



GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

PM NAAQS and Exceptional Events

Jim Boylan
Chief, Air Protection Branch

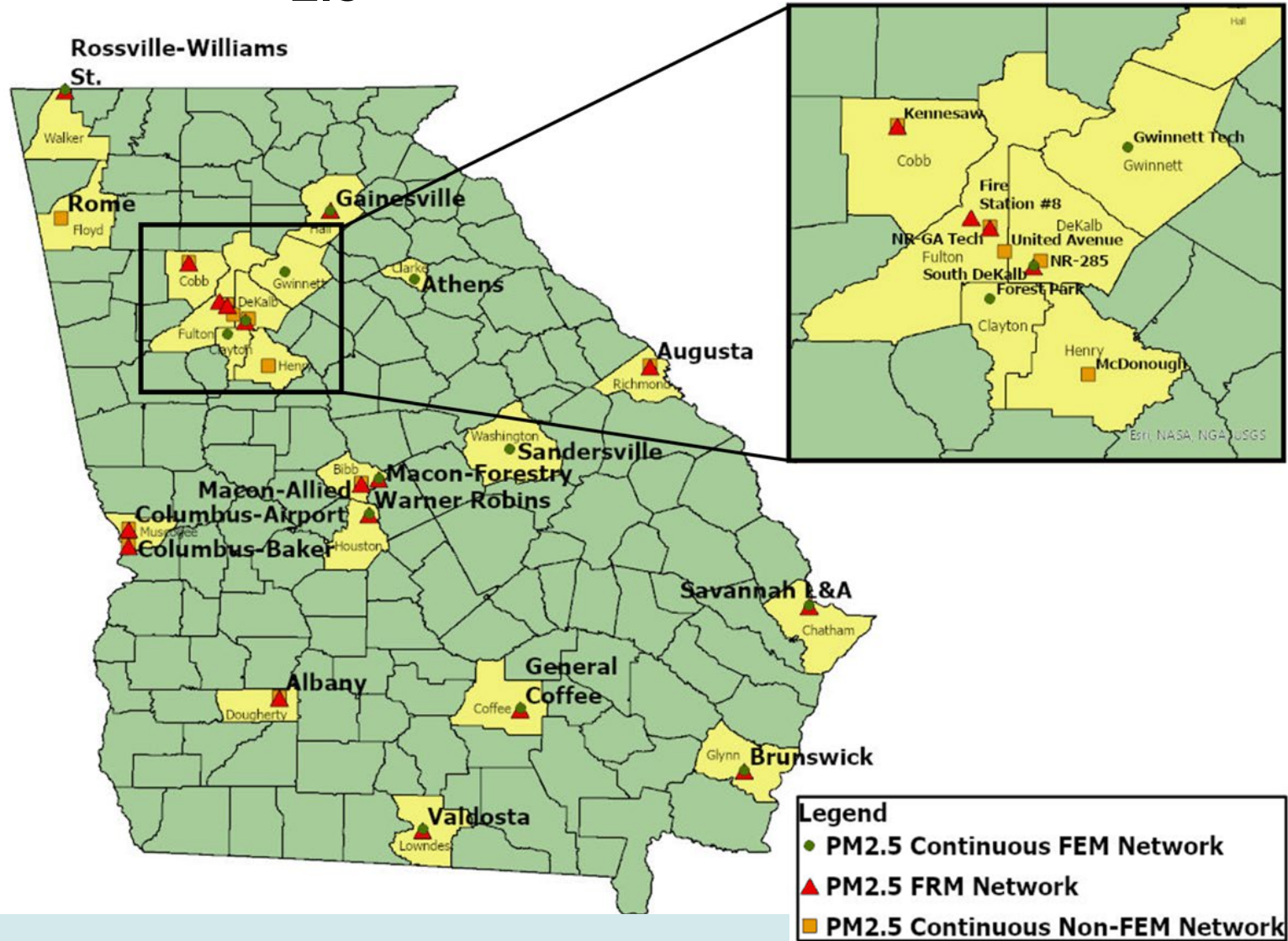
AAPCA 2024 Spring Meeting
Indianapolis, IN
April 25, 2024



PM_{2.5} IN GEORGIA

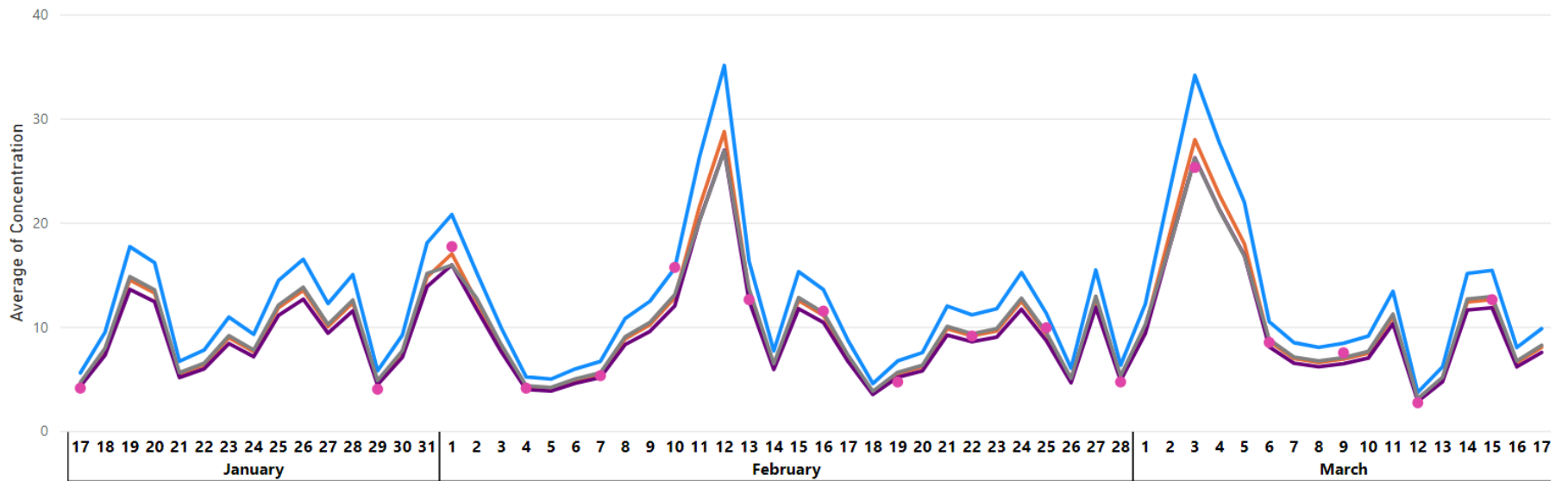
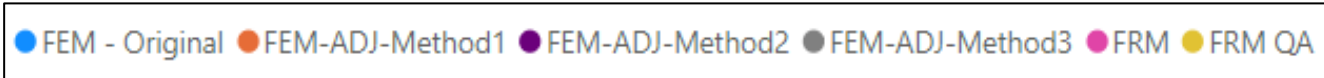


PM_{2.5} MONITOR LOCATIONS



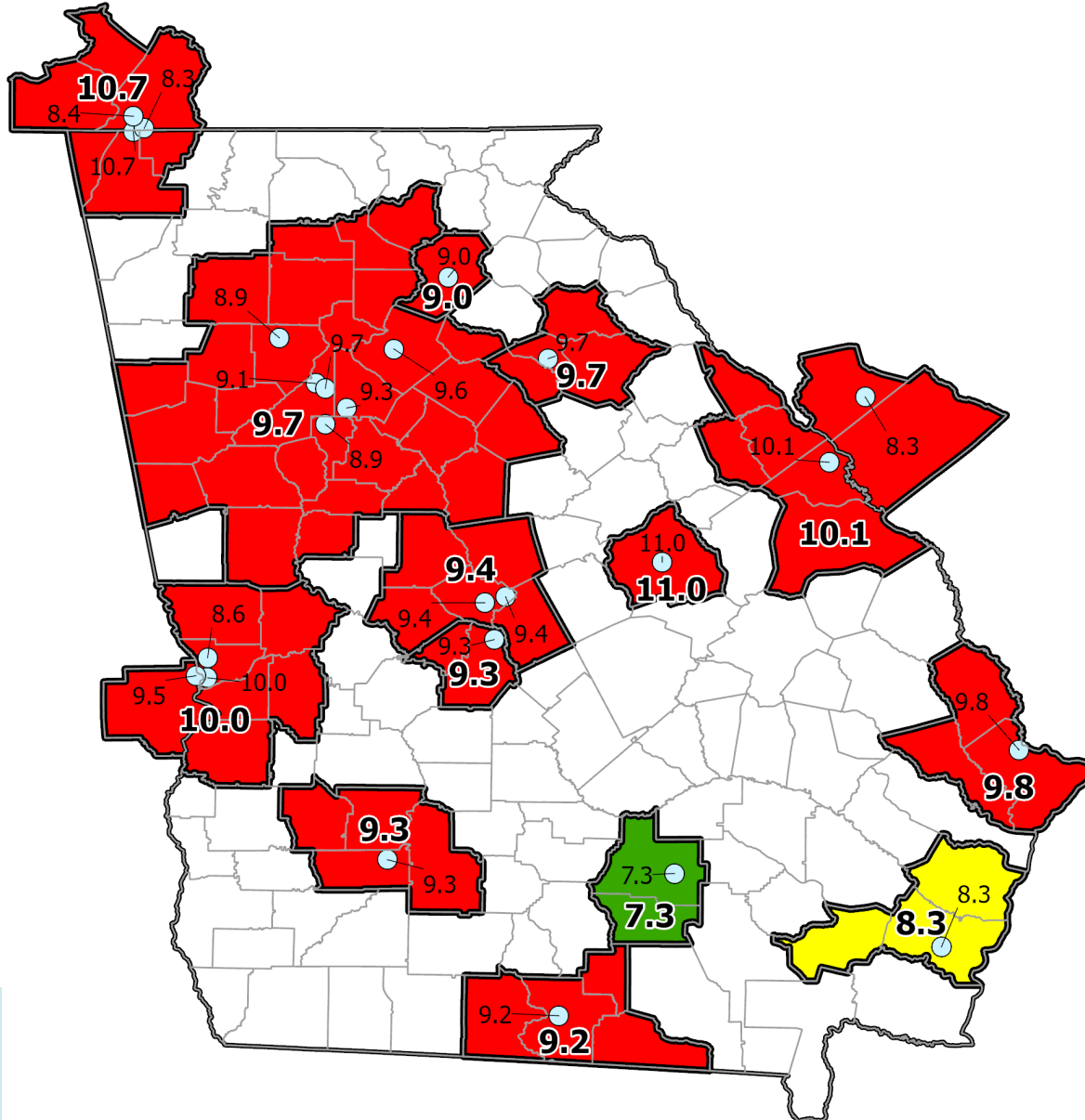


AUGUSTA FEM ADJUSTMENTS - 2022



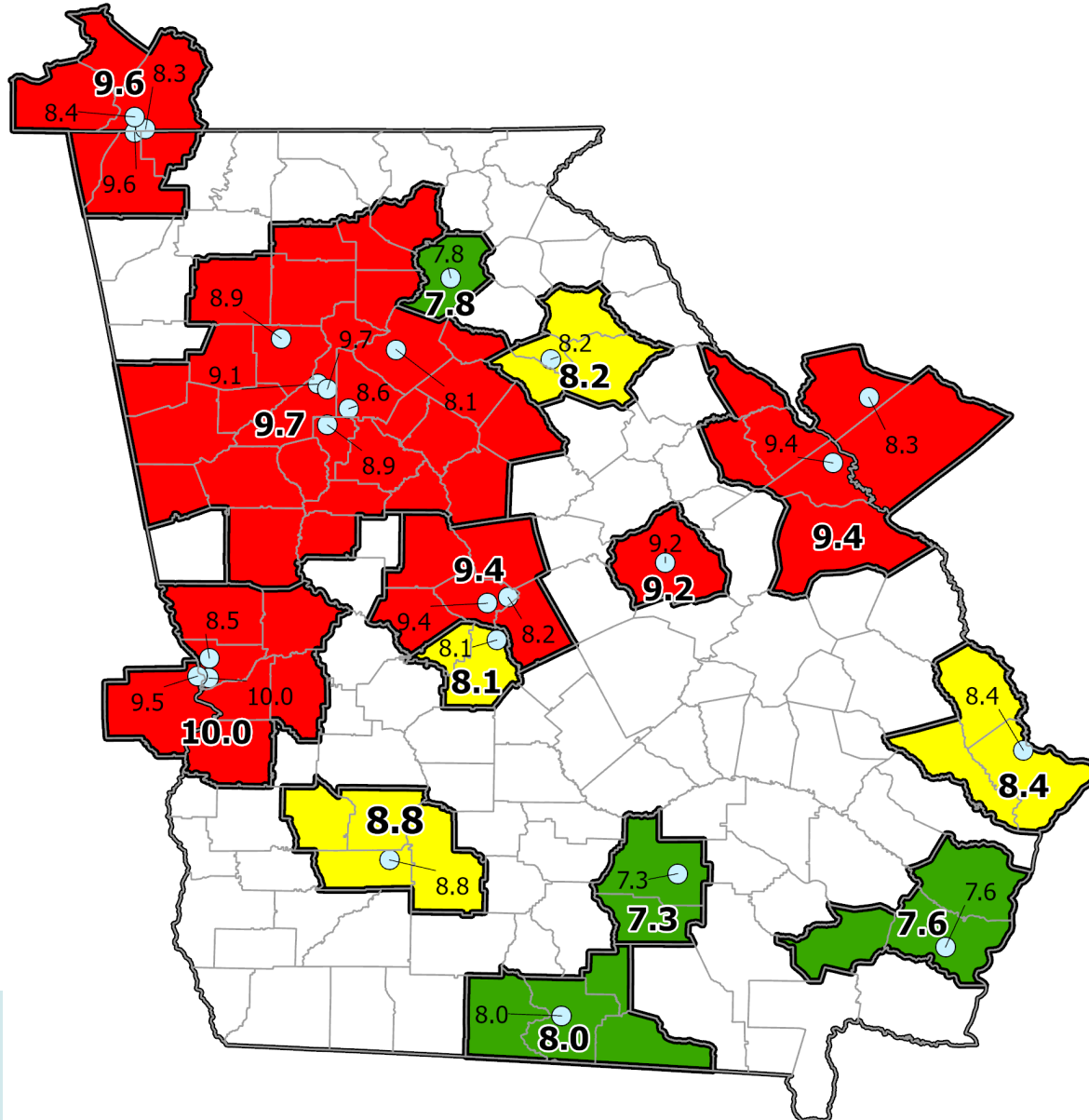


2021-2023 DESIGN VALUES





ADJUSTED 2021-2023 DESIGN VALUES





EXCEPTIONAL EVENTS FOR DESIGNATION RECOMMENDATIONS



DVs FOR DESIGNATIONS

- Apply FEM bias adjustment factor to all FEM measurements prior to August 1, 2023 (Teledyne firmware install date in GA).
- Remove high $PM_{2.5}$ events until 3-year (2021-2023) annual $PM_{2.5}$ design value meets the NAAQS.
 - Focus on 2022 and 2023 events
 - Address EPA's five EE elements
- Submit exceptional events demonstrations for all days removed to EPA for approval.



