Revisit Key MOVES and SMOKE-MOVES Issues in Anticipation of EPA NEI version2

Georgia Department of Natural Resources

Virginia Department of Environmental Quality

MARAMA MOVES Workgroup Conference Call
May 27, 2014

Fuel Sulfur Content

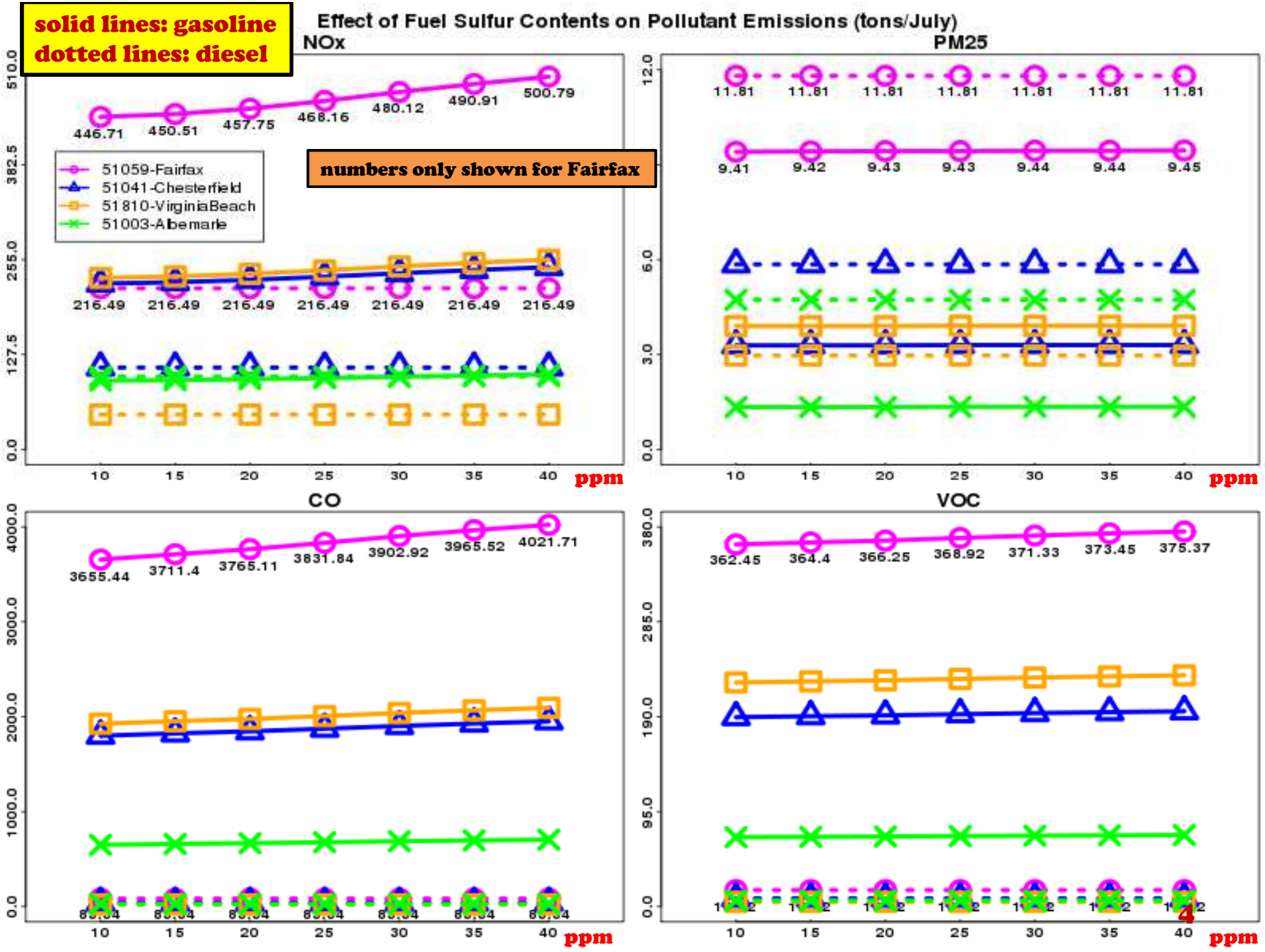
Sulfur in 2011NEI version1

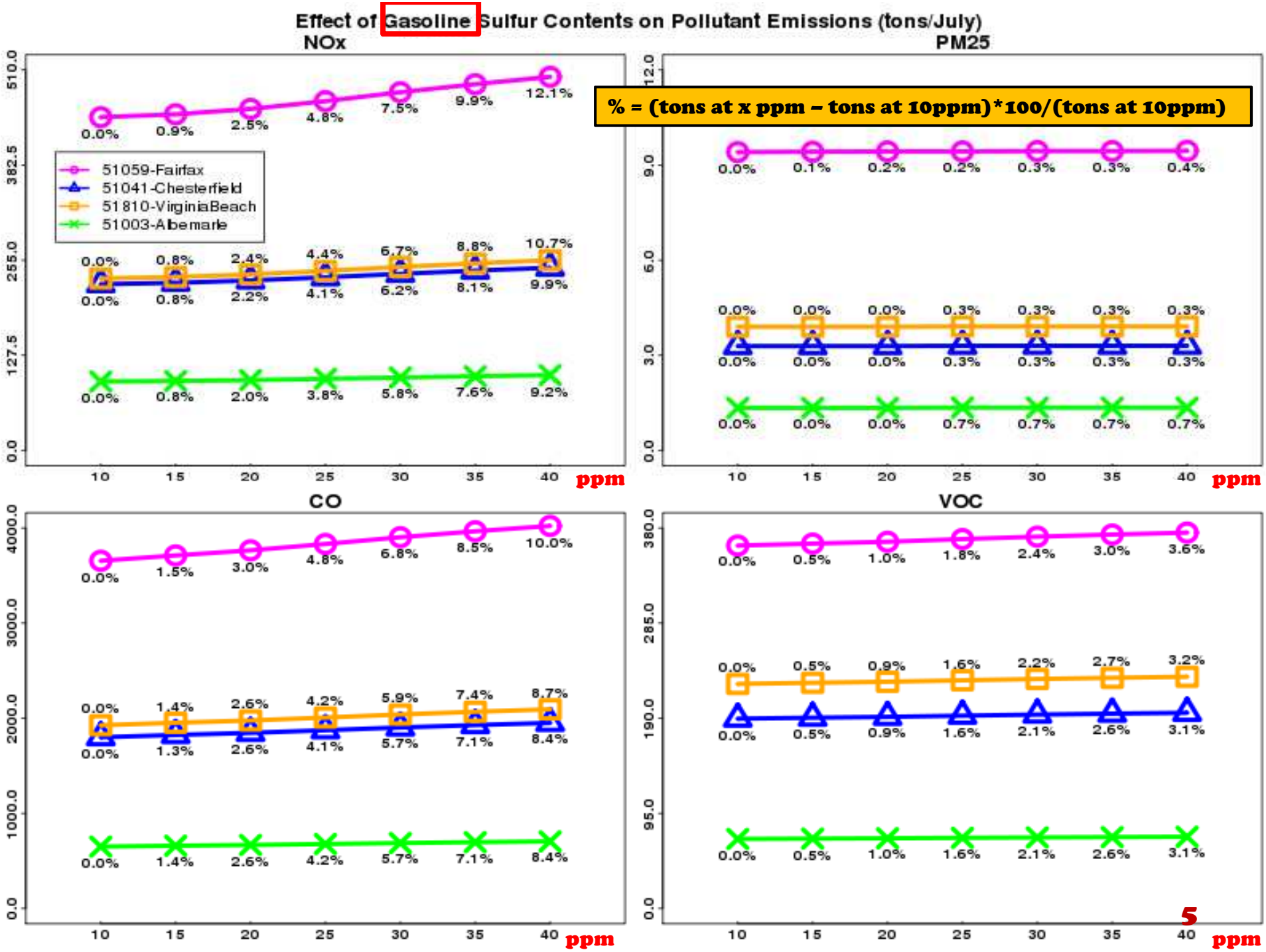
- Only two sulfur levels are found in 2011NEI: 9ppm in CA and 30ppm for the rest of the US
- Tier 3 rule will reduce sulfur level to 10ppm, in line with CA

