



Association of Air Pollution Control Agencies
2019 Spring Meeting
Southeastern VISTAS II Regional Haze Analysis Project Update

March 26, 2019

Department of Environmental Quality



Outline

- “Southeastern VISTAS II Regional Haze Analysis Project” Overview
- Update on Technical Work Supporting VISTAS II Participants on:
 - Baseline visibility conditions (2000 – 2004) and Uniform Rate of Progress (URP) glidepath (40 CFR 51.308(d)(2))
 - Reasonable Progress Goals (RPGs) for each Class I Federal Area (40 CFR 51.308(d)(1))
 - Long-Term Strategy (LTS) (40 CFR 51.308(d)(3))
 - Communications / Consultation Strategy (40 CFR 51.308(d), (f), &(i))
- What we need from EPA
- Summary / Conclusions



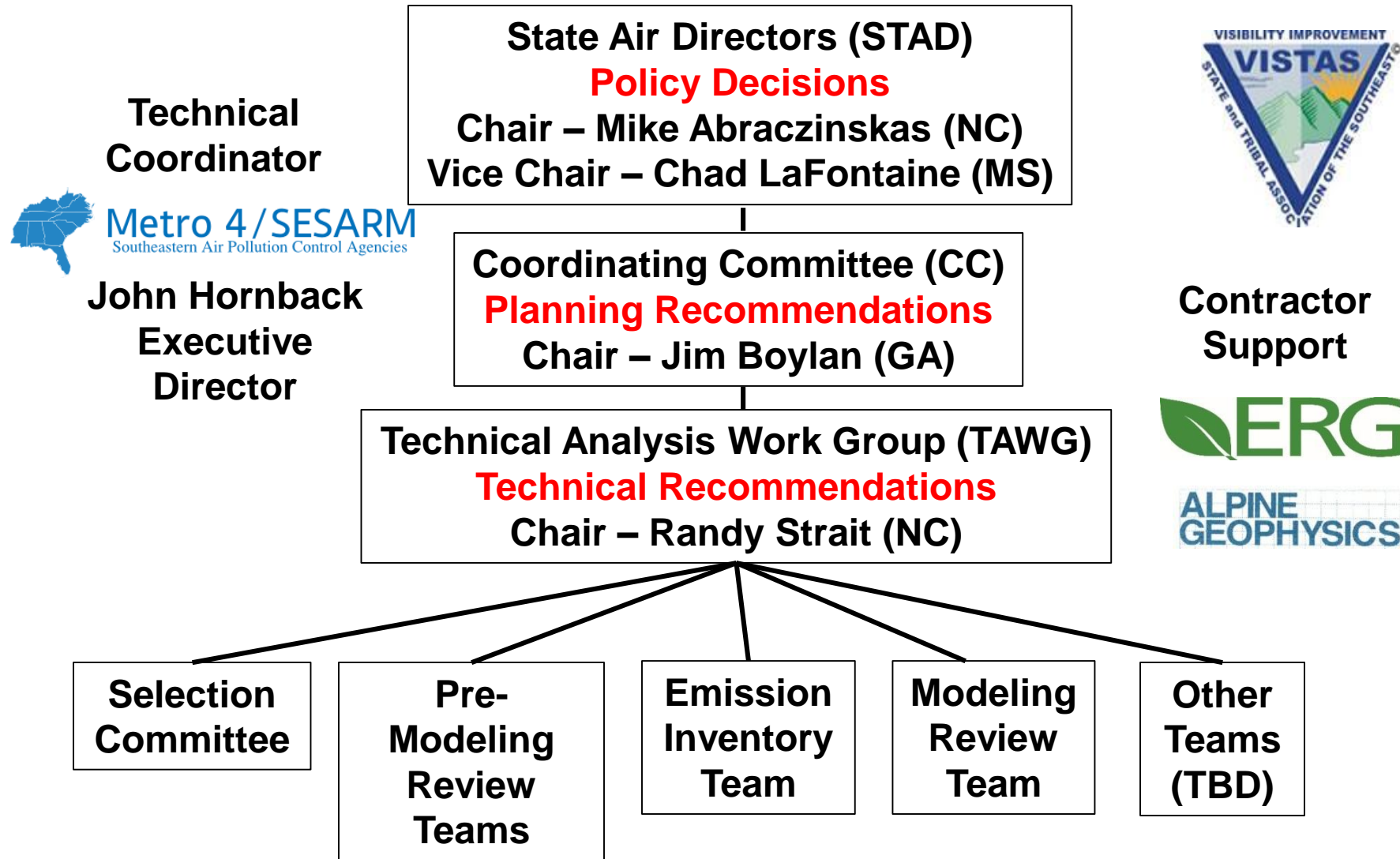
Project Overview

- Visibility Improvement - State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization through Southeastern States Air Resource Managers, Inc. (SESARM)
- Participating Agencies:
 - 10 Southeastern (SE) states (AL, FL, GA, KY, MS, NC, SC, TN, VA, and WV)
 - The Eastern Band of Cherokee Indians (represents SE tribes)
 - Knox County, TN (represents Metro 4 local air pollution control agencies)