EXCEPTIONAL EVENTS

- **When EPA concurs with an Exceptional Event, that data can be excluded from the design value used for comparison to the NAAQS.**
- **Every PM_{2.5} exceedance in Georgia since 2019 was caused by an event that is eligible for exclusion under the Exceptional Events Rule.**
 - **Most exceedances are caused by prescribed fires**
- **Georgia EPD is working with EPA R4 and the Georgia Forestry Commission to develop an Exceptional Events template for prescribed fires in the SE.**



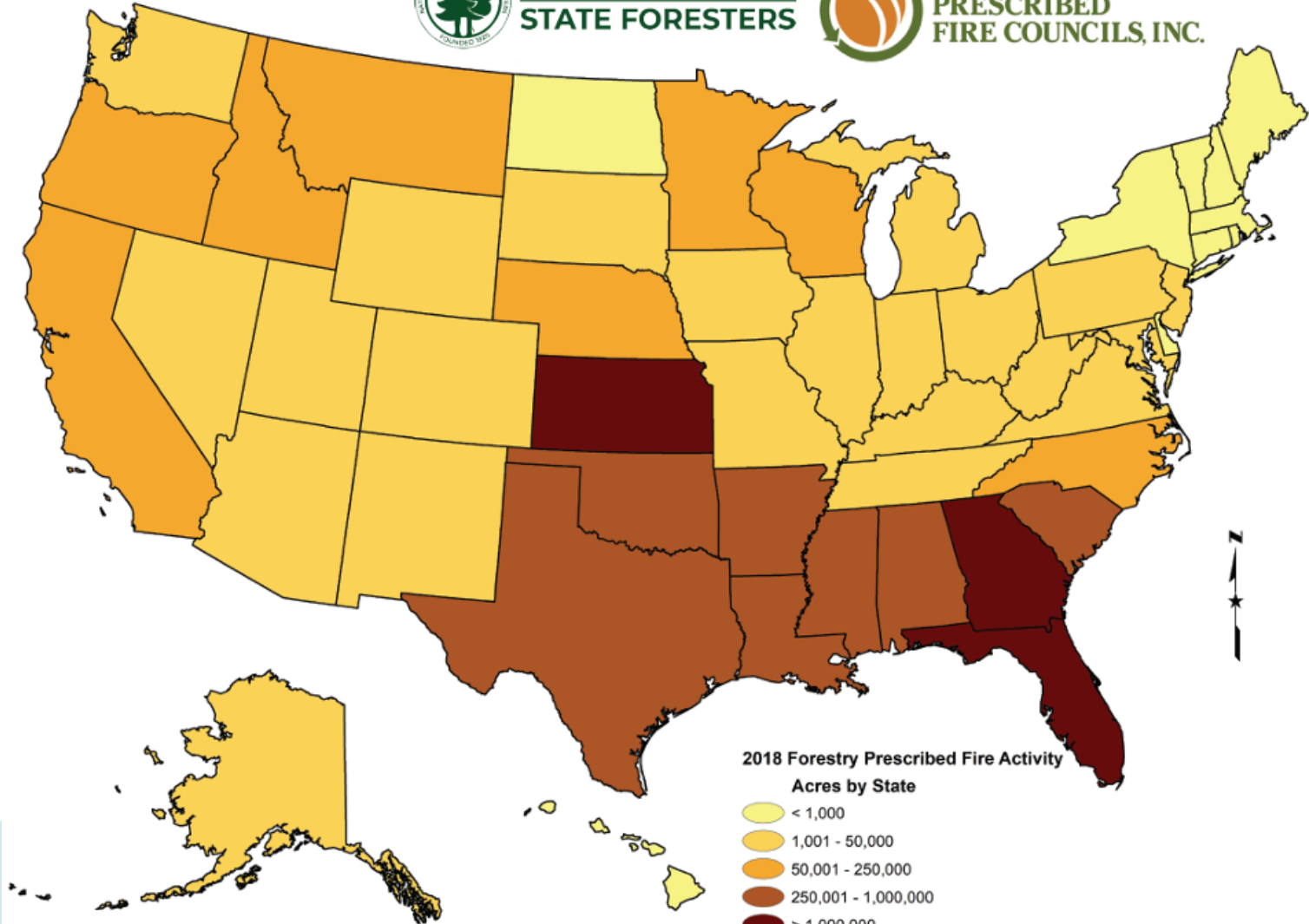
PRESCRIBED FIRE ACRES



NATIONAL ASSOCIATION OF
STATE FORESTERS

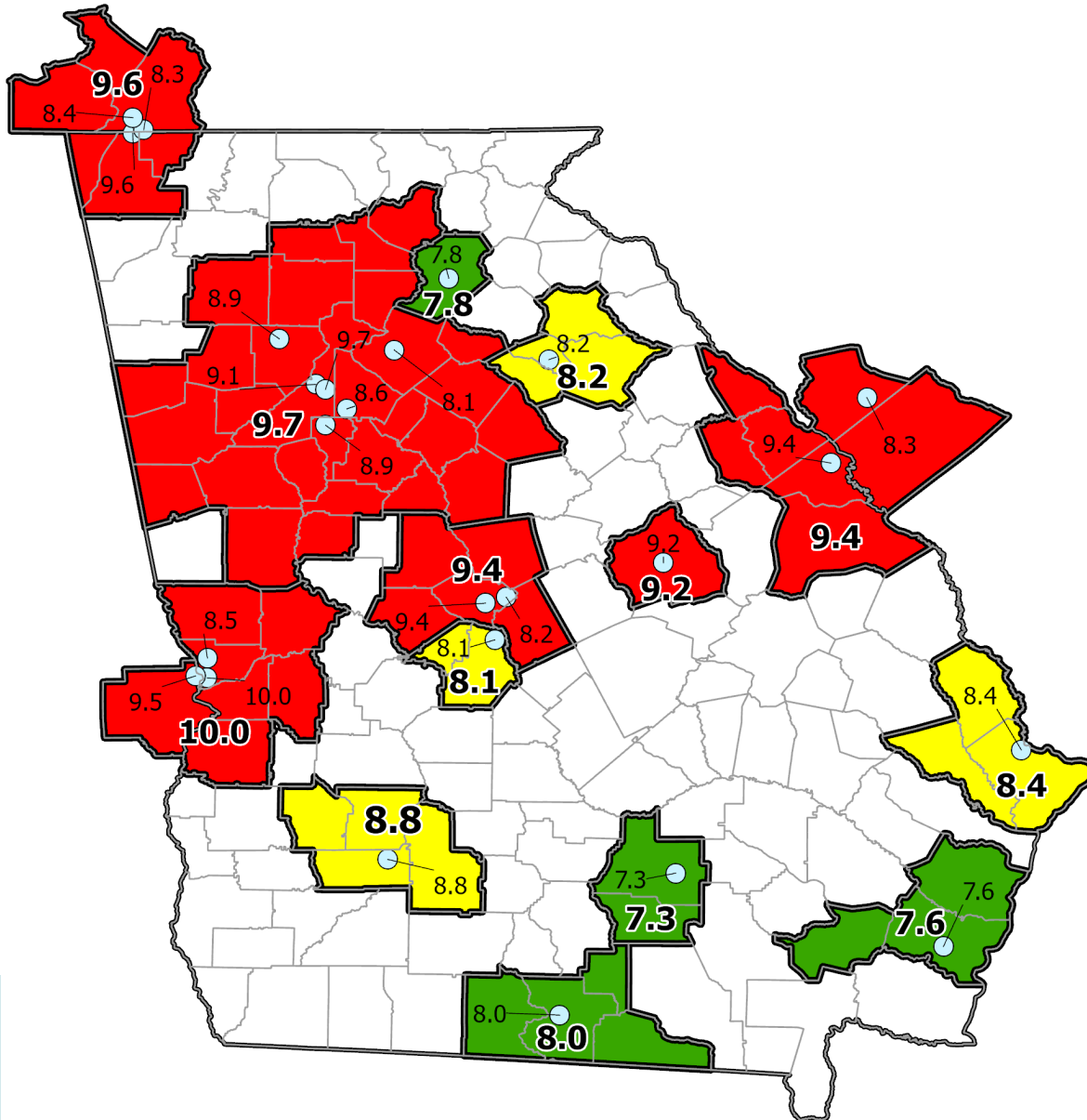


COALITION OF
PRESCRIBED
FIRE COUNCILS, INC.



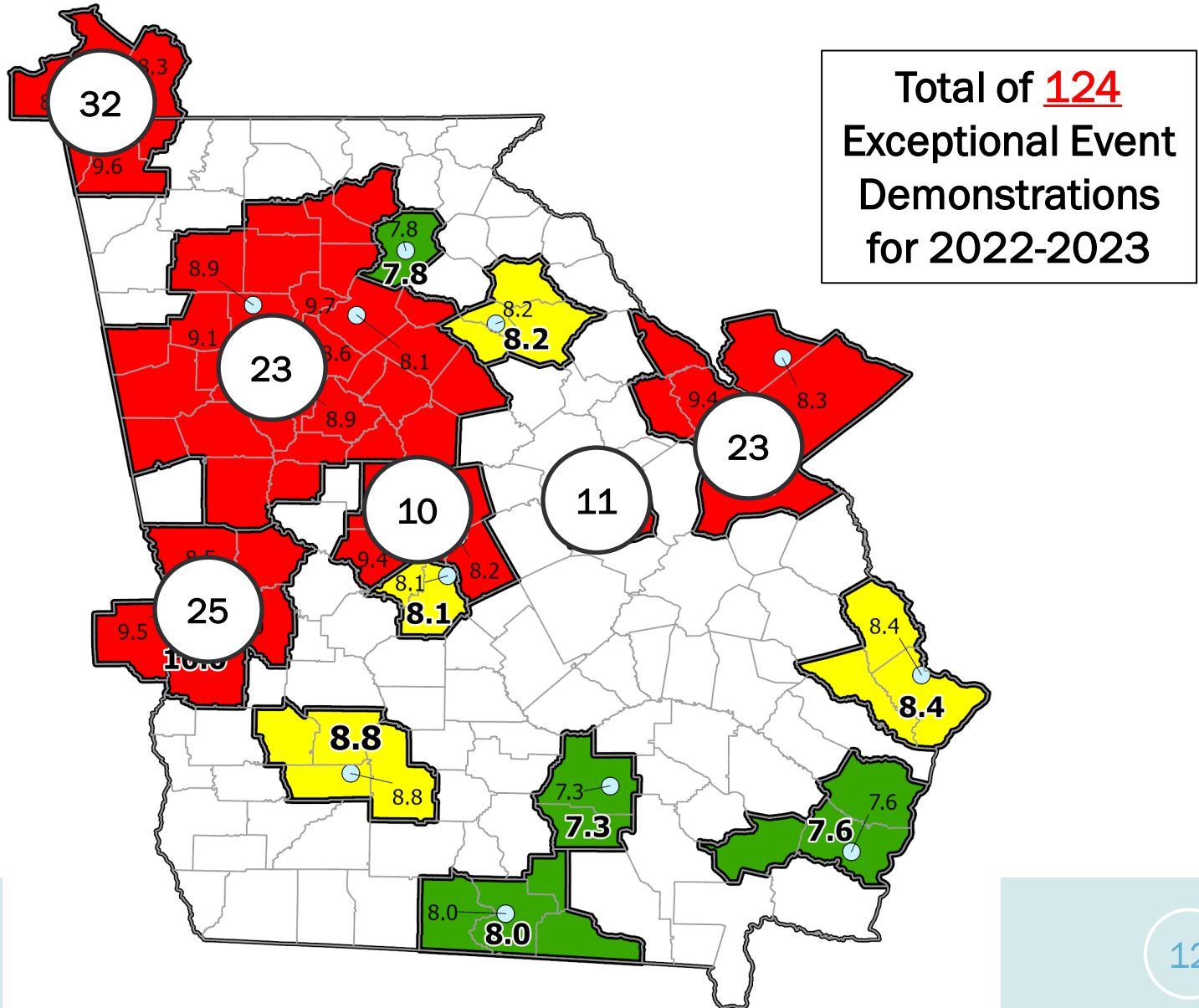


ADJUSTED 2021-2023 DESIGN VALUES





NUMBER OF EE DEMONSTRATIONS





FUTURE EE DEMONSTRATIONS

- **The Georgia Forestry Commission would like to increase burn acres from 1.4M/year to 2.0M/year.**
- **Estimate the need to submit ~60 EE demonstrations in 2024 and 50-100 EE demonstrations in 2025, 2026, 2027 and every year after (forever) to remain in attainment with the standard.**