Fuel Sulfur Sensitivity

- Q: How does change in fuel sulfur content affect summer emissions?
- Gasoline sulfur content varied from 10 to 40 ppm in 5 ppm increments
- July 2011 monthly emissions in inventory mode
- All other inputs remain constant

solid lines: gasoline
dotted lines: diesel




Effect of Gasoline Sulfur Contents on Pollutant Emissions (tons/July)
NOx
PM25
CO
VOC
% = (tons at x ppm – tons at 10ppm)*100/(tons at 10ppm)
51059-Fairfax
51041-Chesterfield
51810-VirginiaBeach
51003-Albemarle
ppm
5

Summary on Sulfur Sensitivity

- Higher sulfur content yields higher emissions for all pollutants
- PM2.5 is not significantly affected by sulfur content
- NOx emissions increase by 10%, on average, when sulfur content is increased from 10ppm to 40ppm
- In general, more emissions are from gasoline vehicles than from diesel vehicles

- Question:

  Does EPA plan to use more realistic sulfur contents for fuel in Version 2? What data source would be used?

Representative County

Representative County

- **Original** county grouping criteria:
  - (a) control programs (CALEV, NLEV, I/M, stageII);
  - (b) fleet age distribution;
  - (c) fuel parameters
    (state-supplied data overridden by EPA);

local, state-specific data

- **Proposed** county grouping criteria:
  - (a) control programs;
  - (b) fleet age distribution;
  - (c) fuel parameters;
  - (d) ramp fraction;
  - (e) VMT/VPOP ratio (by vehicle type)
    (if no activity aggregation, see page 10)

Reconsider with new CRC data

new suggestion for grouping

Representative County
Simple Analogy

Representative County		Range of Actual Numbers	Example Modeled Number
County Blue		1 - 5	5
County Yellow		6 - 10	7
County Red		11 - 15	14

-- Number 5 used to model county blue cannot fully cover actual number range from 1 to 5 (likewise for counties yellow and red), causing incorrect representation.
-- Options: (1) phase out current representative county approach with data from a single representative county and aggregate actual numbers to correctly represent the entire county group or (2) use inventory mode.

Activity Aggregation

- **VMT**
- **VPOP**
- **Fleet Age Distribution**

-- These three activities must be aggregated to correctly represent group
-- "Convenience" is not a good reason for sacrificing accuracy

-- When CRC data becomes available, fleet age distribution should be re-analyzed and counties re-grouped for states which did not submit data;
-- Even though it's a grouping criterion, fleet age distribution should be aggregated over county group, due to the fact that it is the single most important parameter affecting emissions
-- If VMT/VPOP ratio is considered in grouping counties, aggregation may not be necessary (further investigation needed)