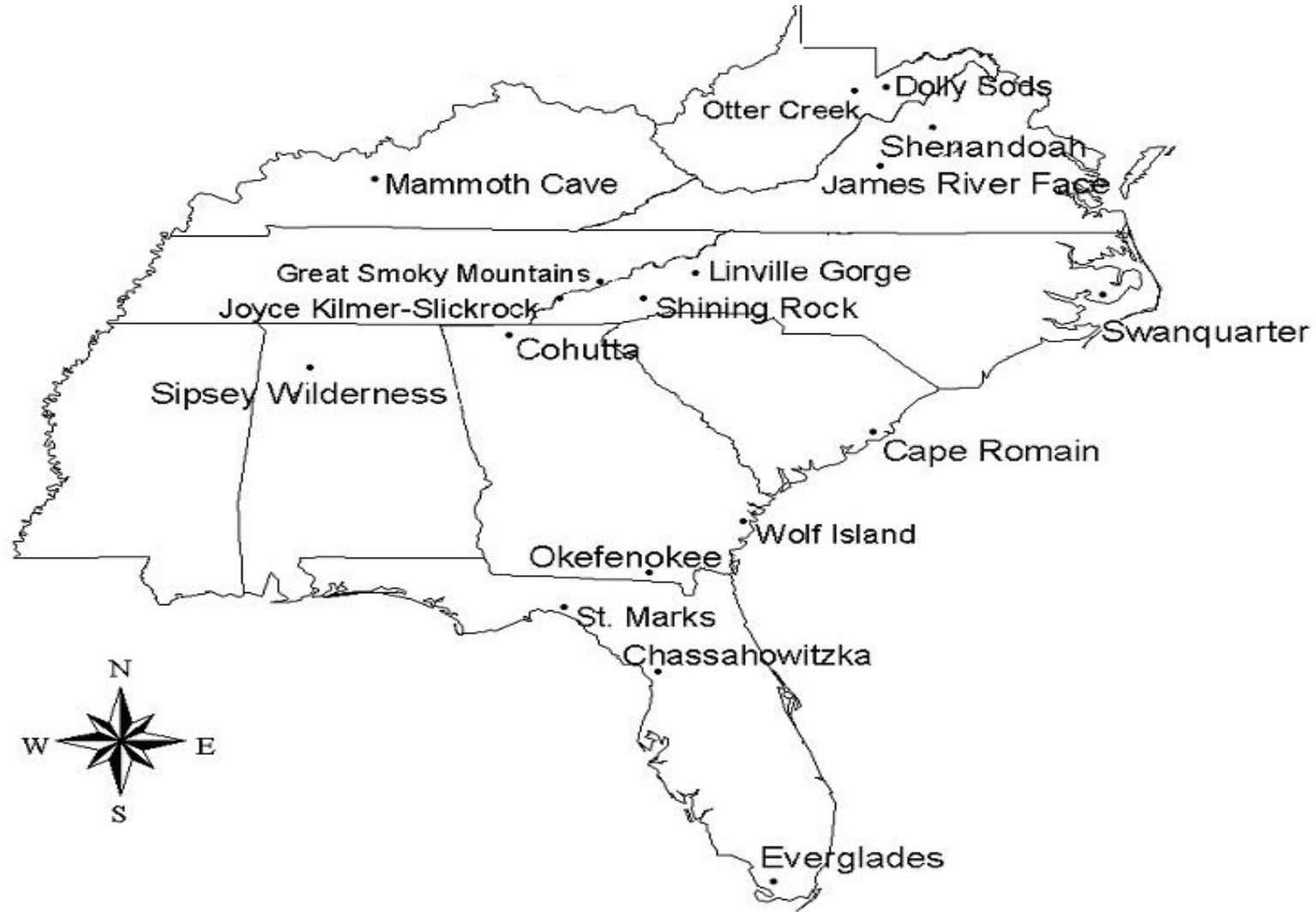
Project Overview

- Contractor team support:
 - Eastern Research Group, Inc. and Alpine Geophysics, LLC
 - Revisions to 2028 emissions inventory for EGU and non-EGU point sources
 - Area of Influence (AOI) screening analysis
 - Photochemical-grid air quality and source apportionment modeling