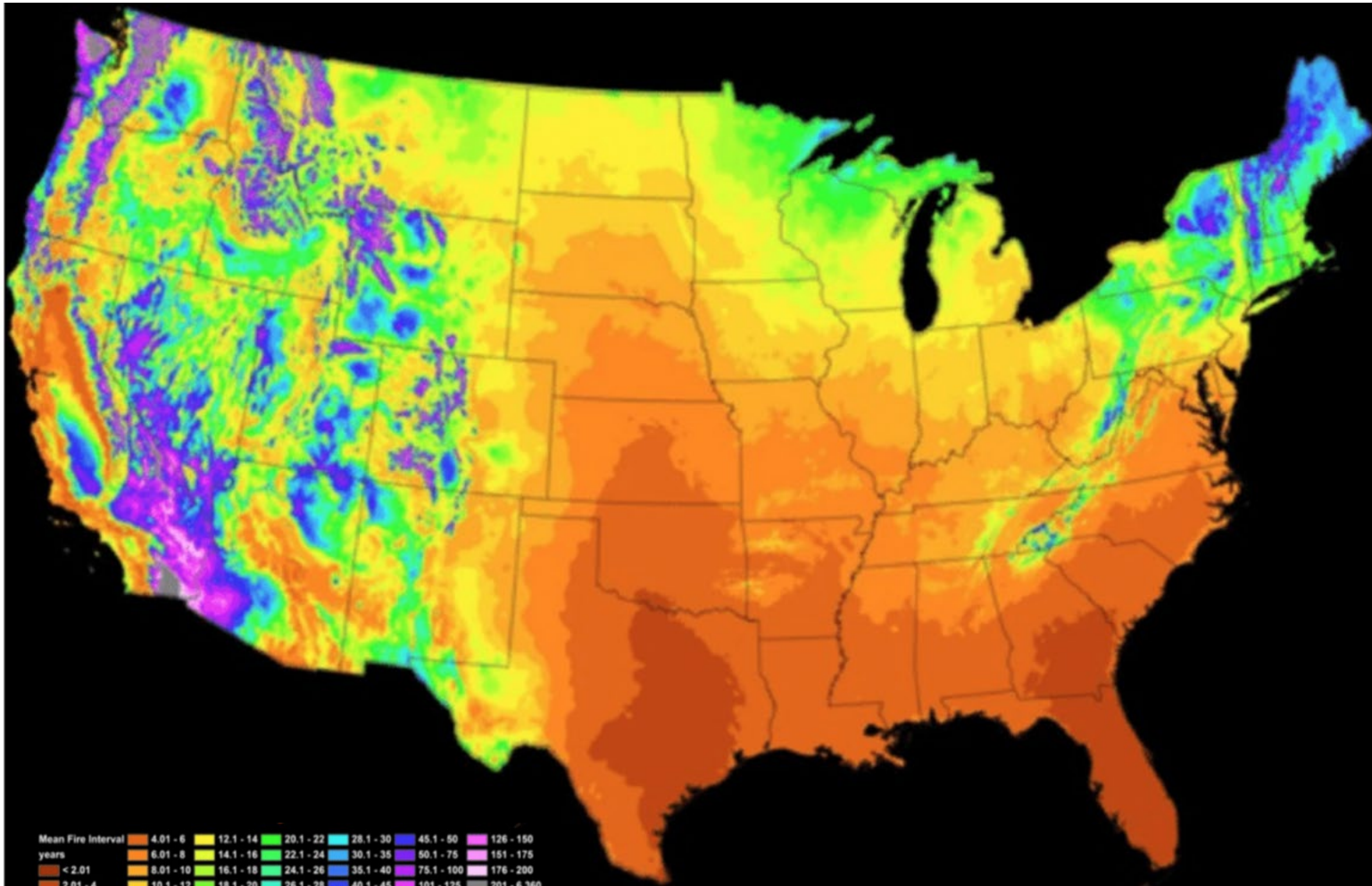
EXCEPTIONAL EVENTS ELEMENTS

- **Conceptual Model of the Event**
- **Clear Causal Relationship**
 - Ambient measurements, modeling, satellite images, etc.
- **Human Activity Unlikely to Recur**
 - Natural fire return interval map
- **Not Reasonably Controllable/Preventable**
 - Certified Smoke Management Program
- **Public Comment Process**

“Exceptional Events Guidance: Prescribed Fire on Wildland that May Influence Ozone and Particulate Matter Concentrations”, EPA-457/B-19-004, August 2019.



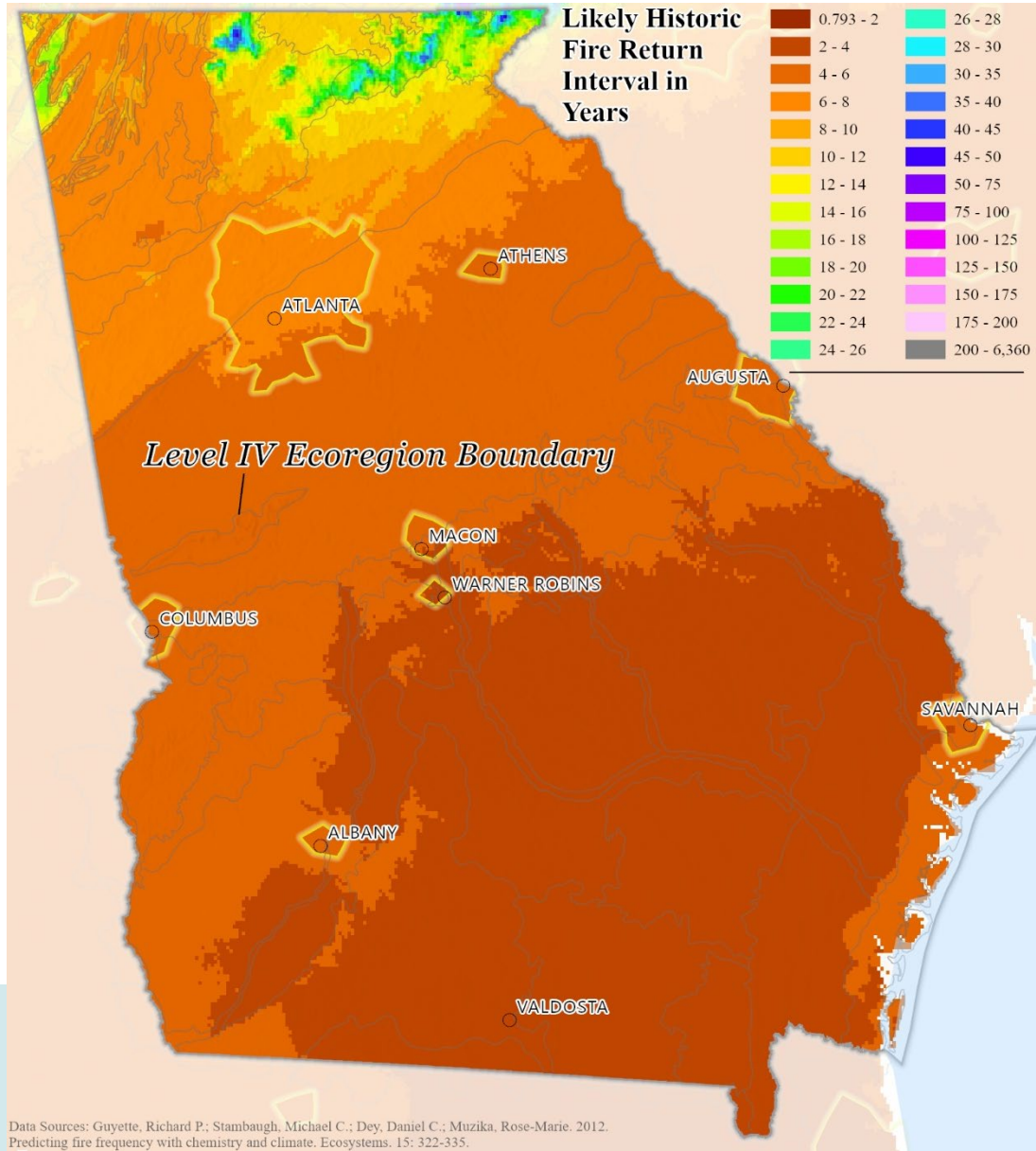
FIRE RETURN INTERVAL MAP



Data Sources: Guyette, Richard P.; Stambaugh, Michael C.; Dey, Daniel C.; Muzika, Rose-Marie. 2012. Predicting fire frequency with chemistry and climate. *Ecosystems*. 15: 322-335.



HUMAN ACTIVITY UNLIKELY TO RECUR



Data Sources: Guyette, Richard P.; Stambaugh, Michael C.; Dey, Daniel C.; Muzika, Rose-Marie. 2012. Predicting fire frequency with chemistry and climate. *Ecosystems*. 15: 322-335.



NOT REASONABLY CONTROLLABLE

- Georgia has a certified Smoke Management Program.
- Georgia Forestry Commission (GFC) issues burn permits.
 - GFC restricts burning on poor dispersion days, on days when the wind is blowing towards sensitive locations, or poor air quality days (forecasted or measured).
 - **Military bases do not require a burn permit.**

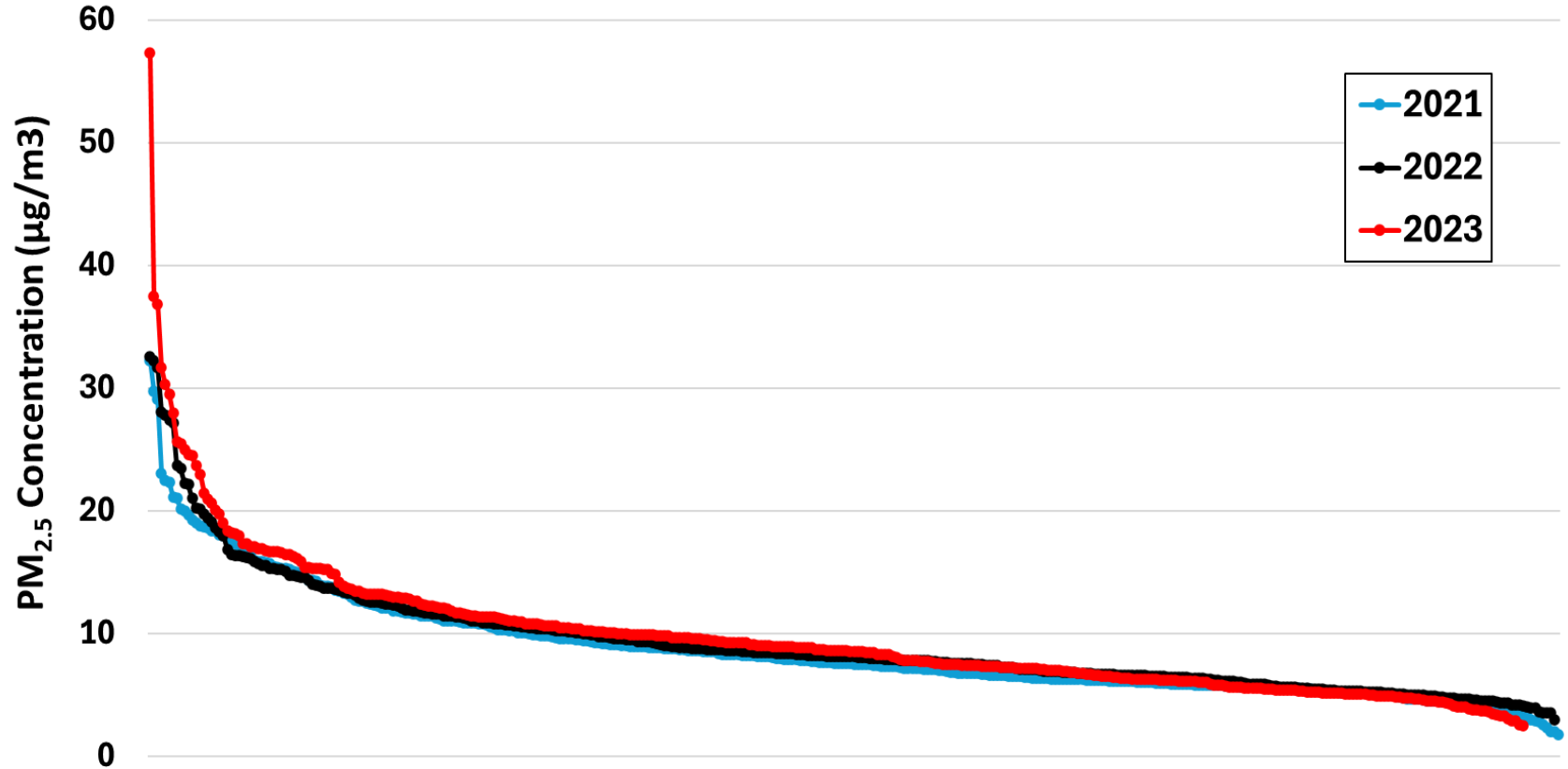


SANDERSVILLE MONITOR



SANDERSVILLE 2021-2023

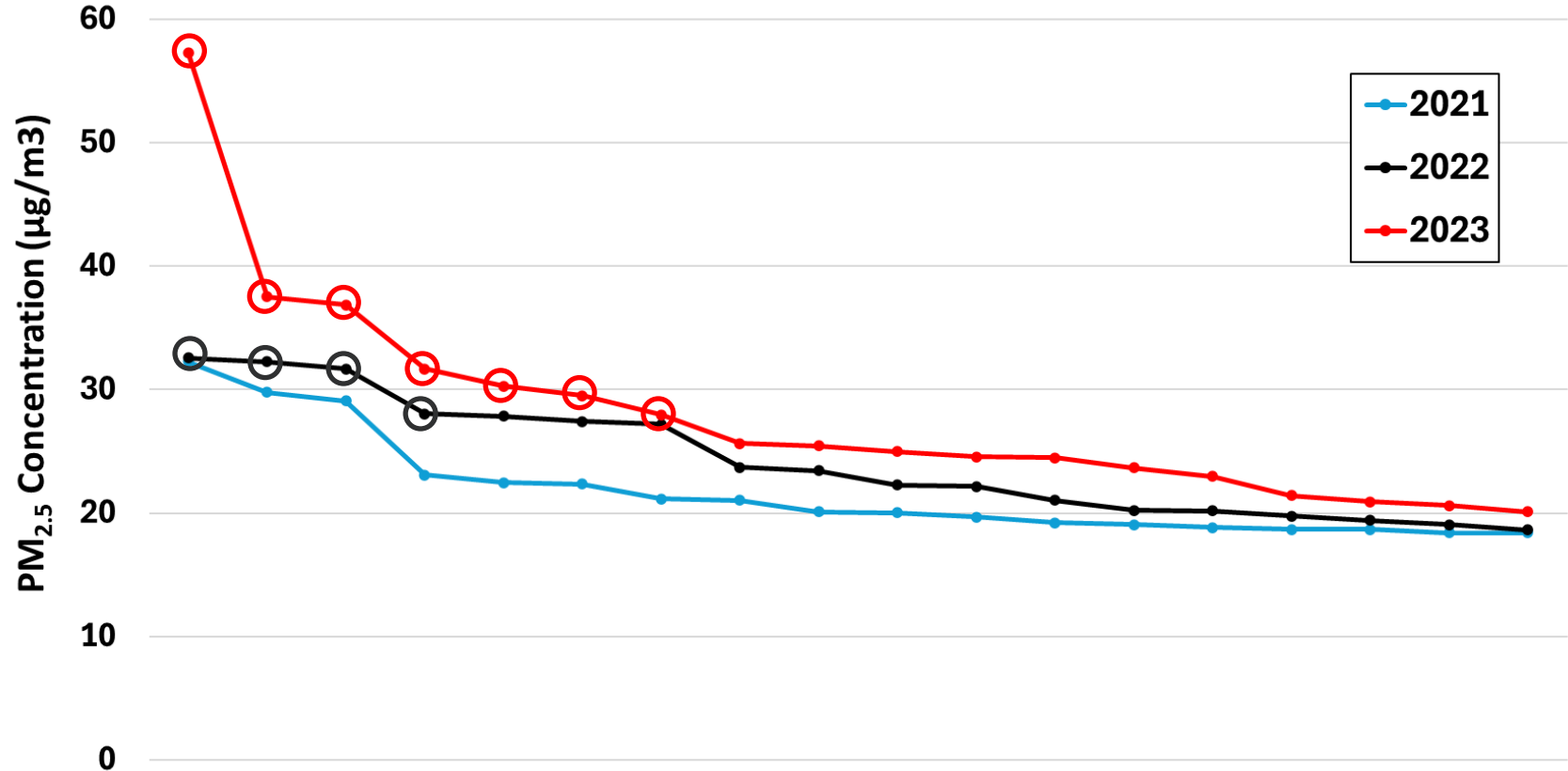
FEM Adjusted PM_{2.5} Concentrations





SANDERSVILLE 2021-2023

FEM Adjusted PM_{2.5} Concentrations





EXCEPTIONAL EVENT DAYS REMOVED

Date	Unadjusted 24-Hour Average ($\mu\text{g}/\text{m}^3$)	FEM Bias Adjusted 24-Hour Average ($\mu\text{g}/\text{m}^3$)
2022-01-31	40.02	32.58
2022-02-01	39.60	32.24
2022-02-15	38.89	31.67
2022-02-14	34.44	28.04