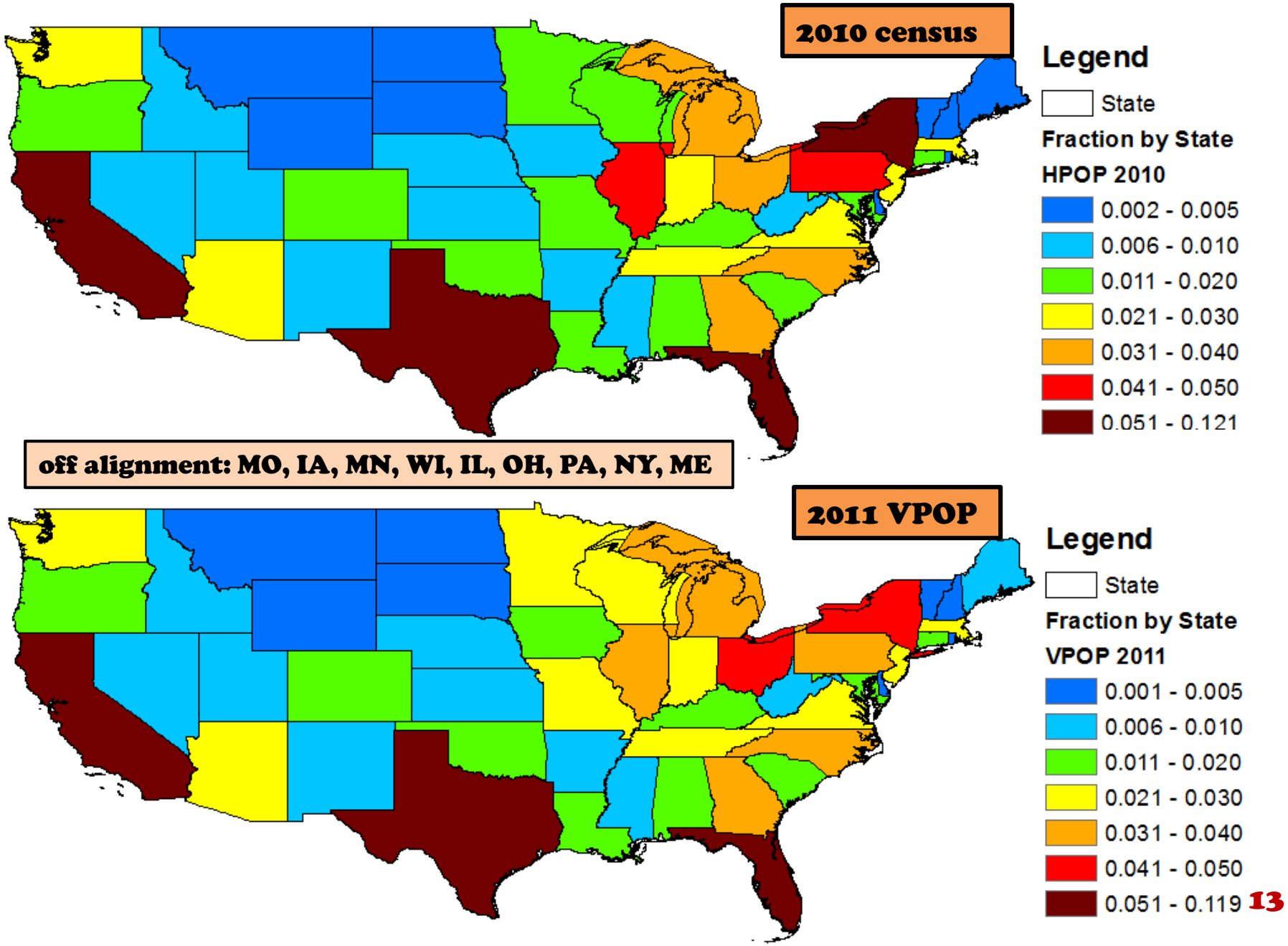
2011 VMT/VPOP and 2010 Census Data

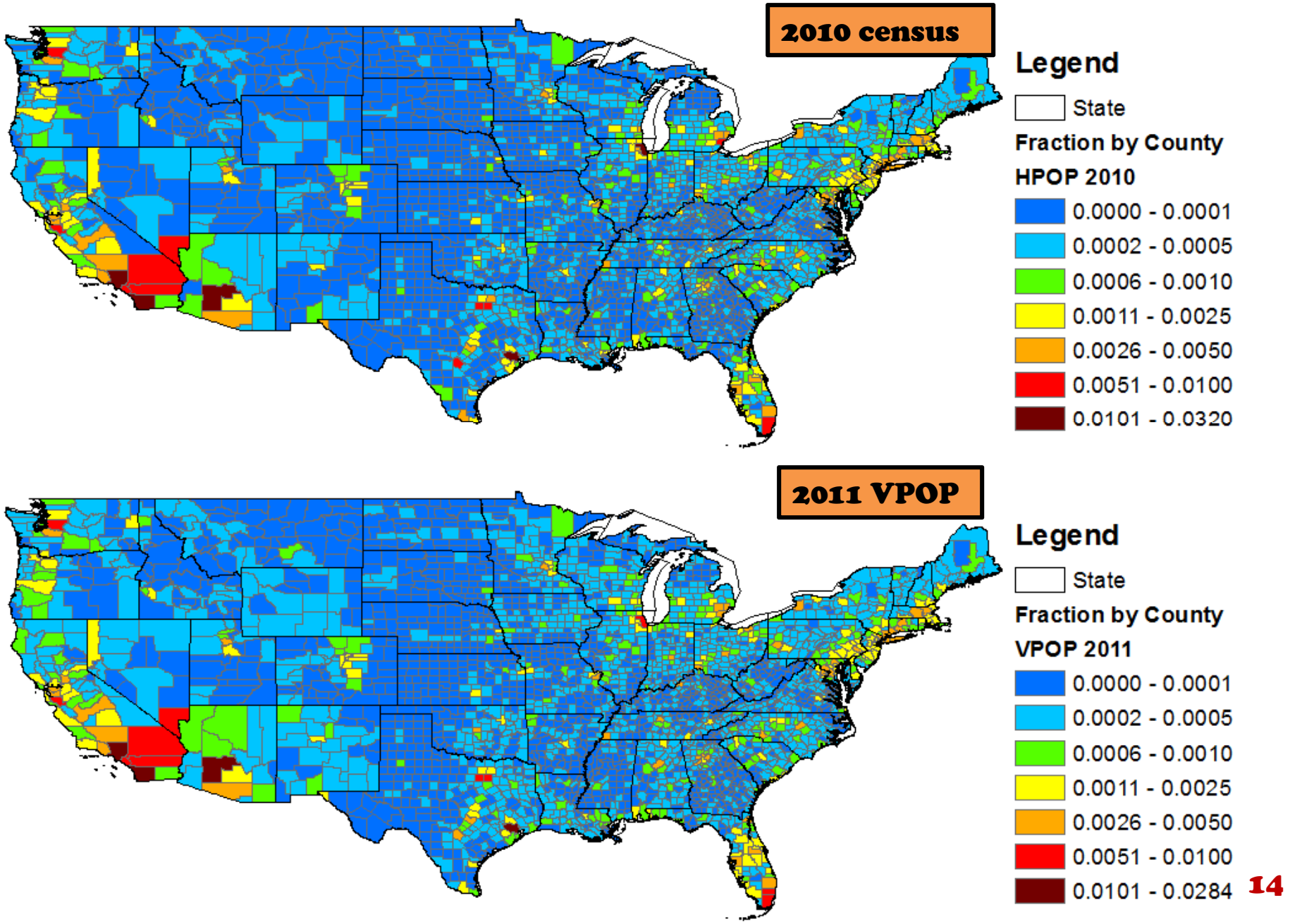
2010 Census Data

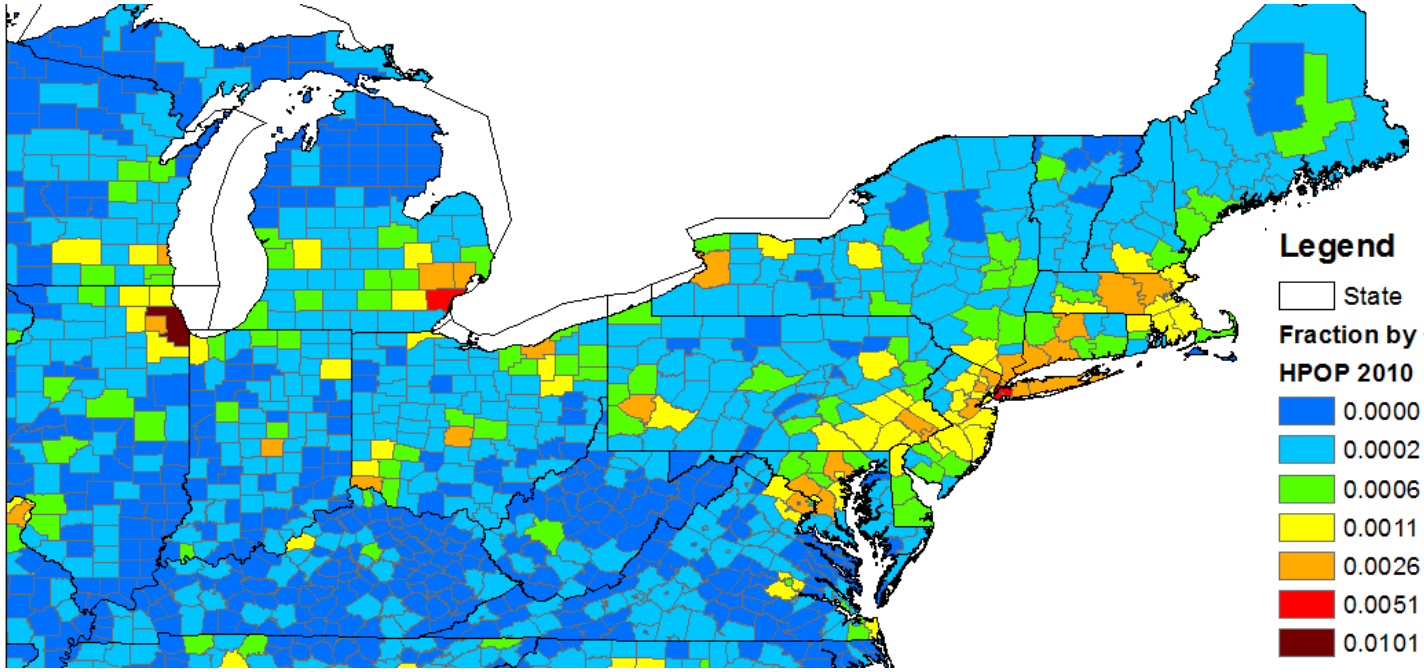
- 2010 Census data, the most recent data available, was collected for comparison with vehicle population counts
- Data source:

  http://factfinder2.census.gov/faces/nav/jsf/pages/guided_search.xhtml

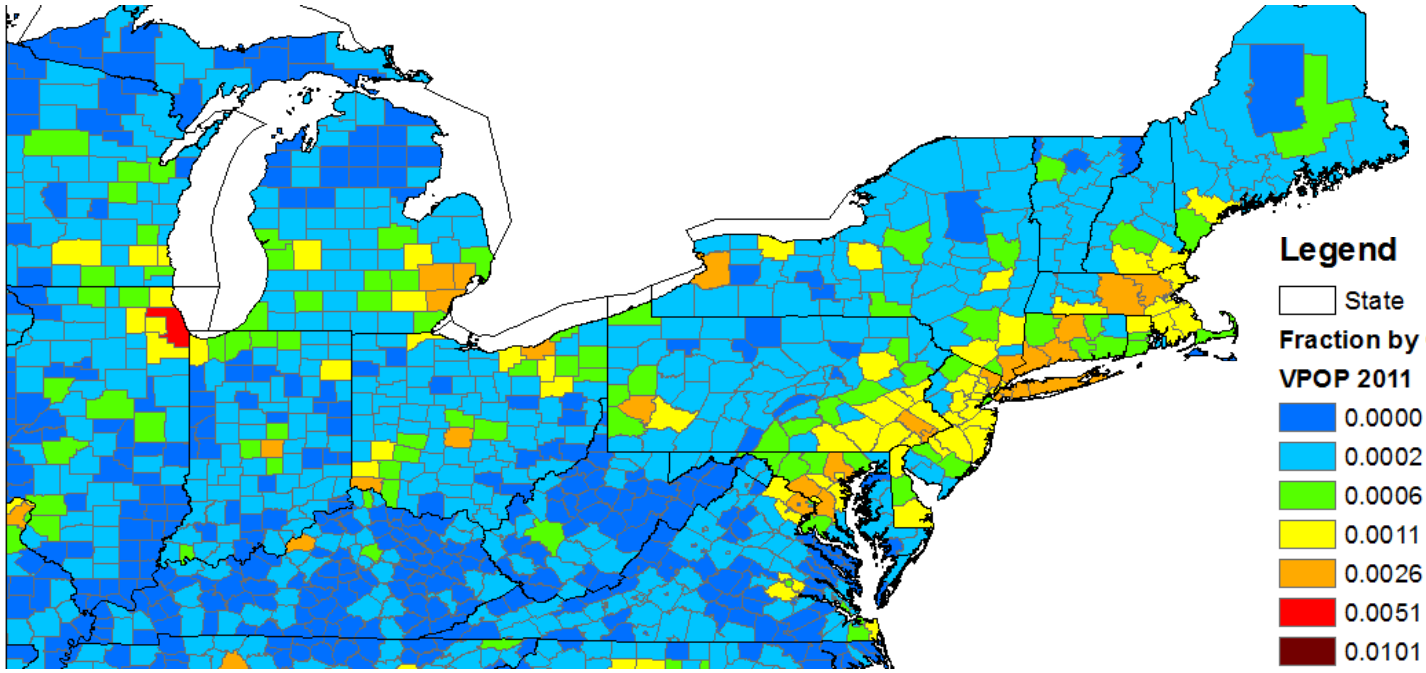
- Queried total population by county for each state in continental US


2010 census
Legend
State
Fraction by State
HPOP 2010
0.002 - 0.005
0.006 - 0.010
0.011 - 0.020
0.021 - 0.030
0.031 - 0.040
0.041 - 0.050
0.051 - 0.121
off alignment: MO, IA, MN, WI, IL, OH, PA, NY, ME
2011 VPOP
Legend
State
Fraction by State
VPOP 2011
0.001 - 0.005
0.006 - 0.010
0.011 - 0.020
0.021 - 0.030
0.031 - 0.040
0.041 - 0.050
0.051 - 0.119

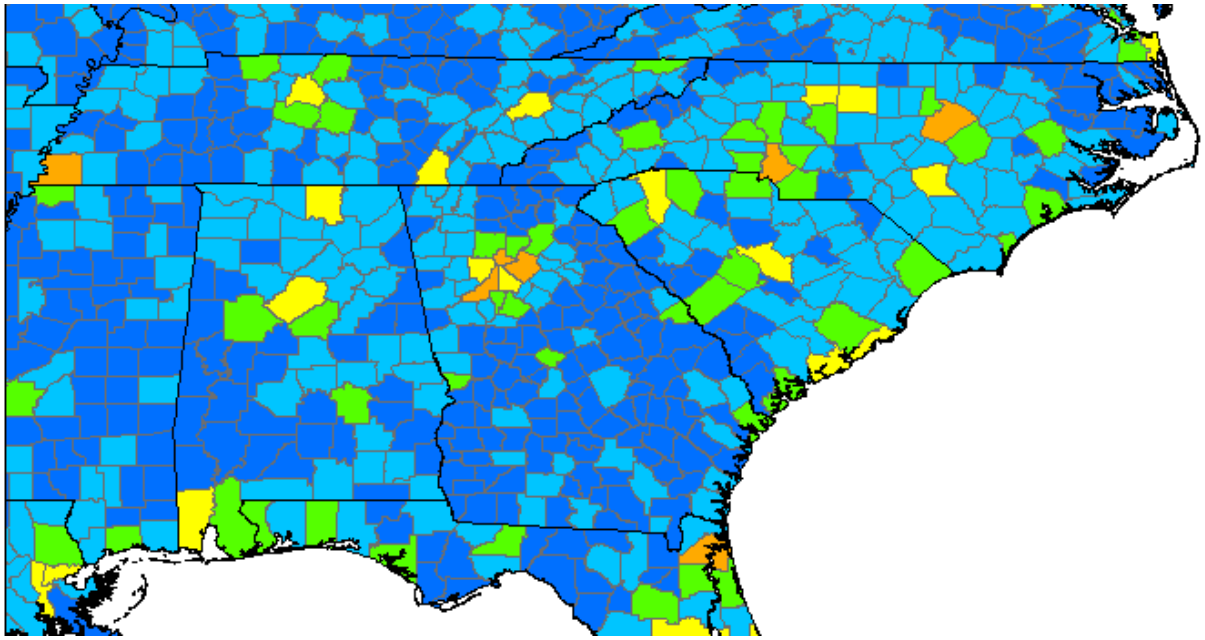

2010 census
Legend
State
Fraction by County
HPOP 2010
0.0000 - 0.0001
0.0002 - 0.0005
0.0006 - 0.0010
0.0011 - 0.0025
0.0026 - 0.0050
0.0051 - 0.0100
0.0101 - 0.0320
2011 VPOP
Legend
State
Fraction by County
VPOP 2011
0.0000 - 0.0001
0.0002 - 0.0005
0.0006 - 0.0010
0.0011 - 0.0025
0.0026 - 0.0050
0.0051 - 0.0100
0.0101 - 0.0284



