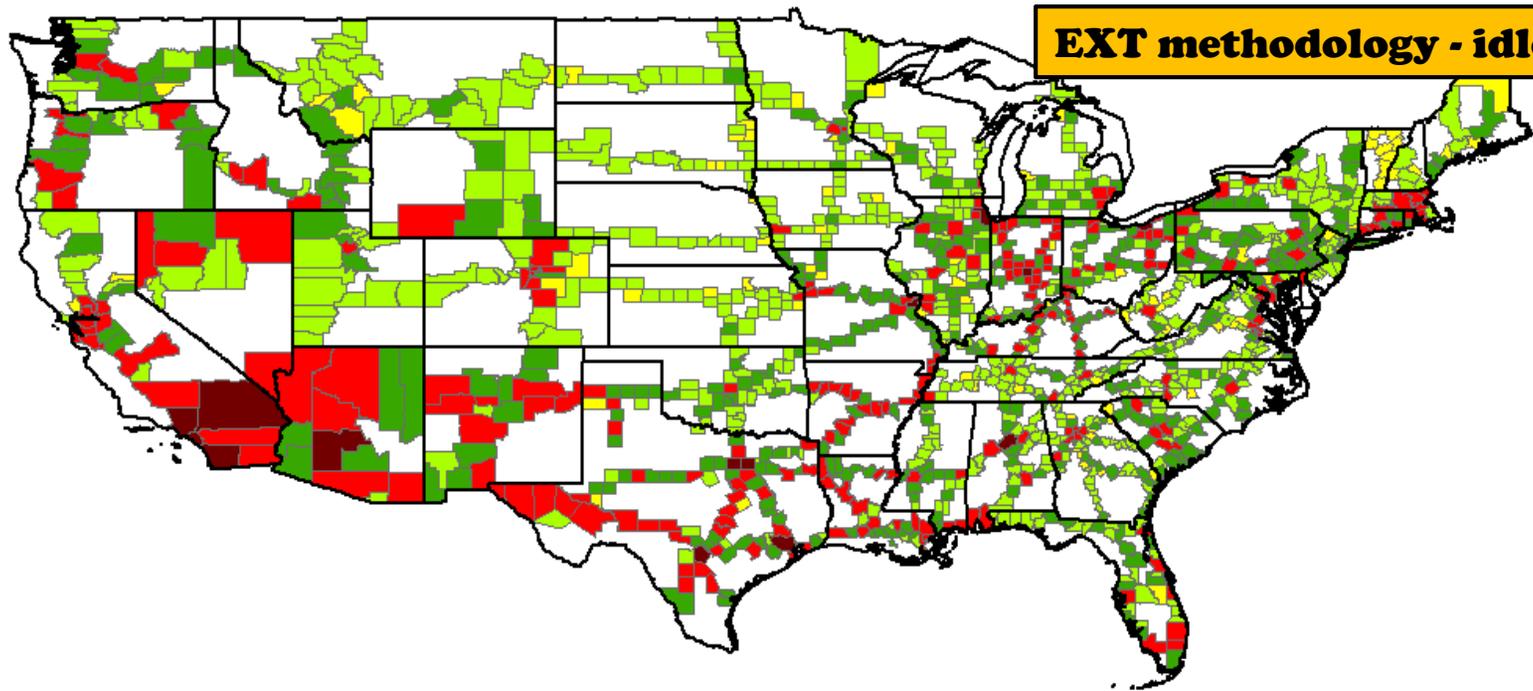


Fractions only sum up to 0.80, not 1.0

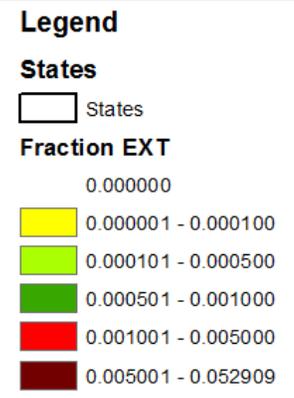
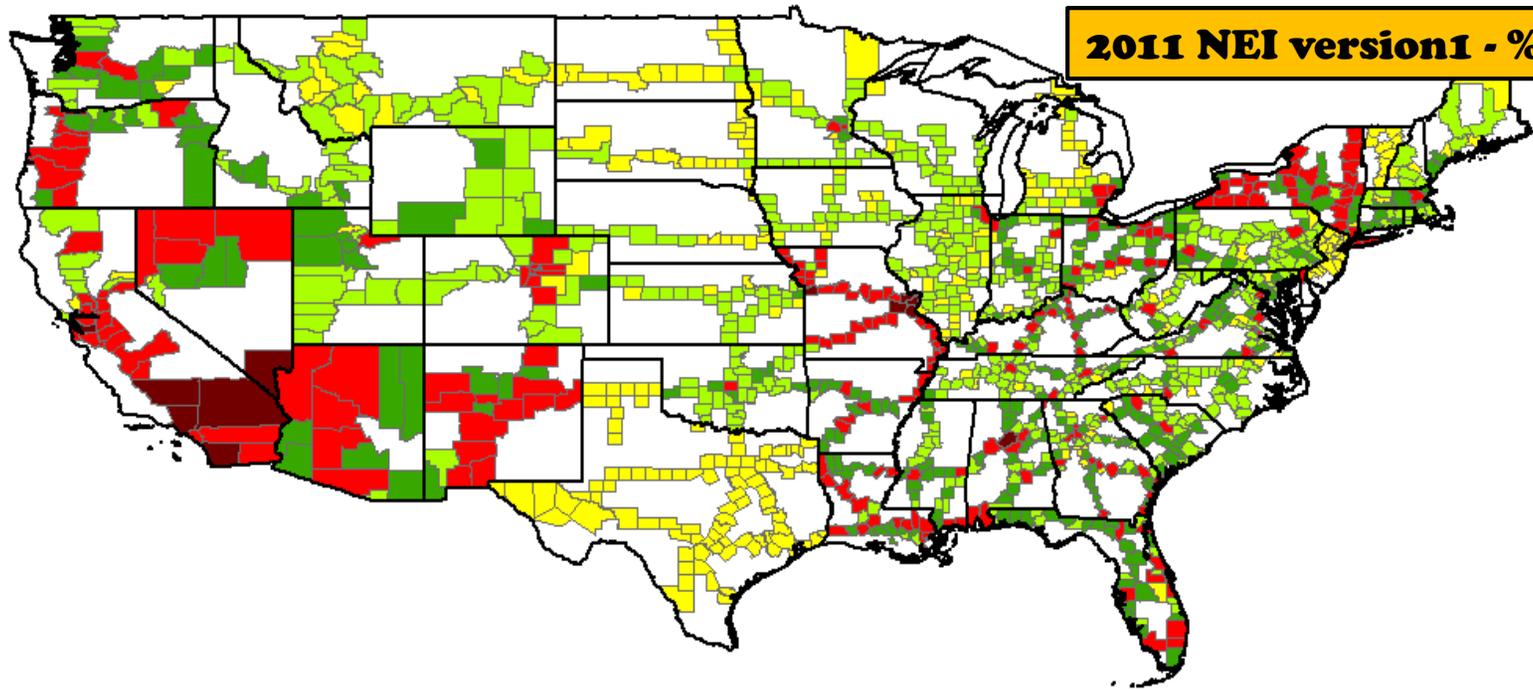
**2011 NEI version1
EXT NOx Emissions (TPY)**



EXT methodology - idleAllocFactor



2011 NEI version1 - % NOx Emissions



Allocating EXT Emissions in SMOKE-MOVES

$$\begin{aligned}
 \blacksquare \text{ Emissions} &= ER_R (\text{g/vehicle}) * EIAdjust * VPOP(\text{county}_i) \\
 &= ER_R (\text{g/vehicle}) * [VPOP_N / VPOP(\text{county}_i)] \\
 &\quad * idleAllocationFactor * VPOP(\text{county}_i) \\
 &= ER_R (\text{g/vehicle}) * [VPOP(\text{county}_i) / VPOP(\text{county}_i)] * VPOP_N \\
 &\quad * idleAllocationFactor \\
 &= ER_R (\text{g/vehicle}) * VPOP_N * idleAllocationFactor
 \end{aligned}$$

- Page 6, “it would not be proper to use the same extended idle emission rates for all of the counties being represented, since the amount of extended idle will vary by county and some counties without interstate highways would have no extended idle emissions.”

 - The same extended idle rates should be used for all represented counties, it is the activity (idleAllocationFactor) that varies across counties.
- ER_R in Texas seems to be too low. The ER_R in NY seems to be too high. The $EIAdjust$ in MO seems to be too high.

Additional Comments on EXT Methodology

- **Was the same hourly allocation approach that was used in determining the total number of extended idle hours (p. 3) also used in SMOKE-MOVES to allocate EXT by hour? If not, what temporal approach was used?**
- **“Hour of day” in EXT methodology should refer to local time (ex, EST or CST). SMOKE/CMAQ use GMT. How did 2011NEI reconcile the differences in time?**