Date	Unadjusted 24-Hour Average ($\mu\text{g}/\text{m}^3$)	FEM Bias Adjusted 24-Hour Average ($\mu\text{g}/\text{m}^3$)
2023-03-08	70.38	57.31
2023-03-09	46.08	37.52
2023-07-18	45.28	36.86
2023-04-19	38.90	31.67
2023-07-17	37.20	30.29
2023-11-07	29.51	29.51
2023-01-11	34.33	27.95

Tier 1 threshold is $21.45 \mu\text{g}/\text{m}^3$.
Tier 2 threshold is $14.3 \mu\text{g}/\text{m}^3$.



SANDERSVILLE DESIGN VALUES

Year	Unadjusted Annual Average ($\mu\text{g}/\text{m}^3$)	FEM Bias Adjusted Annual Average ($\mu\text{g}/\text{m}^3$)	Remove EE Annual Average ($\mu\text{g}/\text{m}^3$)	# EE Days Removed
2021	10.7	8.74	8.74	0
2022	11.3	9.24	9.00	4
2023	11.1	9.74	9.23	7

AVERAGE

11.0

9.2

9.0

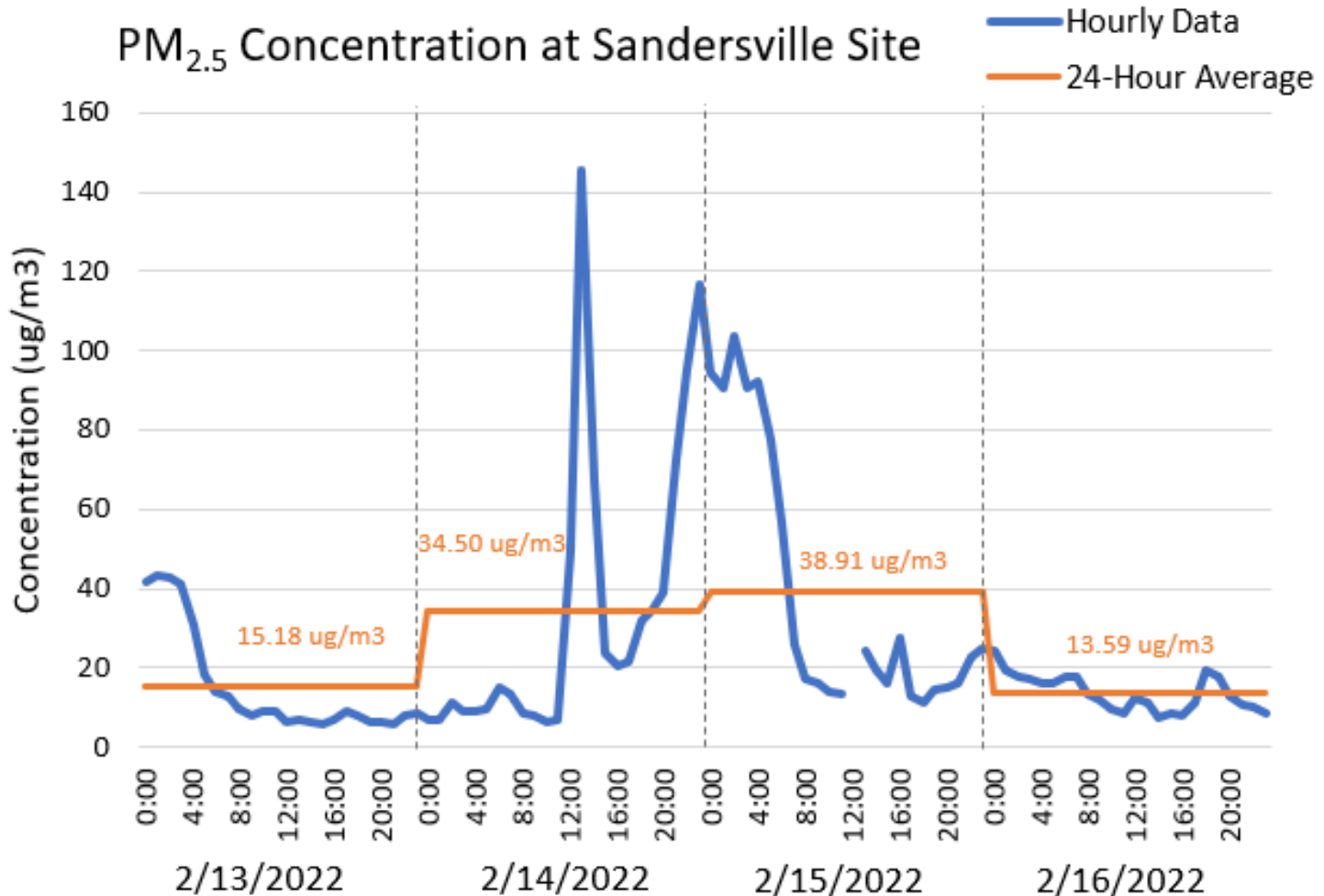