2010 census



2011 VPOP



2010 census

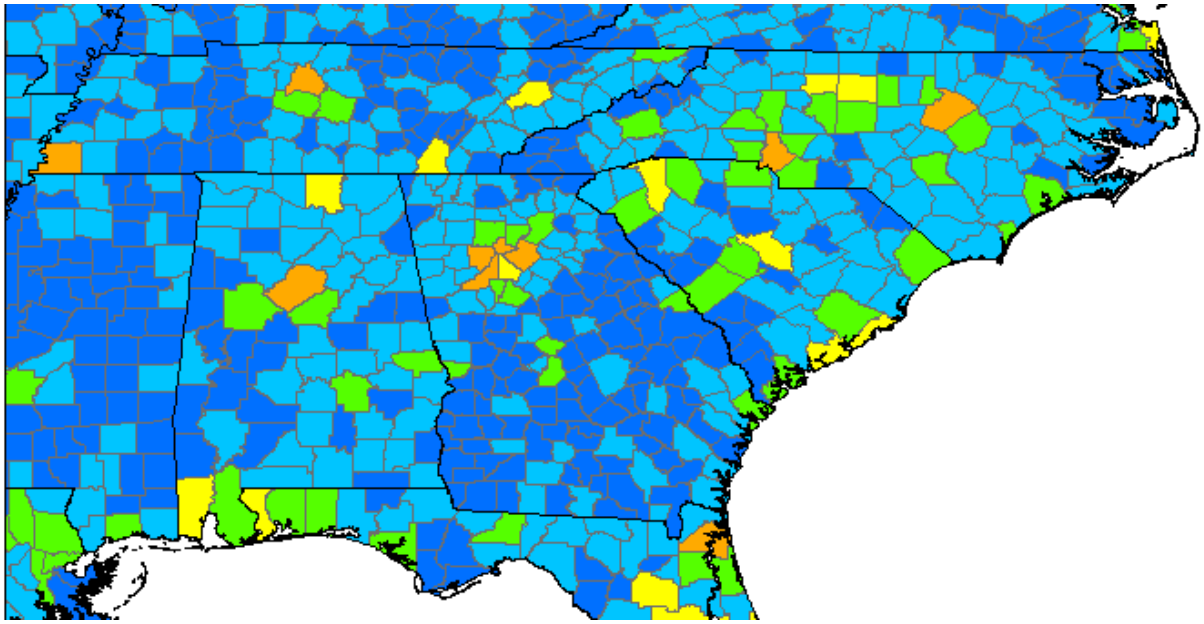
Legend

State

Fraction by County

HPOP 2010

- 0.0000 - 0.0001
- 0.0002 - 0.0005
- 0.0006 - 0.0010
- 0.0011 - 0.0025
- 0.0026 - 0.0050
- 0.0051 - 0.0100
- 0.0101 - 0.0320



2011 VPOP

Legend

State

Fraction by County

VPOP 2011

- 0.0000 - 0.0001
- 0.0002 - 0.0005
- 0.0006 - 0.0010
- 0.0011 - 0.0025
- 0.0026 - 0.0050
- 0.0051 - 0.0100
- 0.0101 - 0.0284

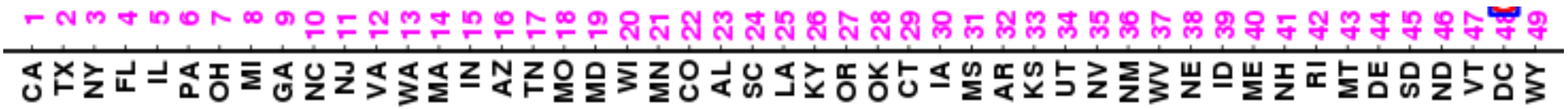
Activity Parameters Examined

Parameter	Unit	Notes
(1) 2010 HPOP	population/ 1 million	2010 census
(2) 2011VMT	miles/1 billion	2011NEI "scaled" VMT
(3) 2011VPOP	vehicles/1 million	2011NEI "scaled" VPOP
(4) 2011VMT/2011VPOP	miles/vehicle	annual average miles driven per vehicle in 2011
(5) 2011VPOP/2010HPOP	vehicles/person	average vehicles owned per person (years mismatch)

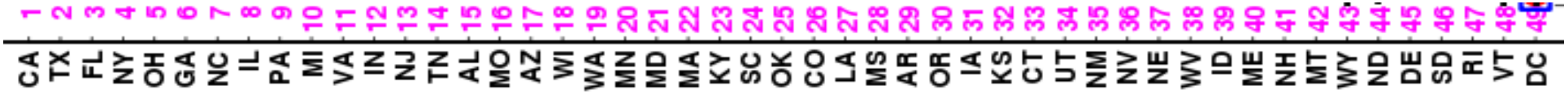
-- Activity data were collected from 2011/2018 NEI modeling platform posted by EPA;
-- States are ranked according to their 2010 census data and plotted on x axis (rank is marked in magenta)
-- Effort was made to have similar scales for 2010HPOP and 2011VPOP for easier comparison

State Ranking

(1) ranked by 2010 census (this presentation)