- **Have all pollutants been adjusted according to the EPA methodology, or just NO_x?**

Other EXT Emissions

- **Does the EPA approach account for all extended idle emissions or only extended idle emissions along interstates?**
 - **If it accounts for all extended idle emissions, then the spatial allocation approach needs to be redefined to allocate EXT to truck stops in counties without interstates, such as truck stops along state roads, shipping ports, rail yards, and oil/gas exploration sites.**
 - **If it only included extended idle emissions along interstates, how do we get extended idle emissions from truck stops in counties without interstates, such as shipping ports, rail yards, and oil/gas exploration sites?**

Summary

- **National total EXT needs to be allocated spatially (nation -> states, state -> counties, county -> grid cells)**
 - **The three spatial allocations have all been found to be inconsistent with MOVES design**
- **An overall review and analysis involving the two models (MOVES and SMOKE-MOVES) is urgently needed to resolve inconsistency**

Policy Related Issues

- **Until EPA updates MOVES to properly calculate EXT, states should no longer use MOVES to estimate EXT**
 - **Extended idle exhaust processes should be unchecked in MOVES runs to exclude EXT from total emissions**
- **SMOKE-MOVES can not be used to estimate EXT until EPA provides year-specific national population of diesel combination long haul trucks**
- **Unless EXT corrections are made in 2011NEI version2, SMOKE-MOVES should not be used in regulatory transport modeling**