SANDERSVILLE

FEBRUARY 14-15, 2022

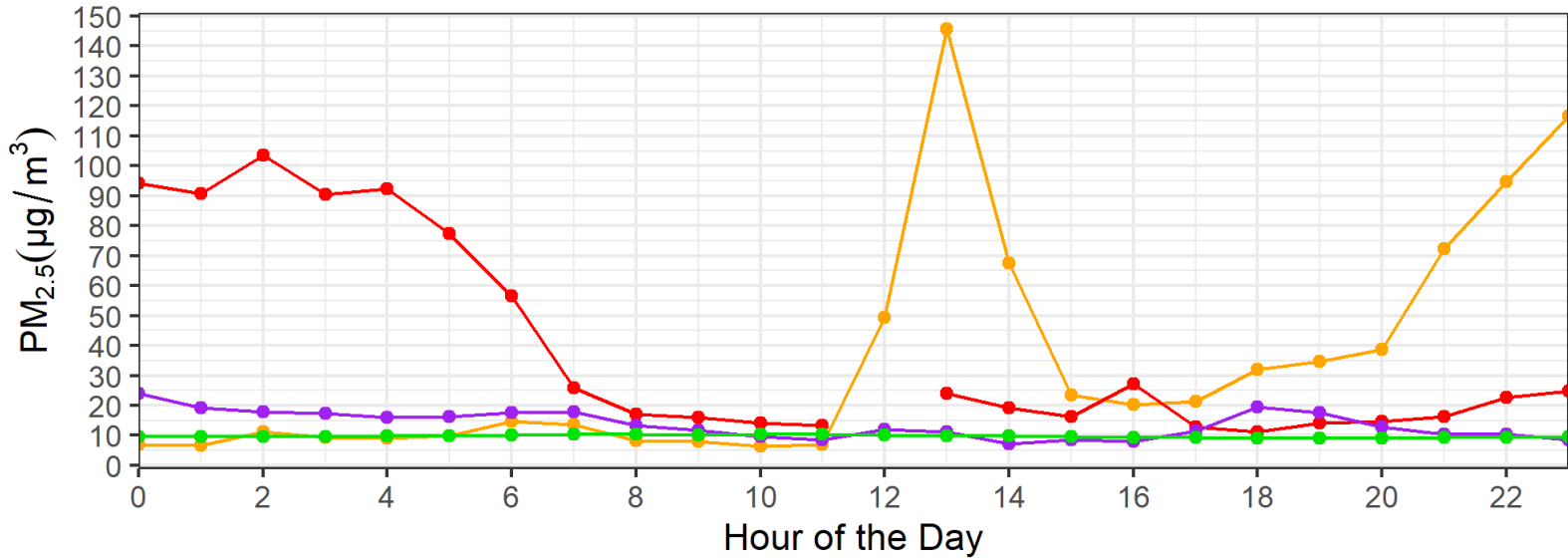


PM_{2.5} TIME SERIES



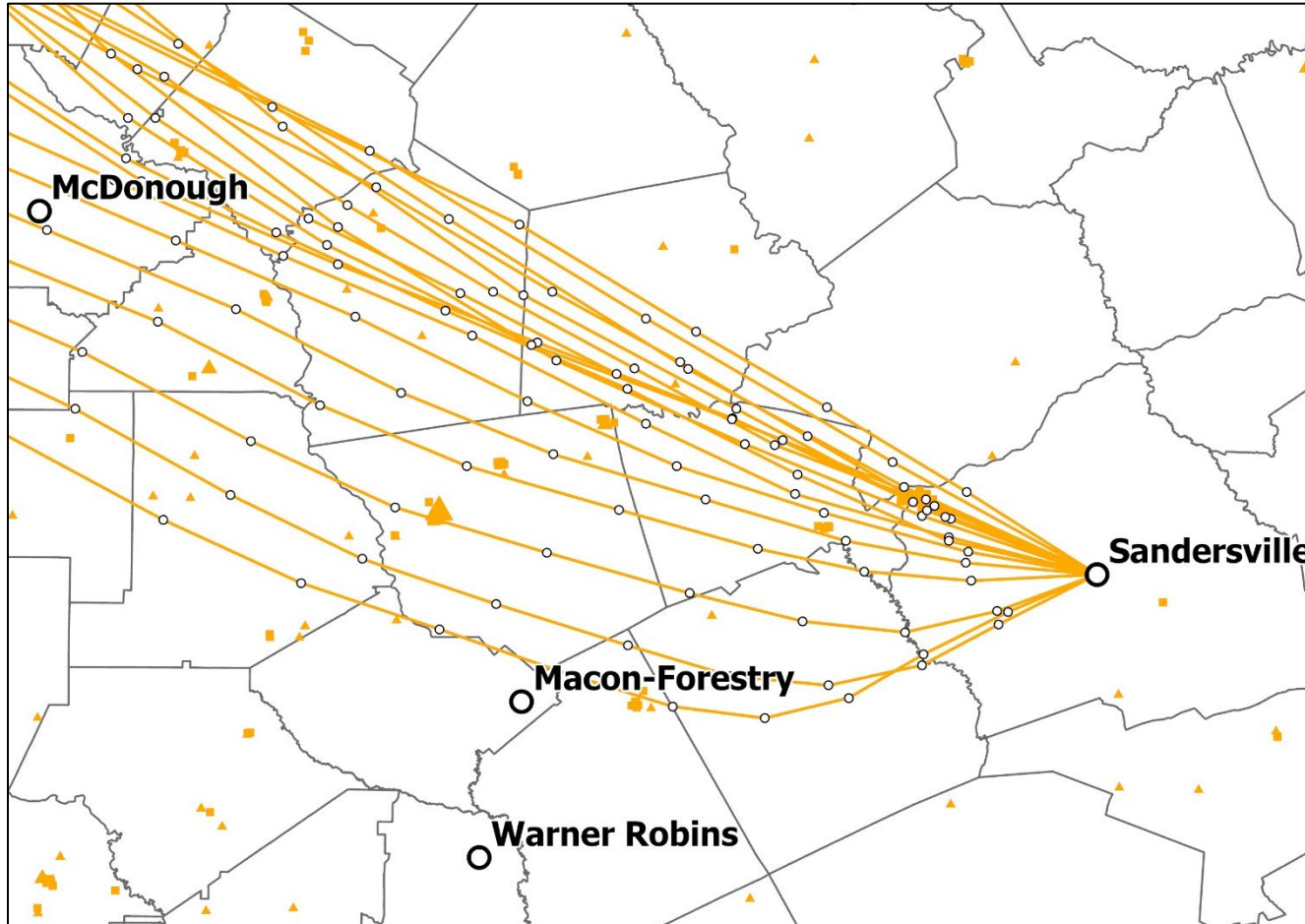


COMPARISON TO SEASONAL AVERAGE





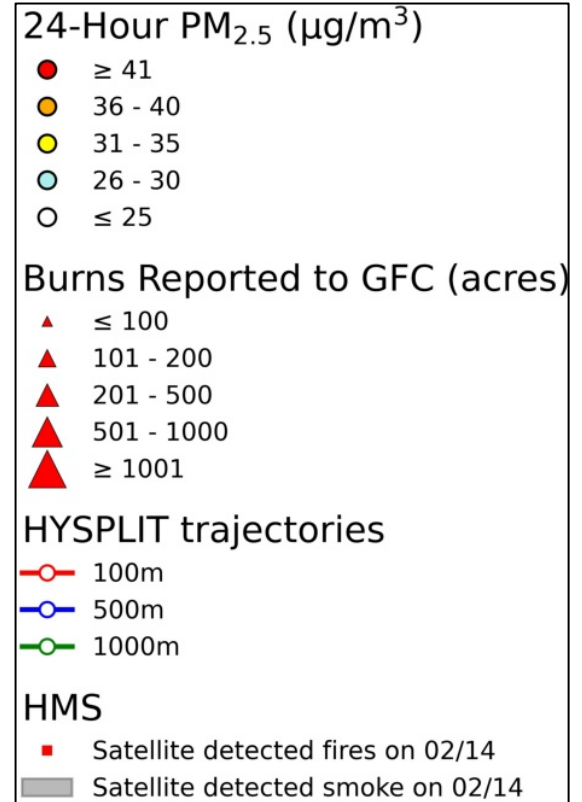
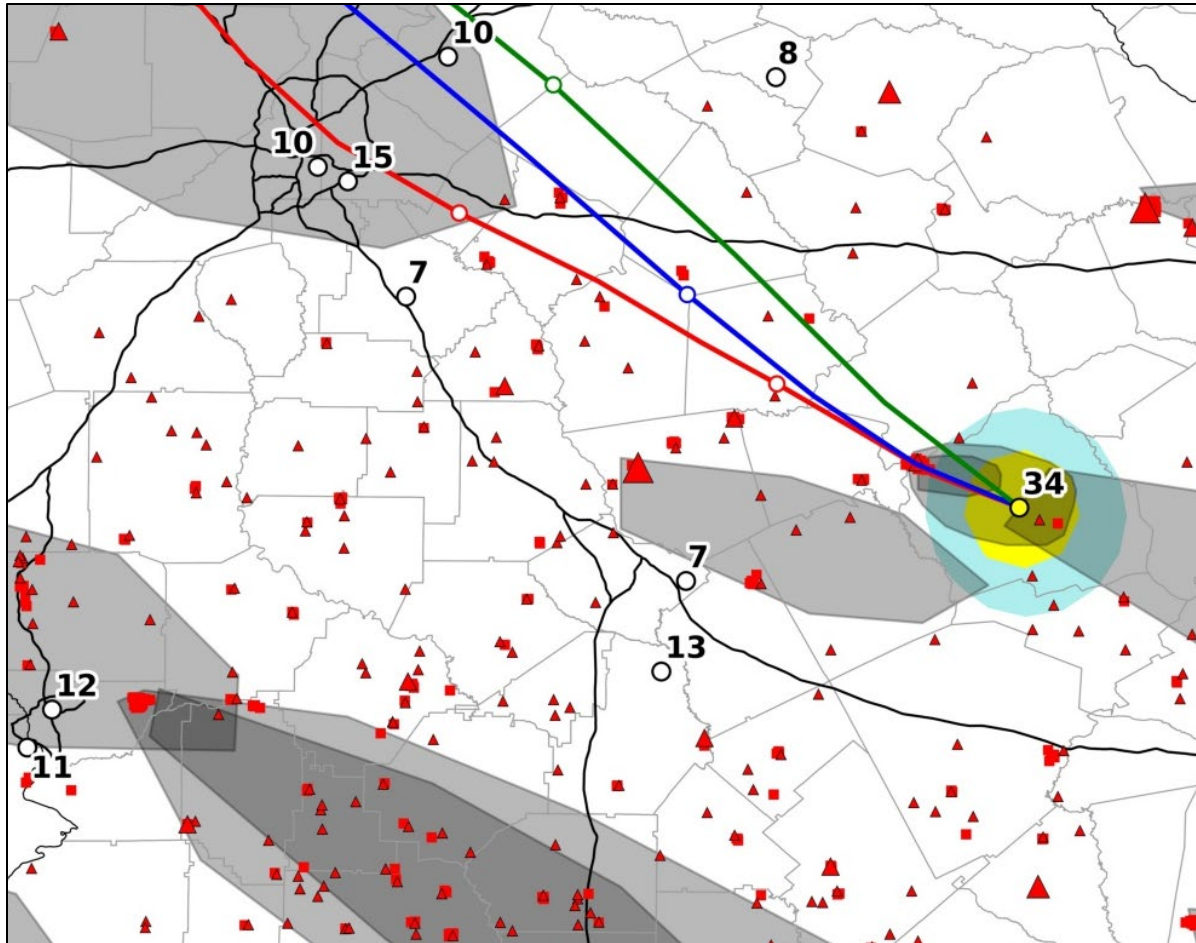
TRAJECTORIES AND BURN PERMITS



- PM2.5 Monitors
- Satellite detected fires on 2/14
- Hysplit trajectories on 2/14
- Burns Reported to GFC (acres)**
- On 2/14**
- ▲ ≤ 100
- ▲ 101 - 200
- ▲ 201 - 500
- ▲ 501 - 1000
- ▲ ≥1001



TRAJECTORIES, HMS, BURN PERMITS

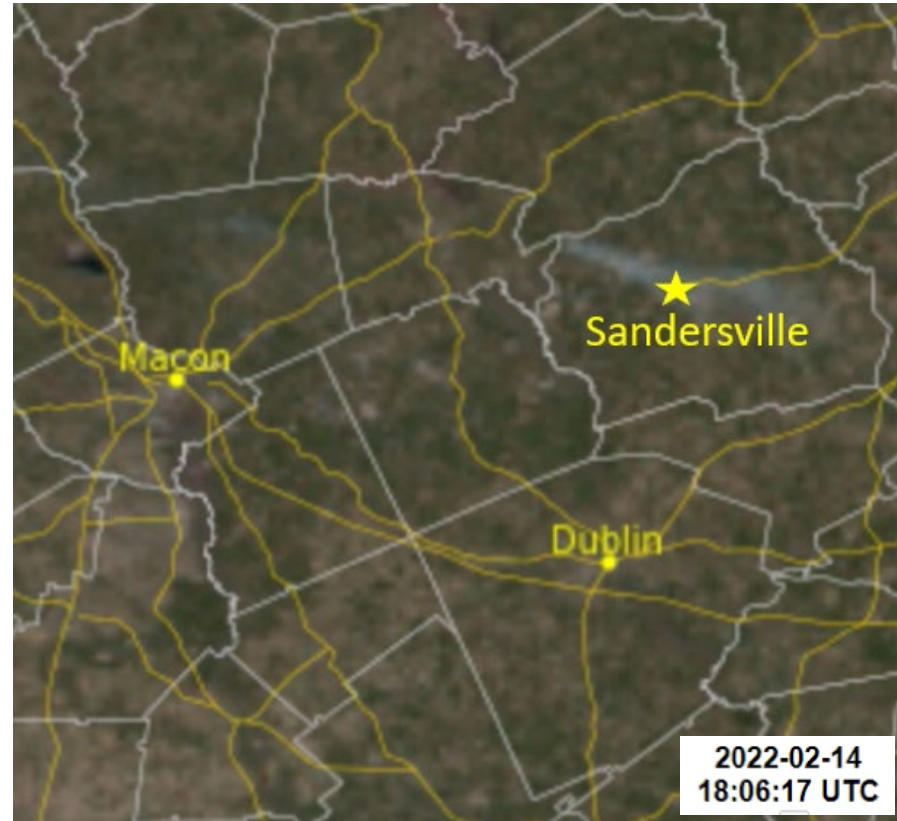
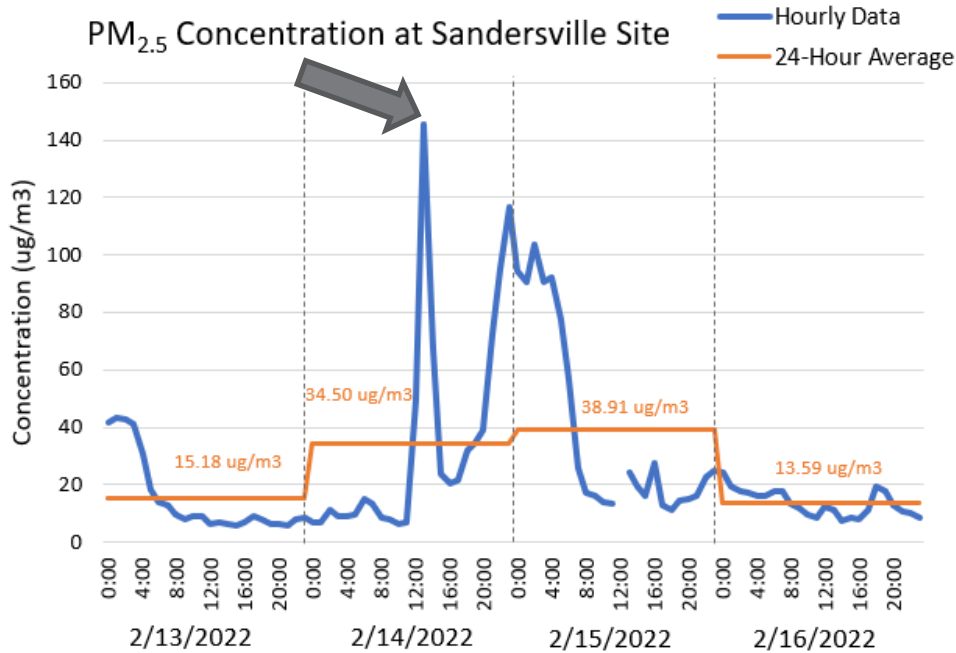


February 14 at 1:00 PM



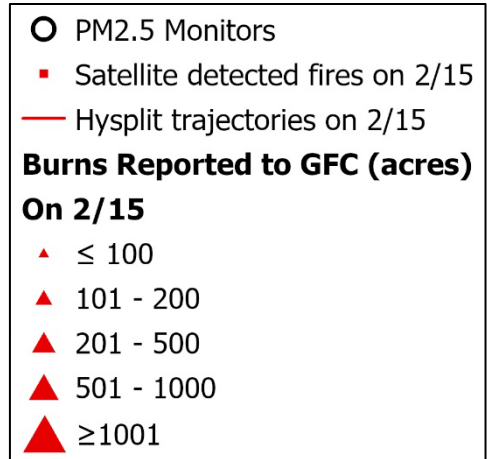
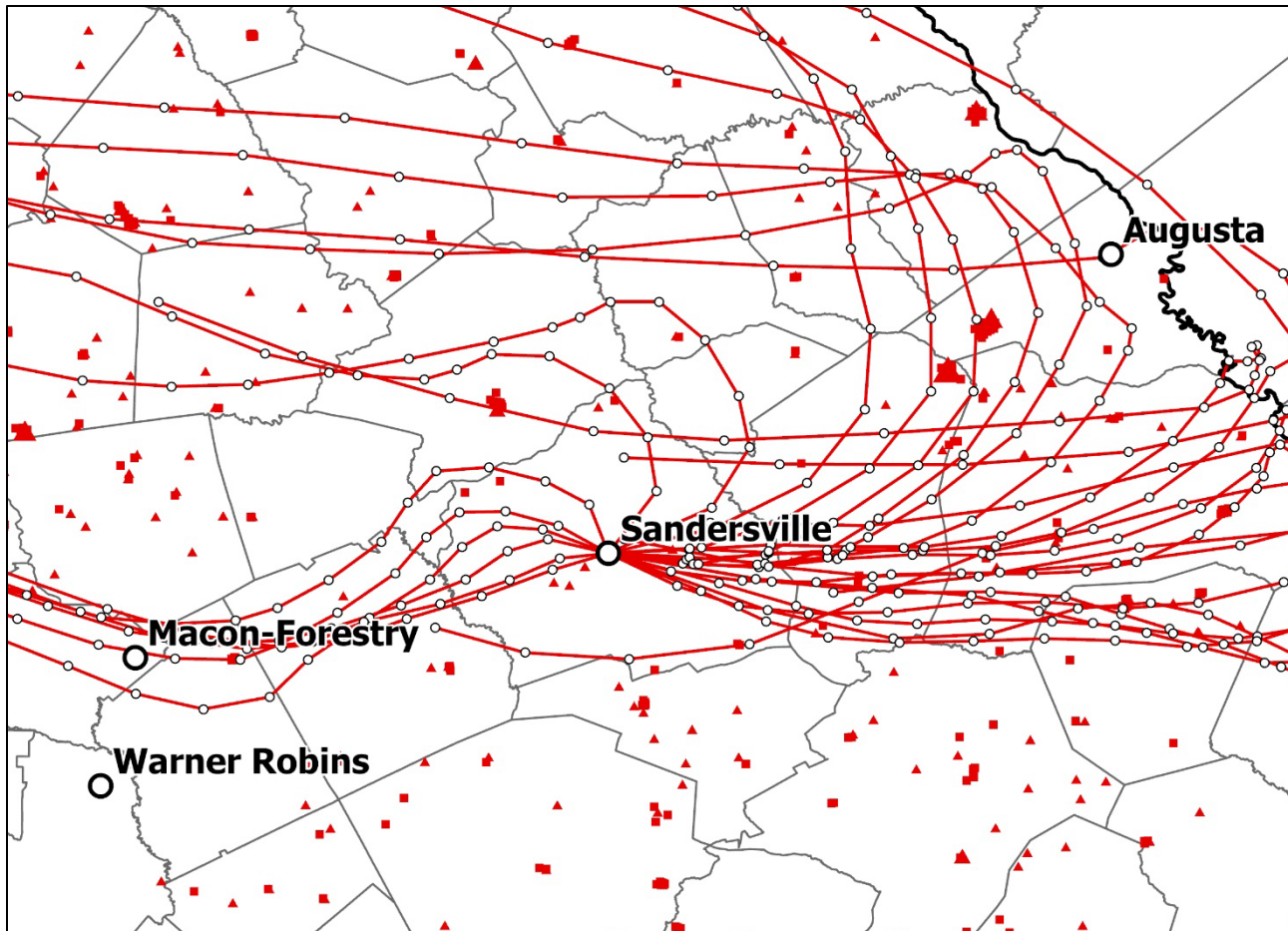
SANDERSVILLE - FEBRUARY 14 , 2022