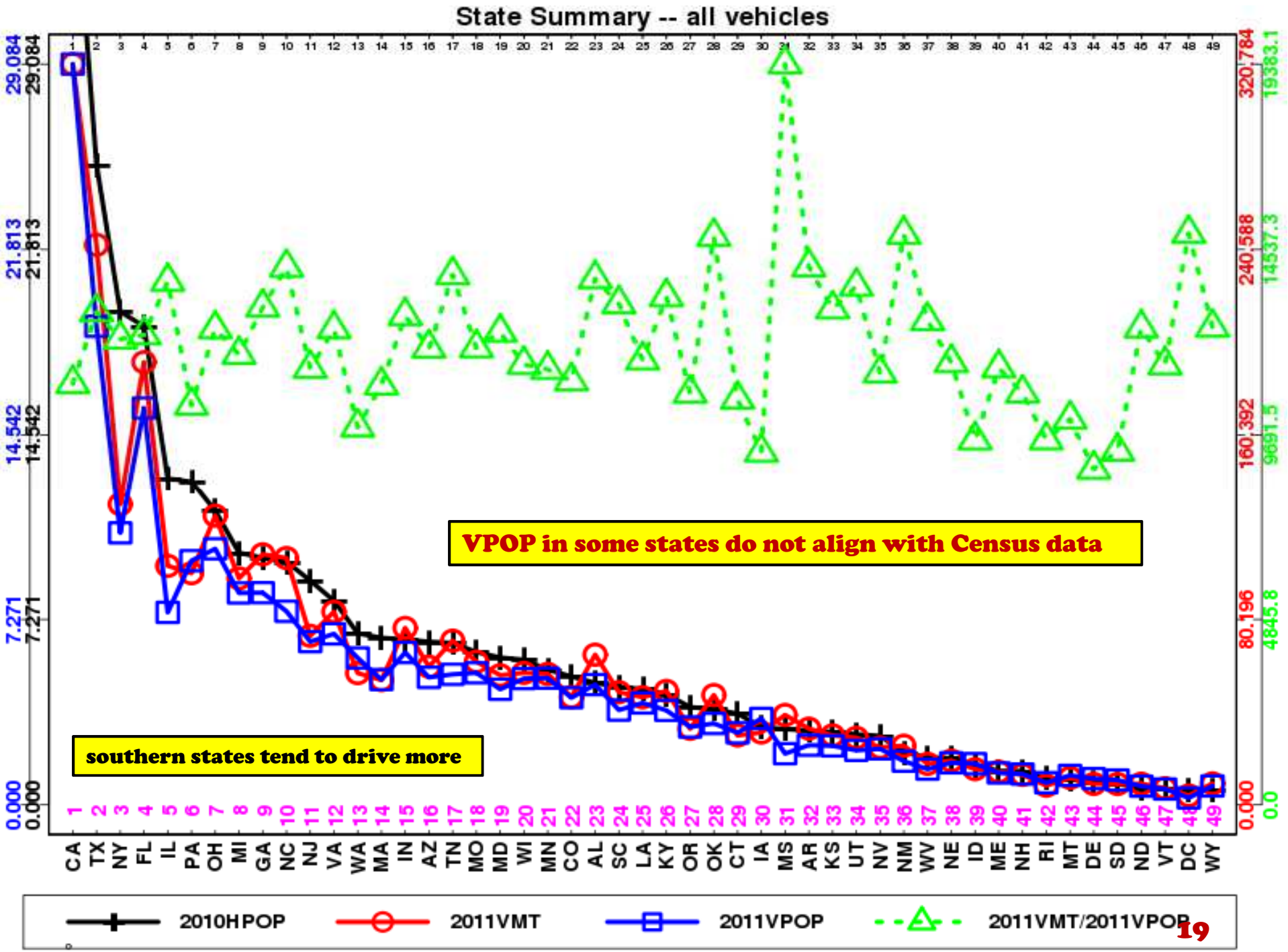


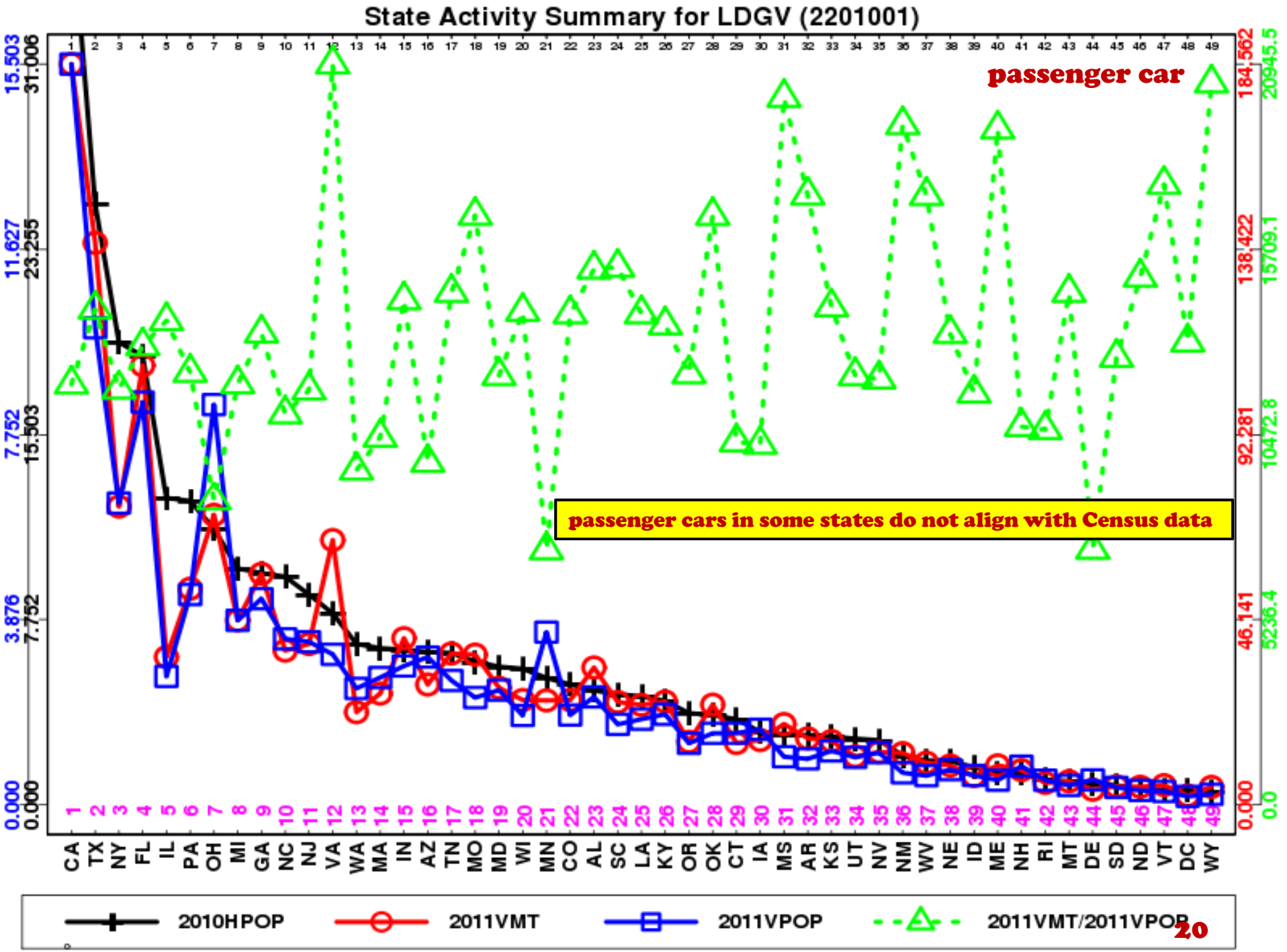
(2) ranked by 2011 VMT (April 28 presentation)



Same rank: CA (1), TX (2), SC (24), UT (34), ID (39), ME (40), NH (41)

Wild swing in two rankings: AL, WA, MA, WY


State Summary -- all vehicles
29.084
21.813
14.542
7.271
0.000
320,784
240,588
160,392
80,196
0.000
19383.1
14537.3
9691.5
4845.8
0.0
VPOP in some states do not align with Census data
southern states tend to drive more
CA TX NY FL IL PA OH MI GA NC NJ VA WA MA IN AZ TN MO MD WI MN CO AL SC LA KY OR OK CT IA MS AR KS UT NV NM WV NE ID ME NH RI MT DE SD ND VT DC WY
2010HPOP
2011VMT
2011VPOP
2011VMT/2011VPOP


State Activity Summary for LDGV (2201001)
passenger car
passenger cars in some states do not align with Census data
15.503
11.627
7.752
3.876
0.000
31.006
23.255
15.503
7.752
0.000
184.562
138.422
92.281
46.141
0.000
20945.5
15709.1
10472.8
5236.4
0.0
CA TX NY FL IL PA OH MI GA NC NJ VA WA MA IN AZ TN MO MD WI MN CO AL SC LA KY OR OK CT IA MS AR KS UT NV NM WV NE ID ME NH RI MT DE SD ND VT DC WY
2010HPOP
2011VMT
2011VPOP
2011VMT/2011VPOP

Average Passenger Cars Owned

VPOP2011 for 2201001 /HPOP2010

OH	0.73	MI	0.39
MN	0.68	NJ	0.39
NH	0.61	VA	0.39
DE	0.58	LA	0.39
IA	0.52	KS	0.39
RI	0.49	ID	0.39
AZ	0.48	ME	0.39
AL	0.47	WY	0.39
FL	0.45	MO	0.37
IN	0.45	CO	0.37
SD	0.45	NC	0.36
ND	0.45	WA	0.36
VT	0.45	SC	0.36
GA	0.44	UT	0.36
KY	0.44	PA	0.35
CA	0.42	OR	0.34
MD	0.42	MS	0.34
CT	0.42	NY	0.33
MA	0.41	WI	0.33
TN	0.41	AR	0.33
MT	0.41	WV	0.33
TX	0.40	NM	0.32
OK	0.40	DC	0.29
NV	0.40	IL	0.21
NE	0.40		

Medium/Average =~ 0.40

Possible issues:

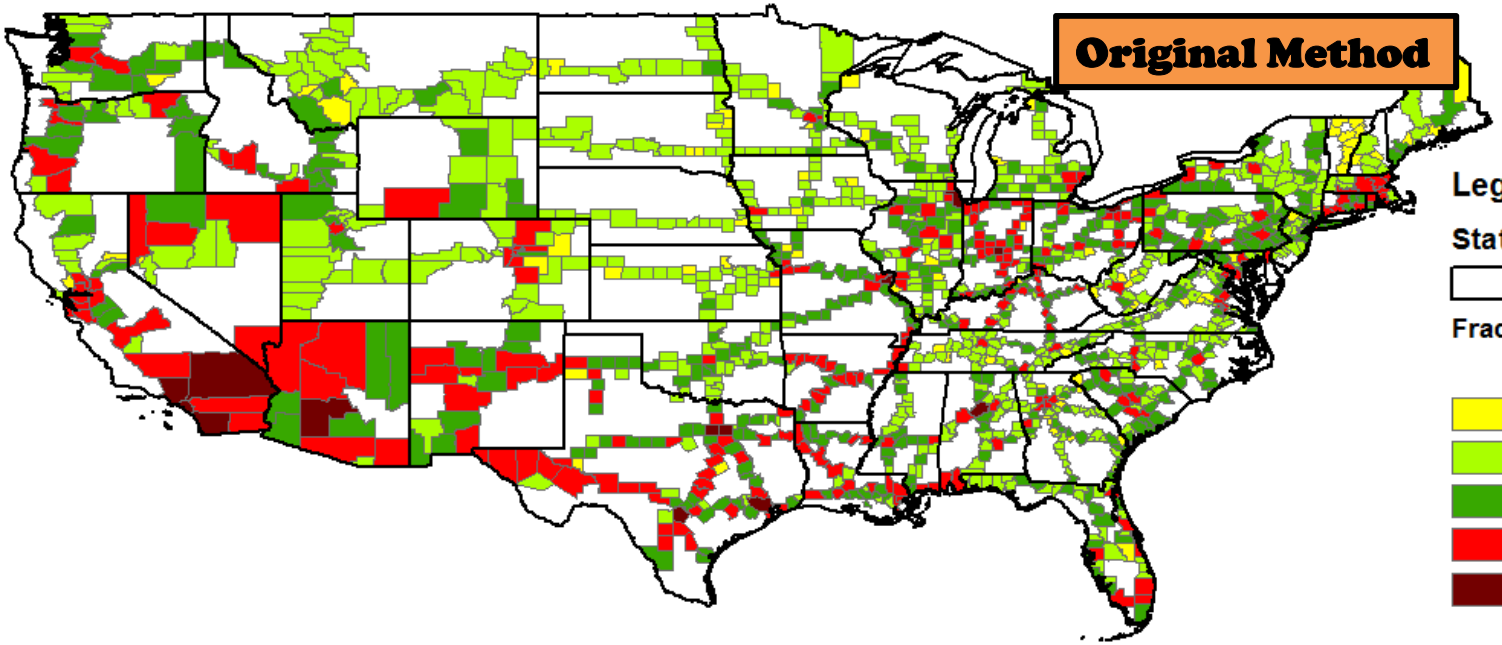
(1) Non state-specific or faulty data;

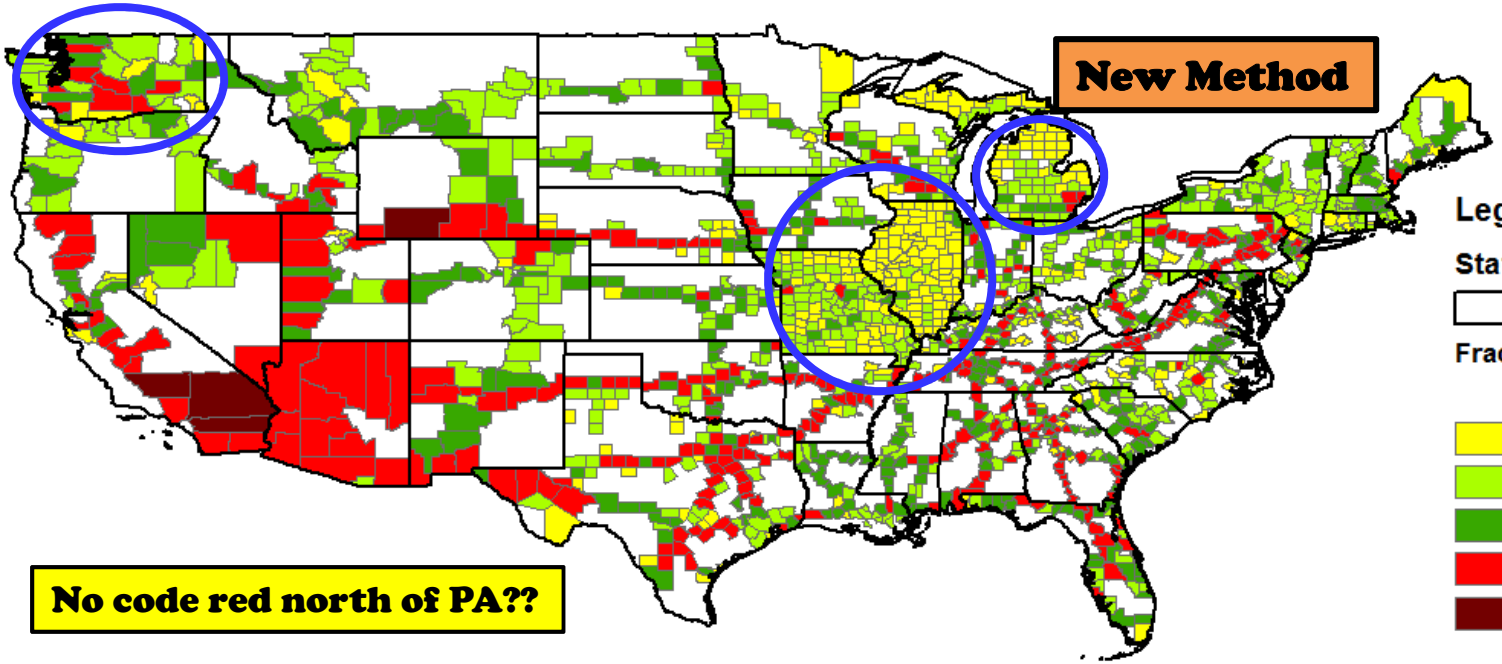
(2) Generic VMT/VPOP ratio used for VPOP estimates instead of local data;