February 14, 1:06 PM



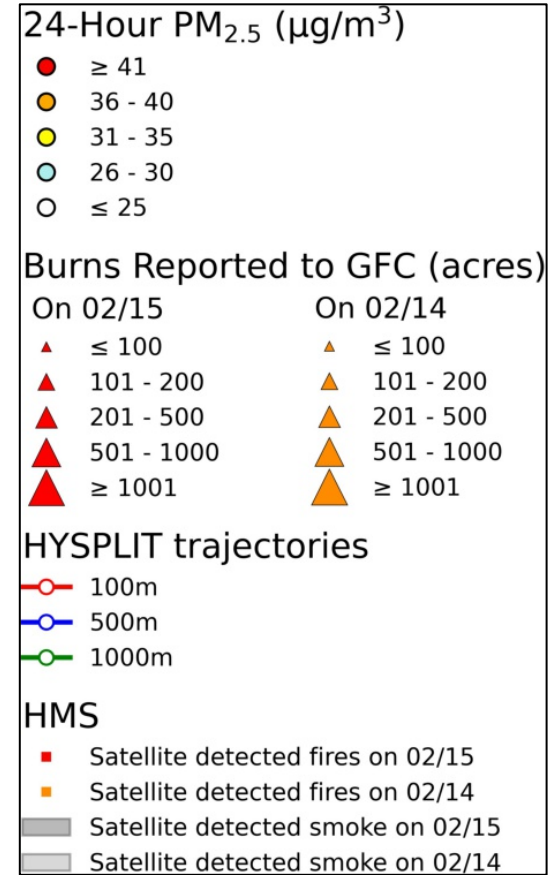
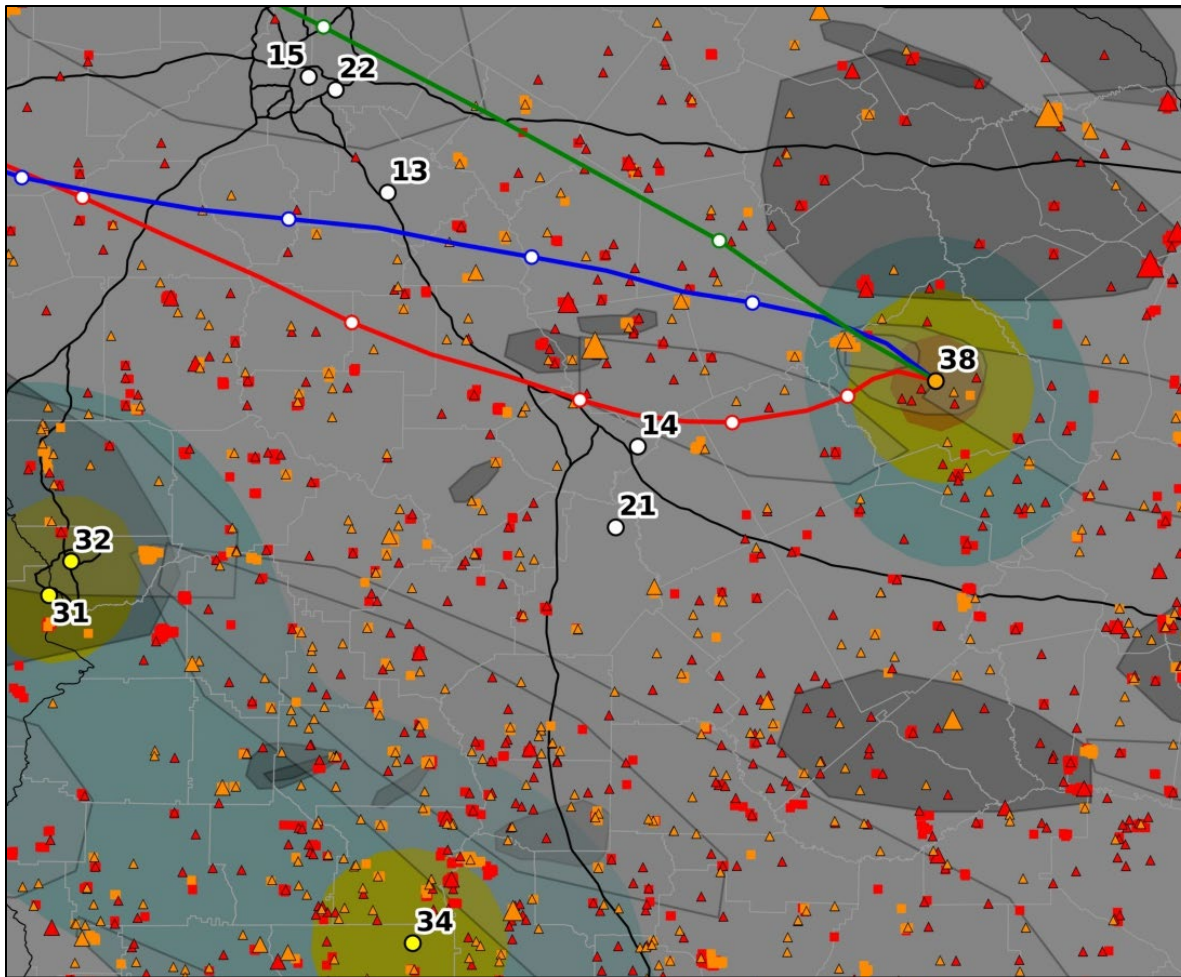


TRAJECTORIES AND BURN PERMITS





TRAJECTORIES, HMS, BURN PERMITS

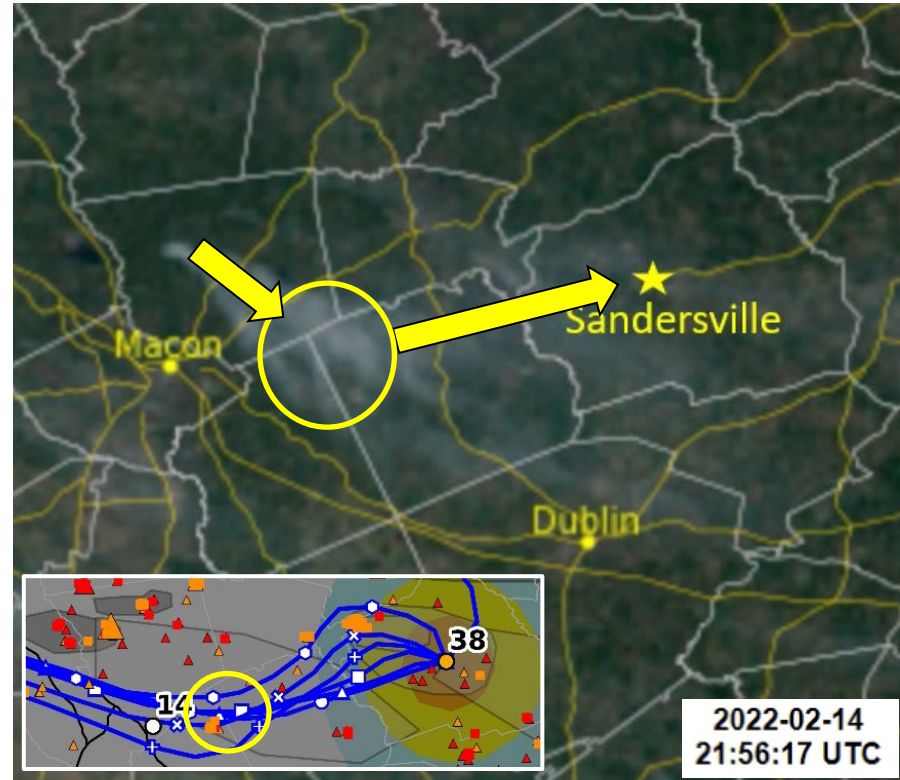
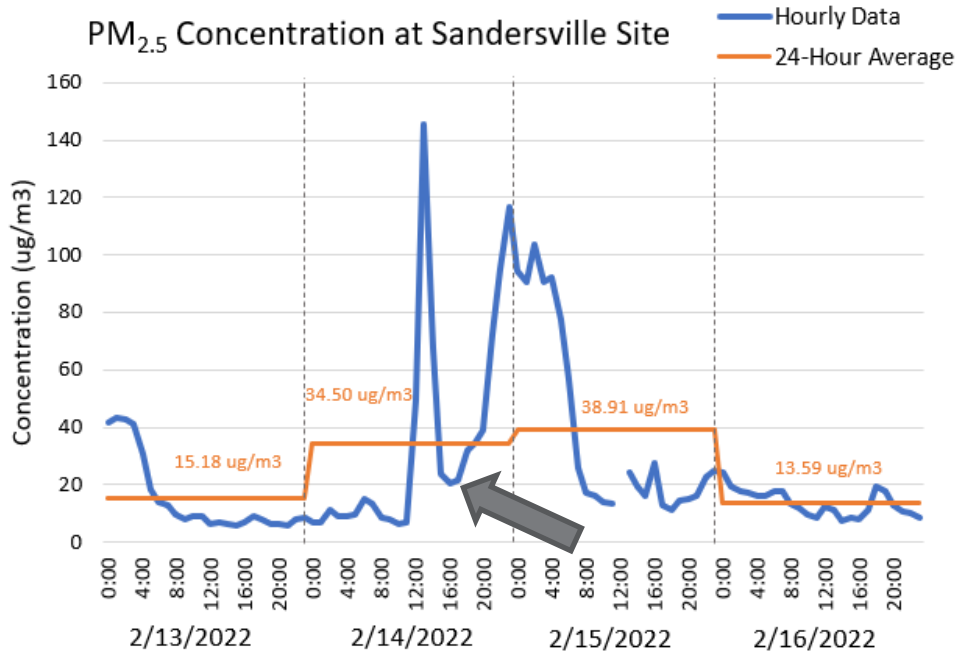


February 15 at 2:00 AM



SANDERSVILLE - FEBRUARY 14 , 2022

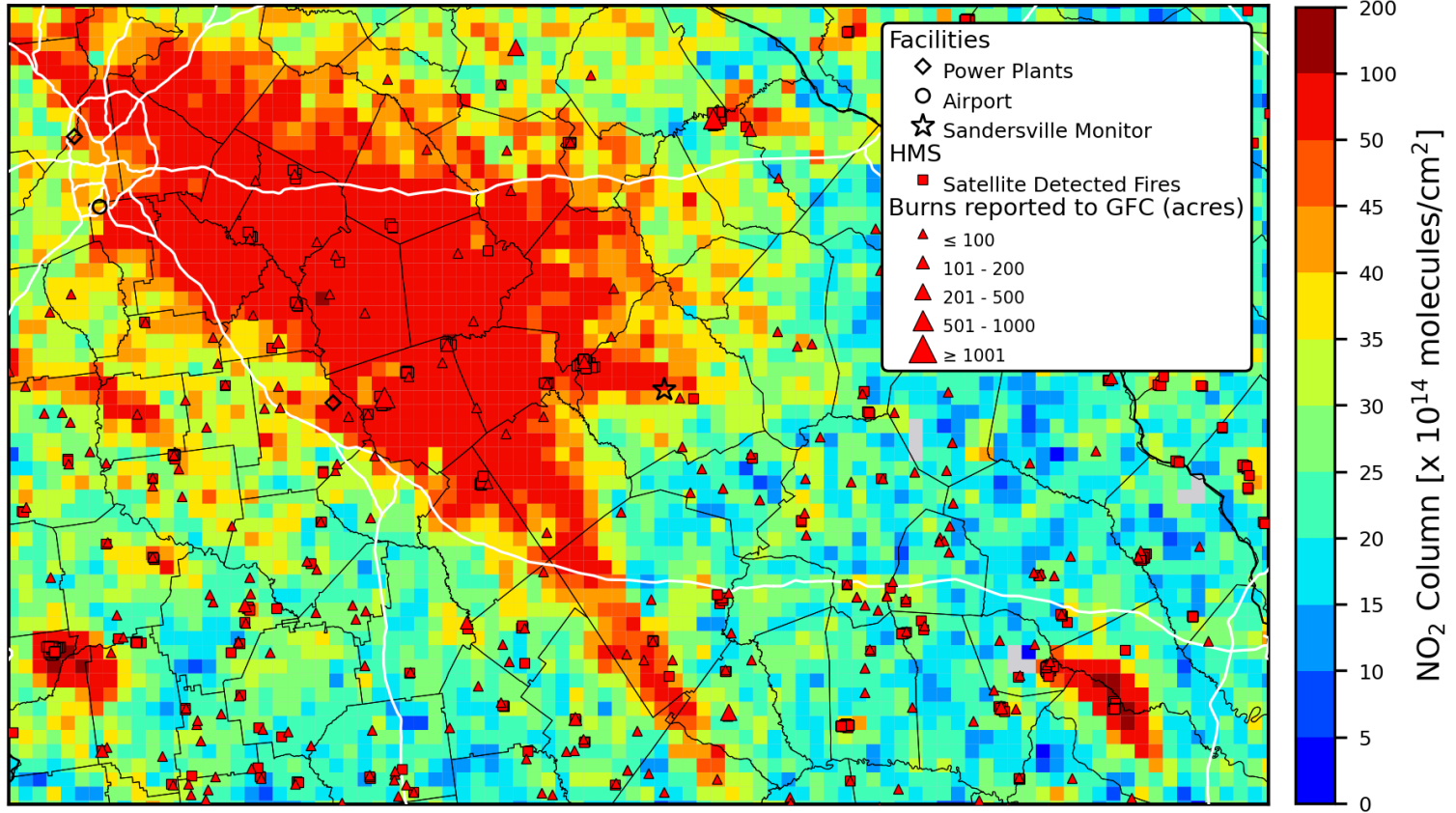
February 14, 3:56 PM





TROPOMI NO₂ – FEBRUARY 14, 2022

2022-02-14



1:30 PM EST



GFC PERMITS – FEBRUARY 14, 2022

Top 20

COUNTY	SIZE	Burn_Purpose	LATITUDE	LONGITUDE
Jones	610	Silviculture	33.05586996	-83.64946724
Mcduffie	513	Silviculture	33.62945556	-82.52864167
Wheeler	300	Silviculture	32.13085963	-82.76524669
Burke	178	Silviculture	33.0354647	-81.84254273
Houston	176	Silviculture	32.45871362	-83.50279312
Dodge	175	Silviculture	32.17451051	-83.2241628
Jones	160	Silviculture	33.16473333	-83.43642778
Washington	150	Silviculture	33.0675871	-83.0321329
Mcduffie	110	Silviculture	33.58500983	-82.42389031
Tattnell	100	Agriculture	32.26333791	-82.1979173
Twiggs	100	Silviculture	32.7994666	-83.3775476
Monroe	100	Silviculture	32.8899525	-83.8283828
Jones	100	Silviculture	33.09904299	-83.5660269
Toombs	100	Silviculture	32.23339655	-82.31679178
Laurens	90	Silviculture	32.2853189	-82.9084566
Baldwin	81	Silviculture	33.02804769	-83.15559807
Emanuel	76	Silviculture	32.54512838	-82.45107522
Emanuel	75	Silviculture	32.60075505	-82.4454209
Putnam	65	Land Clearing	33.3905891	-83.3622145
Monroe	60	Silviculture	33.01961111	-83.76498611

Bottom 20

COUNTY	SIZE	Burn_Purpose	LATITUDE	LONGITUDE
Hancock	2	Land Clearing	33.12209313	-82.94030162
Toombs	2	Silviculture	32.18670019	-82.33943488
Candler	2	Agriculture	32.47340351	-82.05904372
Jones	1	Land Clearing	33.1214944	-83.45910935
Laurens	1	Silviculture	32.29594504	-82.99188602
Candler	1	Land Clearing	32.5088926	-82.0194364
Laurens	1	Land Clearing	32.44466475	-82.94317169
Emanuel	1	Land Clearing	32.3275789	-82.2735341
Bibb	1	Land Clearing	32.91197664	-83.70384959
Burke	1	Land Clearing	33.16960301	-82.03784217
Jefferson	1	Land Clearing	33.06817504	-82.43631337
Greene	1	Land Clearing	33.6298167	-83.1682649
Jenkins	1	Land Clearing	32.81644766	-82.12885796
Pulaski	1	Silviculture	32.2938868	-83.4965858
Monroe	1	Land Clearing	32.90466884	-83.82116405
Laurens	1	Land Clearing	32.4308006	-82.7088315
Bleckley	1	Silviculture	32.34435074	-83.39492223
Emanuel	0.5	Agriculture	32.36934204	-82.32976799
Wilkinson	0.5	Silviculture	32.918108	-83.2997279
Emanuel	0.5	Agriculture	32.6578591	-82.0955841

Total of 100 GFC permits issues in 100 km radius.



GFC PERMITS – FEBRUARY 15, 2022

Top 20

COUNTY	SIZE	Burn_Purpose	LATITUDE	LONGITUDE
Jefferson	650	Silviculture	33.25766201	-82.2768854
Richmond	468	Silviculture	33.3376	-82.2092
Columbia	227	Silviculture	33.661599	-82.2326544
Jasper	203	Silviculture	33.16174677	-83.7157592
Jasper	203	Silviculture	33.16174677	-83.7157592
Emanuel	200	Silviculture	32.49771944	-82.2543111
Hancock	150	Silviculture	33.194256	-82.9792846
Oglethorpe	140	Silviculture	33.73521273	-83.0130749
Morgan	135	Silviculture	33.50802083	-83.5650609
Emanuel	120	Silviculture	32.36137778	-82.3561472
Candler	100	Silviculture	32.3600635	-82.2403231
Washington	100	Silviculture	32.91926324	-82.8667001
Monroe	95	Silviculture	33.04679655	-83.7615599
Wilkes	90	Silviculture	33.70246718	-82.6994377
Tattnall	80	Agriculture	32.26237482	-82.2029487
Monroe	80	Silviculture	32.89060247	-83.8297173
Montgomery	80	Silviculture	32.16713628	-82.5385253
Candler	80	Agriculture	32.36370109	-82.2183497
Morgan	80	Silviculture	33.6632088	-83.4838475
Wheeler	75	Silviculture	32.09760989	-82.8628067

Bottom 20

COUNTY	SIZE	Burn_Purpose	LATITUDE	LONGITUDE
Dodge	1	Land Clearing	32.2383411	-83.3417157
Jones	1	Land Clearing	33.1214944	-83.4591093
Lincoln	1	Land Clearing	33.7687499	-82.5352188
Greene	1	Land Clearing	33.5104272	-83.1972729
Jones	1	Land Clearing	32.93680653	-83.6692115
Candler	1	Land Clearing	32.4814047	-82.1671153
Burke	1	Silviculture	33.12359627	-82.1573745
Jenkins	1	Land Clearing	32.8475515	-81.8874917
Candler	1	Agriculture	32.3212149	-82.1125963
Lincoln	1	Land Clearing	33.774539	-82.3901027
Washington	0.75	Land Clearing	32.94866106	-82.8426185
Burke	0.5	Land Clearing	33.2350296	-82.1144248
Mcduffie	0.5	Land Clearing	33.5099776	-82.4485447
Jones	0.5	Land Clearing	33.02773	-83.4064719
Jefferson	0.5	Land Clearing	33.20111157	-82.3736033
Mcduffie	0.5	Silviculture	33.53087533	-82.3901567
Jasper	0.5	Land Clearing	33.2143337	-83.5627646
Twiggs	0.25	Land Clearing	32.5771211	-83.2779279
Emanuel	0.15	Agriculture	32.34250951	-82.338383
Candler	0.1	Land Clearing	32.37462268	-82.1830182

Total of 198 GFC permits issues in 100 km radius.



GFC PERMIT SUMMARY

Purpose	February 14	February 15
Silviculture	90.5%	86.7%
Agriculture*	7.2%	9.8%
Land Clearing*	2.6%	3.4%
Storm Debris*	0.0%	0.0%

Purpose of silviculture burns:

- Restore or maintain wildlife ecosystem.
- Hazard reduction to reduce the risk of wildfire.



NEXT STEPS

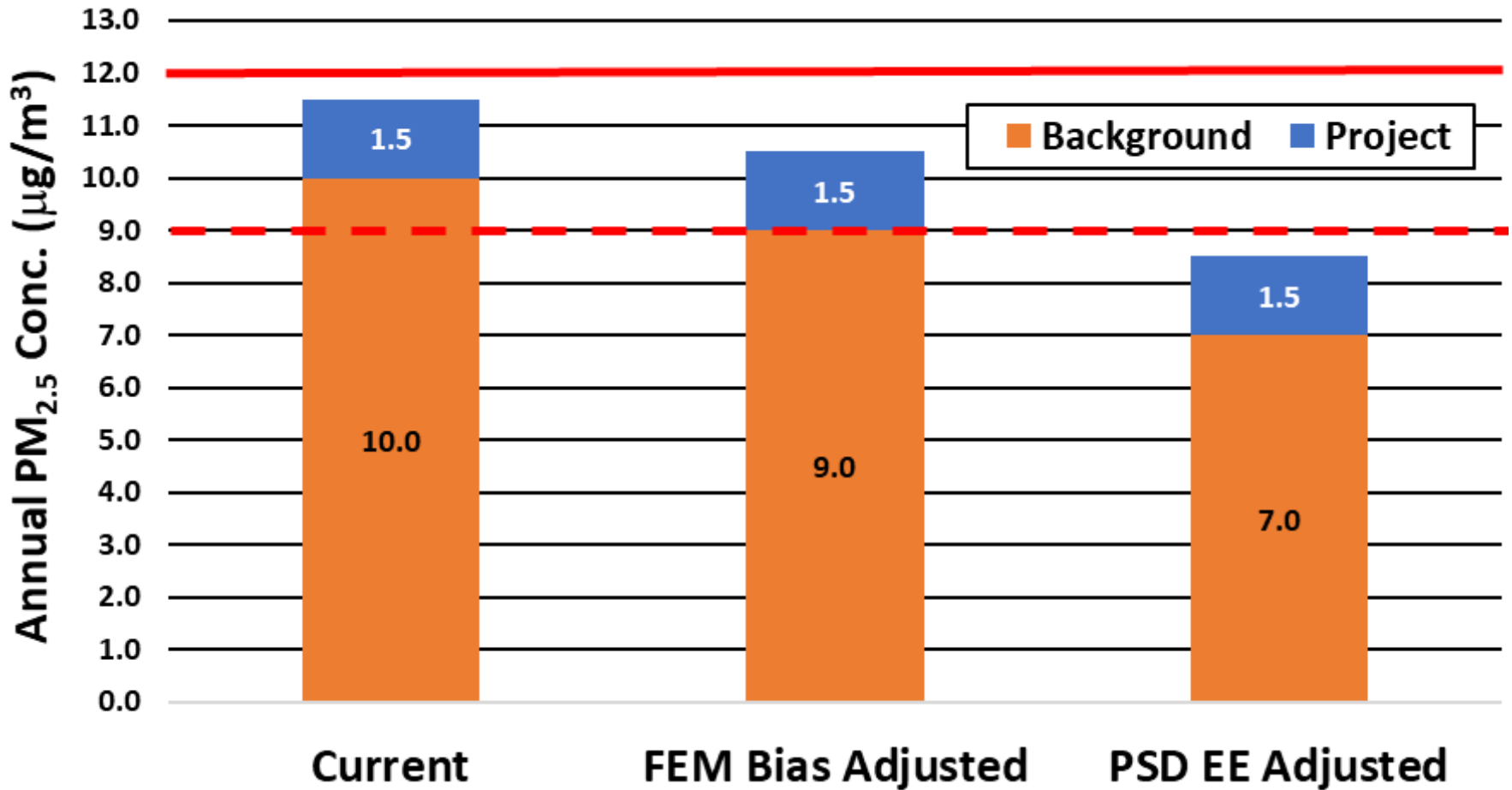
- **Need to streamline the development of our exceptional event demonstrations in order to meet EPA deadlines, especially with multi-state collaboration.**
- **Need to better understand how fires at military bases will be treated under the exceptional events rule since States do not have any authority to restrict burning at DOD facilities.**



ATYPICAL ACTIVITIES FOR PSD MODELING BACKGROUND

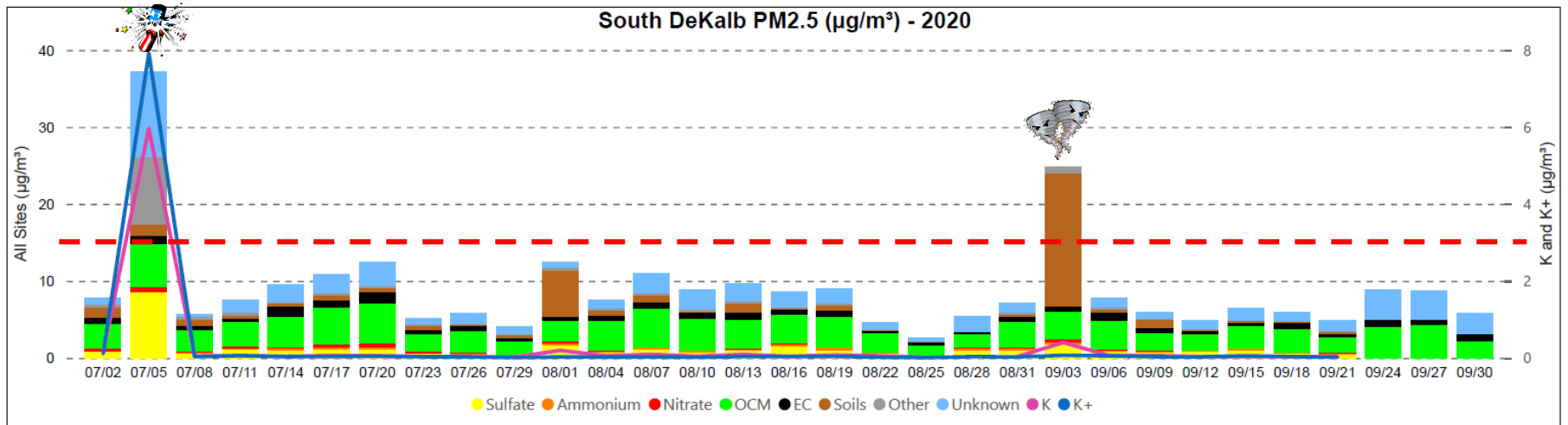
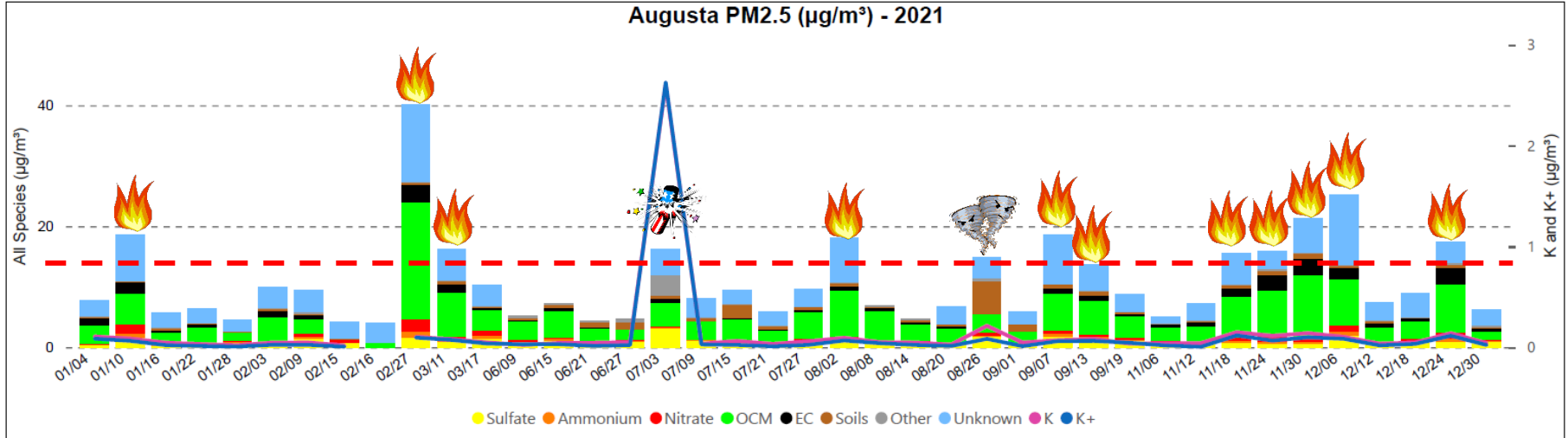