(3) MOVES SCC conversion flaws

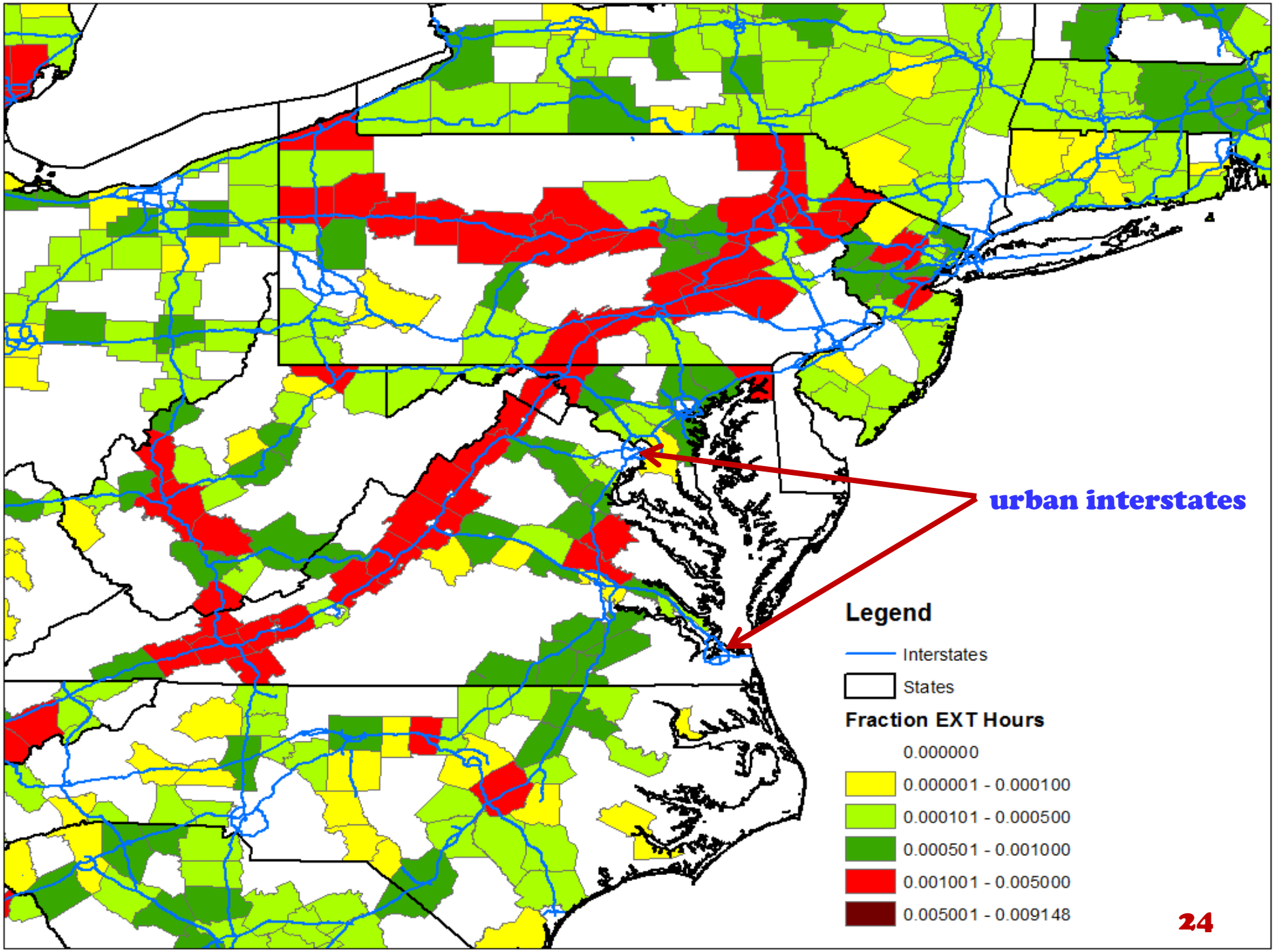
Low: NY, WI, AR, WV, NM, DC, IL
High: OH, MN, NH, DE, IA, RI, AZ

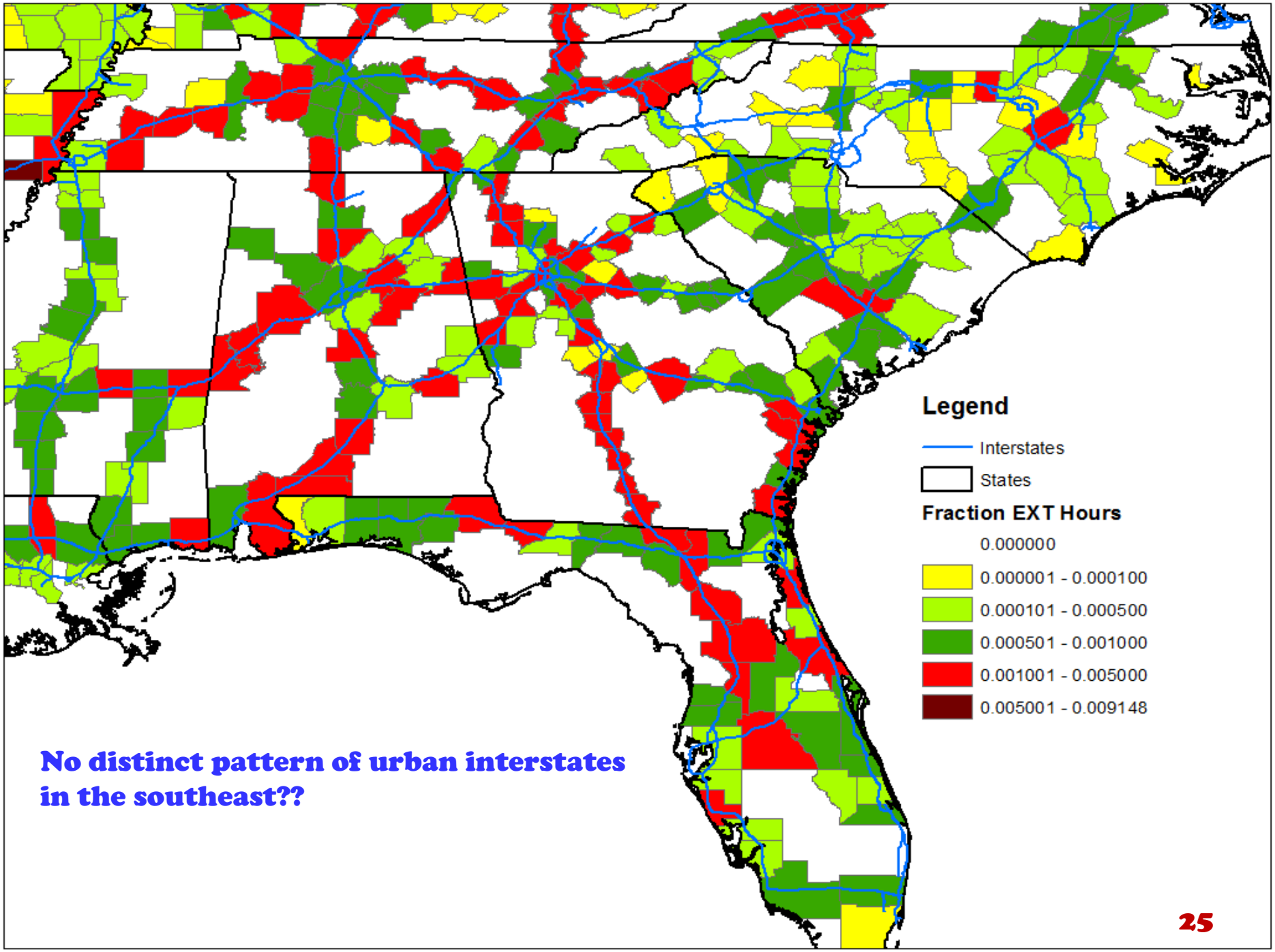
New EXT Methodology





No code red north of PA??


urban interstates
Legend
Interstates
States
Fraction EXT Hours
0.000000
0.000001 - 0.000100
0.000101 - 0.000500
0.000501 - 0.001000
0.001001 - 0.005000
0.005001 - 0.009148



No distinct pattern of urban interstates in the southeast??

New EXT Methodology
What's known

- Differences between original and new EXT methods appear to be merely updates from 1999 data to "semi" 2011 data
- New EXT has higher idle hours than original method
- Idle hours for WA, MO, IL, and MI are questionable (idling activity for every county)
- New method should consistently place EXT on rural interstates only (no idling on urban interstates)
  - Is the assumption that Idling only occurs on rural interstates valid?
- 2011 NEI version2 should use most recent data (CRC + state-supplied) to calculate EXT hours

New EXT Methodology
Unknown

EXT = VMT (mile) * Default Rate (hour/mile) * Emission Factor (gram/hour)
= Idle Hour (hour) * Emission Factor (gram/hour)

Questions:
(a) How can default rates or idle hours be calculated?
(b) How are emission factors estimated? Note that rates in existing RPV lookup tables will NOT work.
(a) Will new default rates and/or emission factors be in MOVES2014?
(b) Will SMOKE-MOVES integration tool and SMOKE be updated and released in conjunction with release of MOVES2014?

Guidance are needed to assist states to run the tools correctly

Action Plan

- **MARAMA workgroup intends to repeat all analyses when 2011 NEI version2 is released**
- **Every effort should be made to resolve all identified issues**

Comments on EXT due to EPA on May 31, 2014