PSD BACKGROUND ADJUSTMENTS





SPECIATED PM_{2.5} DATA





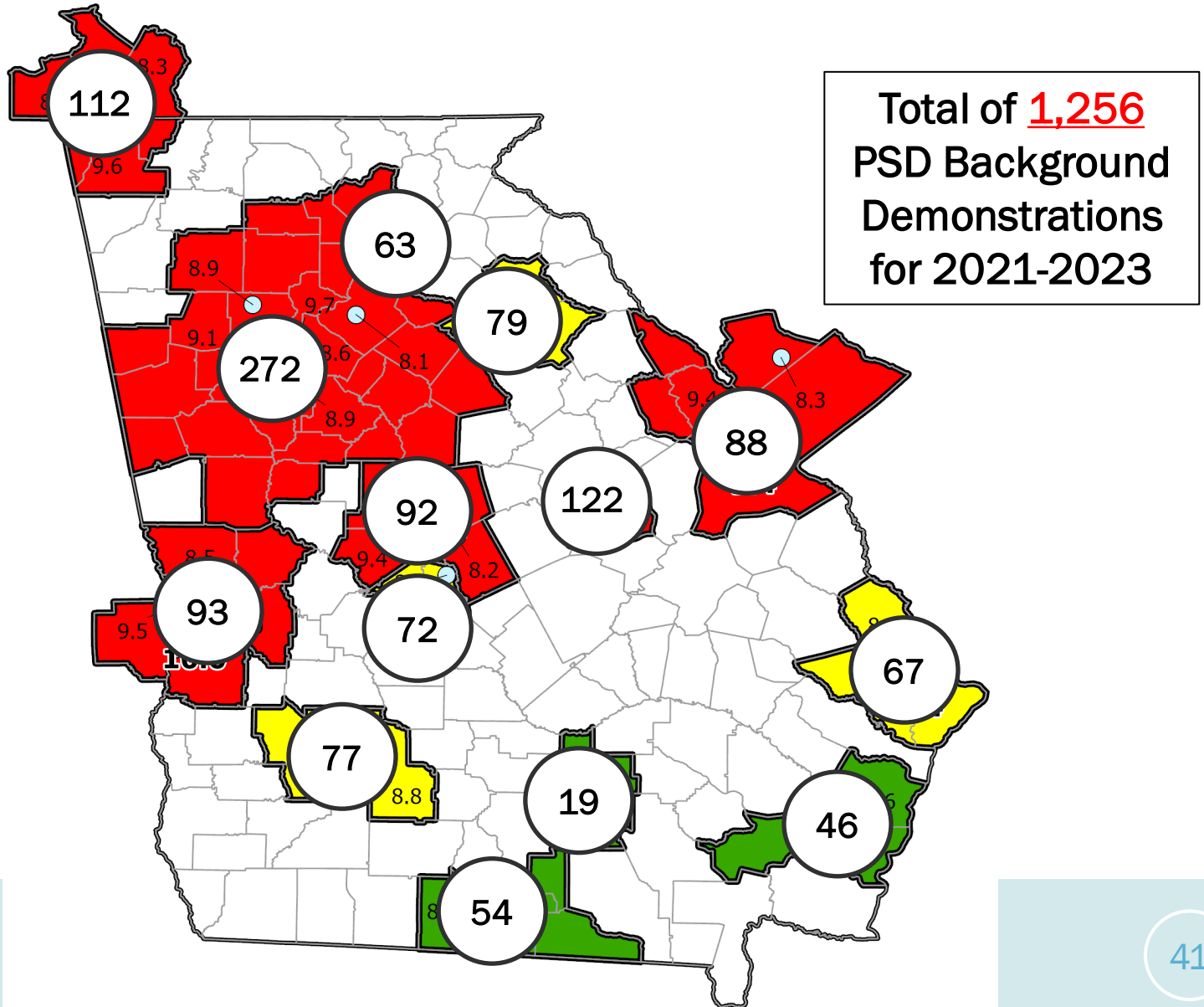
DVs FOR PSD BACKGROUND

- **Apply FEM bias adjustment factor to all FEM measurements prior to August 1, 2023 (Teledyne firmware install date in GA).**
- **For all monitors (regardless of DVs), examine all days above EPA’s “Tier 2” threshold.**
 - **Address clear causal relations w/ HYSPLIT, GFC permit locations, and HMS Smoke maps**
 - **Focus on 2021-2023 events**
- **Does not need EPA approval.**
- **Need backgrounds values by May 6, 2024.**

“Draft Guidance on Developing Background Concentrations for Use in Modeling Demonstrations”, EPA-454/P-23-001, October 2023.

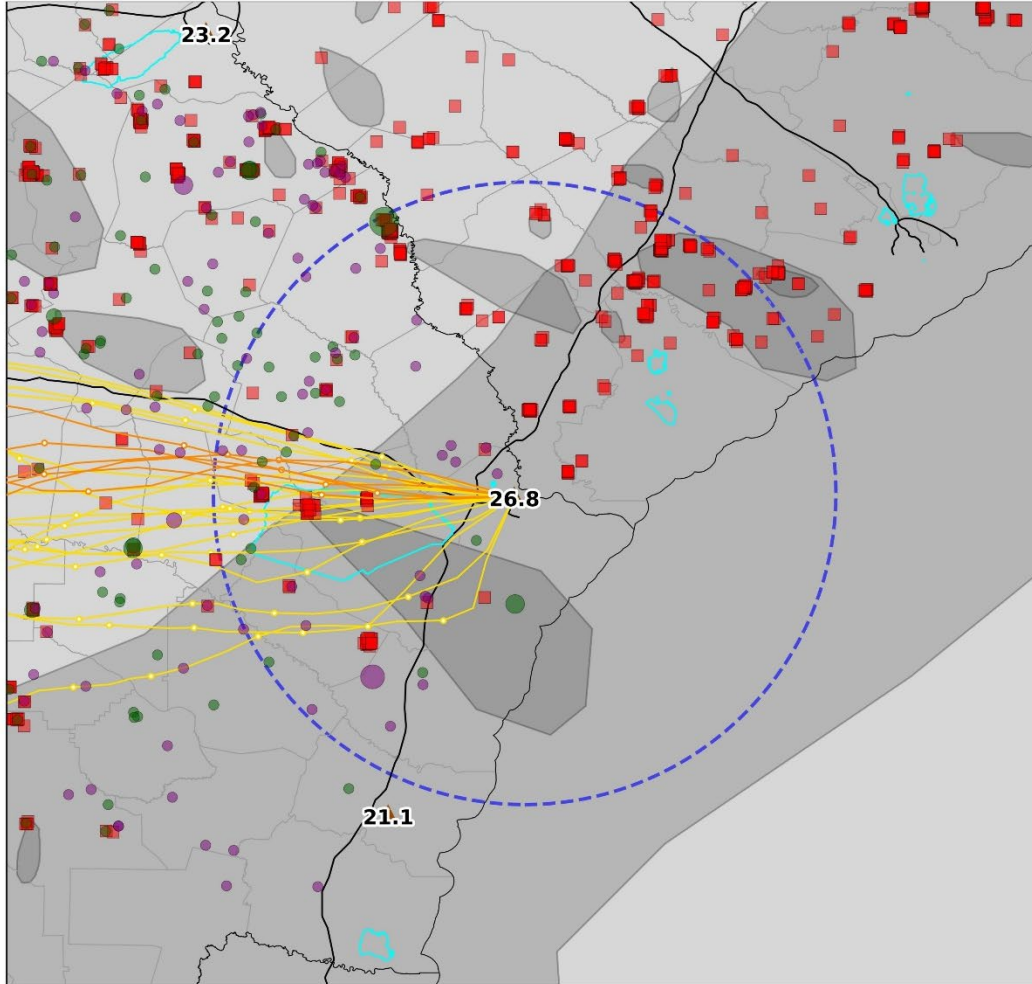


NUMBER OF DEMONSTRATIONS





SAVANNAH - MARCH 2, 2022



Military Base
 — Military Base
 — 100 km Buffer

Monitors
 ▲ Monitor

GFC Burns (acres) on 03/02

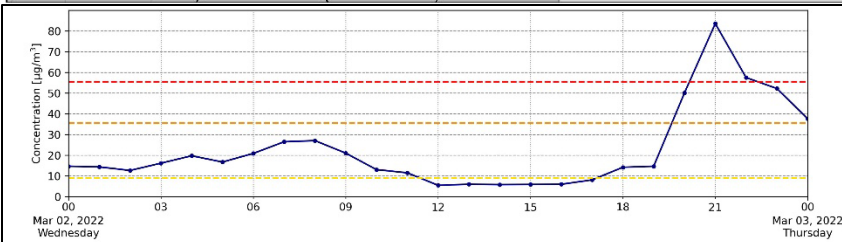
Silviculture	Non-Silviculture
● ≤ 100	● ≤ 100
● 101 - 200	● 101 - 200
● 201 - 500	● 201 - 500
● 501 - 1000	● 501 - 1000
● ≥ 1001	● ≥ 1001

HYSPLIT trajectories from 03/03

- 9.1 to 35.4 $\mu\text{g}/\text{m}^3$
- 35.5 to 55.4 $\mu\text{g}/\text{m}^3$
- 55.5 to 125.4 $\mu\text{g}/\text{m}^3$
- $\geq 125.5 \mu\text{g}/\text{m}^3$

HMS on 03/02

- HMS fires
- HMS smoke Light
- HMS smoke Medium
- HMS smoke Heavy

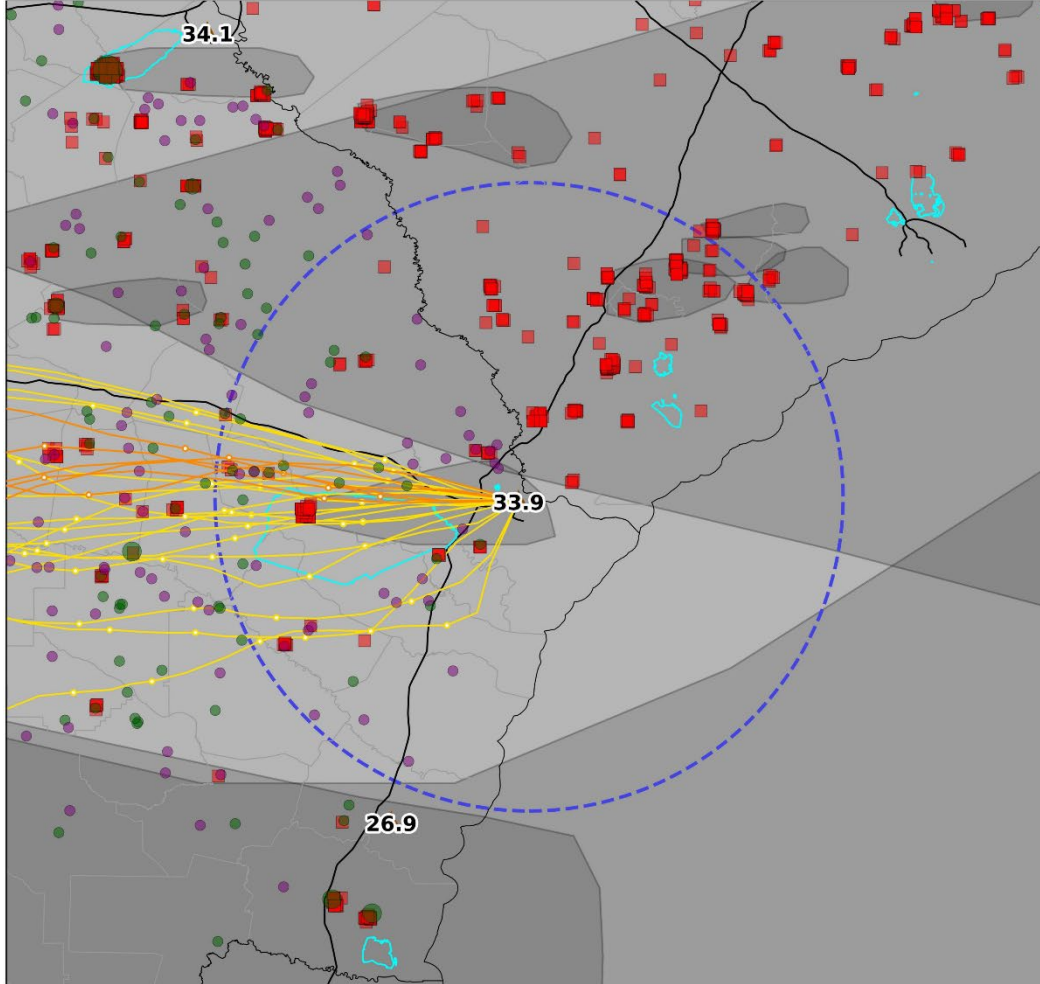


— Savannah-L&A

- 9.1 to 35.4 $\mu\text{g}/\text{m}^3$
- 35.5 to 55.4 $\mu\text{g}/\text{m}^3$
- 55.5 to 125.4 $\mu\text{g}/\text{m}^3$
- > 125.5 $\mu\text{g}/\text{m}^3$



SAVANNAH - MARCH 3, 2022



Military Base
 Military Base
 100 km Buffer
 100 km buffer

Monitors
 Monitor

GFC Burns (acres) on 03/03

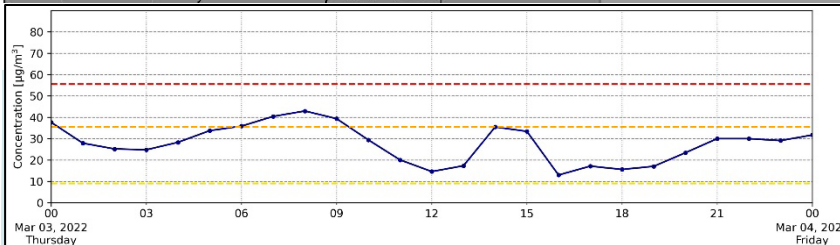
Silviculture	Non-Silviculture
● ≤ 100	● ≤ 100
● 101 - 200	● 101 - 200
● 201 - 500	● 201 - 500
● 501 - 1000	● 501 - 1000
● ≥ 1001	● ≥ 1001

HYSPLIT trajectories from 03/03

- 9.1 to 35.4 $\mu\text{g}/\text{m}^3$
- 35.5 to 55.4 $\mu\text{g}/\text{m}^3$
- 55.5 to 125.4 $\mu\text{g}/\text{m}^3$
- $\geq 125.5 \mu\text{g}/\text{m}^3$

HMS on 03/03

- HMS fires
- HMS smoke Light
- HMS smoke Medium
- HMS smoke Heavy



—●— Savannah-L&A

—●— 9.1 to 35.4 $\mu\text{g}/\text{m}^3$

—●— 35.5 to 55.4 $\mu\text{g}/\text{m}^3$

—●— 55.5 to 125.4 $\mu\text{g}/\text{m}^3$

—●— > 125.5 $\mu\text{g}/\text{m}^3$



CONTACT INFORMATION

James Boylan, Ph.D.

**Georgia Dept. of Natural Resources
4244 International Parkway, Suite 120
Atlanta, GA 30354**

**James.Boylan@dnr.ga.gov
470-524-0697**