VISTAS II Project Management



18 VISTAS Class I Areas



Round 2 SIP Development Process – Key Elements

1. Calculate baseline visibility conditions (2000 – 2004) and URP from baseline to 2064
 - Most impaired days = 20% of monitored days in a calendar year with the highest amounts of anthropogenic visibility impairment
 - Clearest days = 20% of monitored days in a calendar year with the lowest deciview (dv) index values
2. Calculate RPGs for each Class I Federal Area
 - Project 2028 visibility conditions using air quality modeling
 - Adjust based on results of 4-factor analysis, if applicable
 - Compare the RPG for the 20% most impaired days to the URP line
 - No degradation in 20% clearest days

Round 2 SIP Development Process – Key Elements

3. Develop LTS for 2028 (40 CFR 51.308(d)(3))
 - AOI screening analysis
 - 4-Factor analysis of stationary sources controls:
 - Costs of compliance
 - Time necessary for compliance
 - Energy and non-air quality environmental impacts of compliance; and
 - Remaining useful life of any existing source subject to such requirements
4. Communications / Consultation (40 CFR 51.308(d), (f), and (i))

Element 1
Calculate Baseline Visibility Conditions and URP

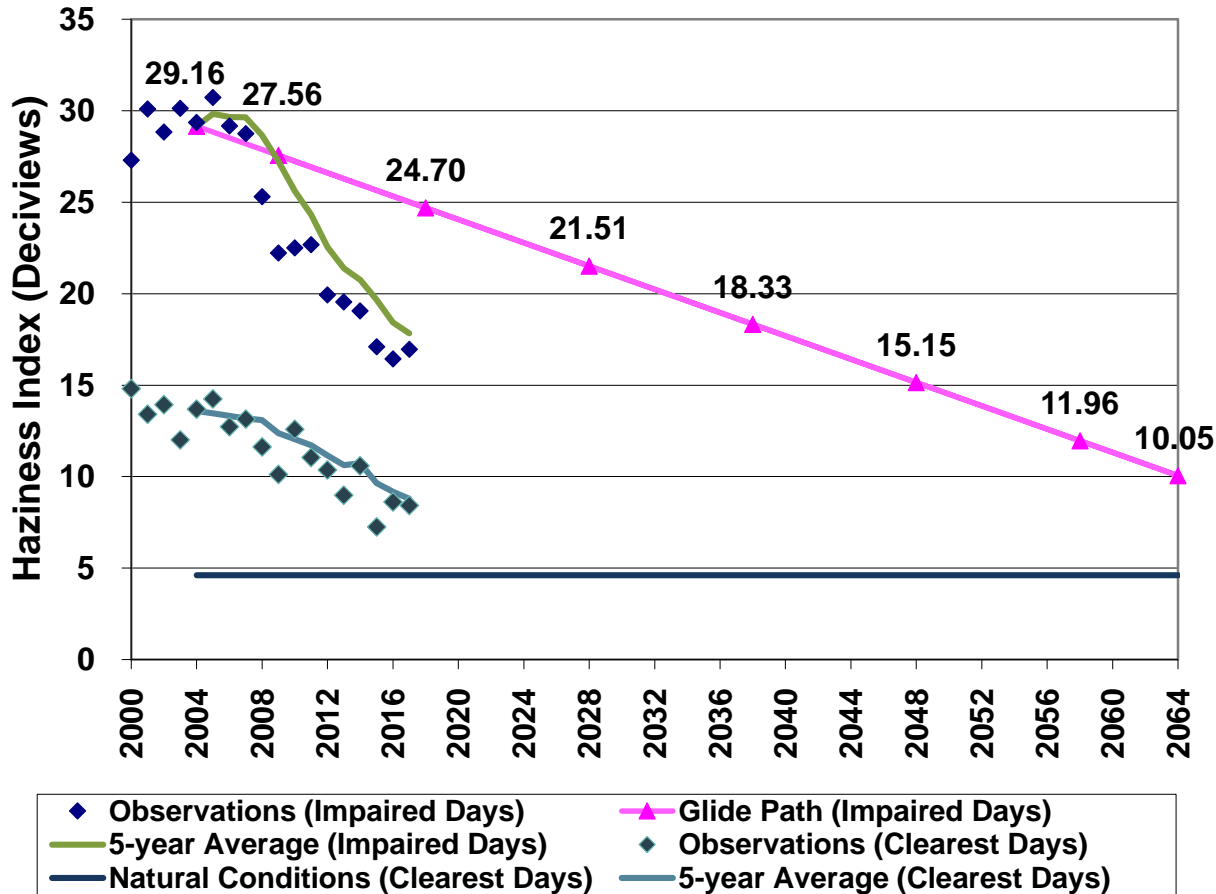
IMPROVE Monitor Data Analysis

IMPROVE Monitor Data Analysis

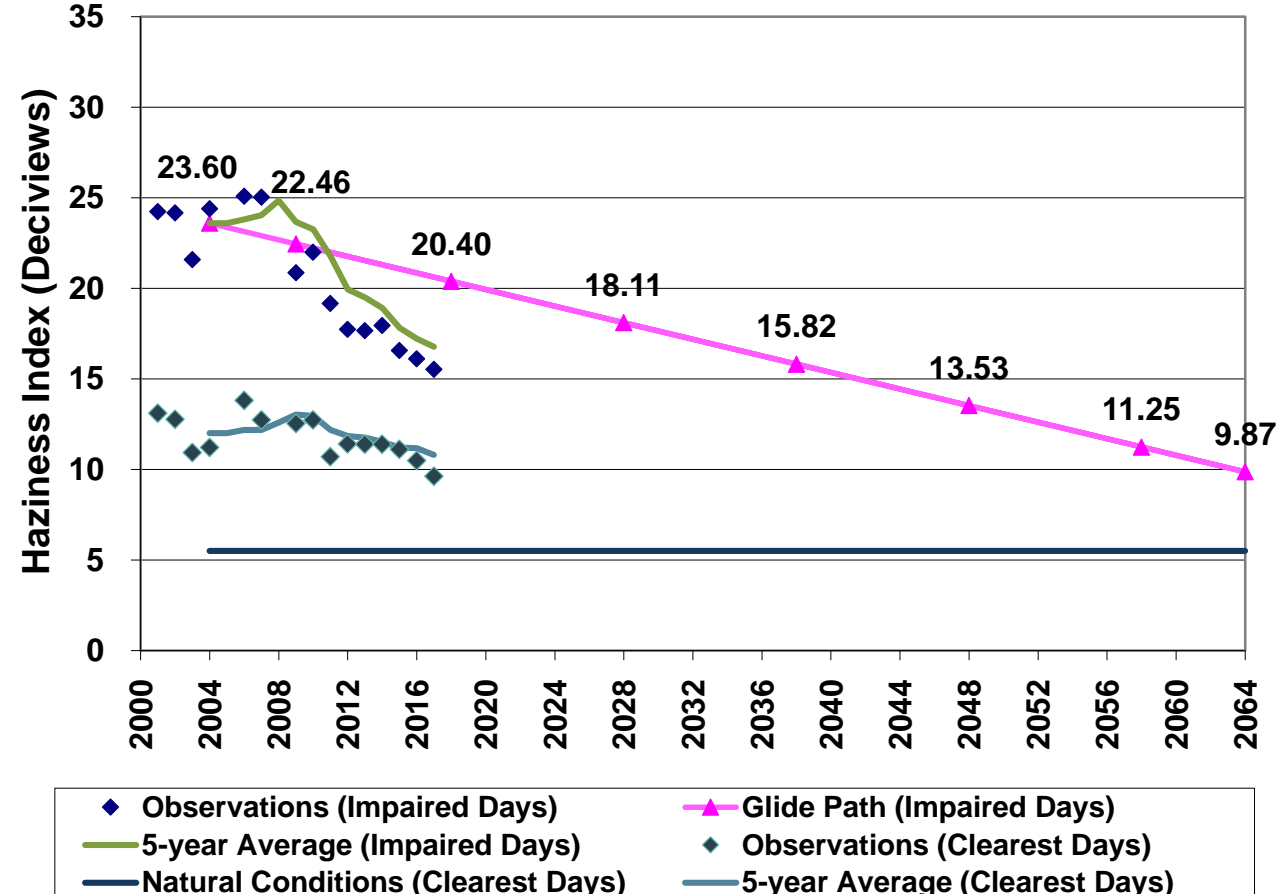
- Review monitoring data and develop charts for use in SIPs
- For each mandatory Class I Area:
 - For most impaired and clearest days:
 - Baseline visibility conditions
 - Natural visibility conditions
 - Current visibility conditions
 - Progress to date
 - Differences between current and natural visibility condition
 - Define URP

Visibility Impairment Trends (20% Most Impaired Days)

Great Smoky Mountains National Park



Swanquarter Wilderness Area



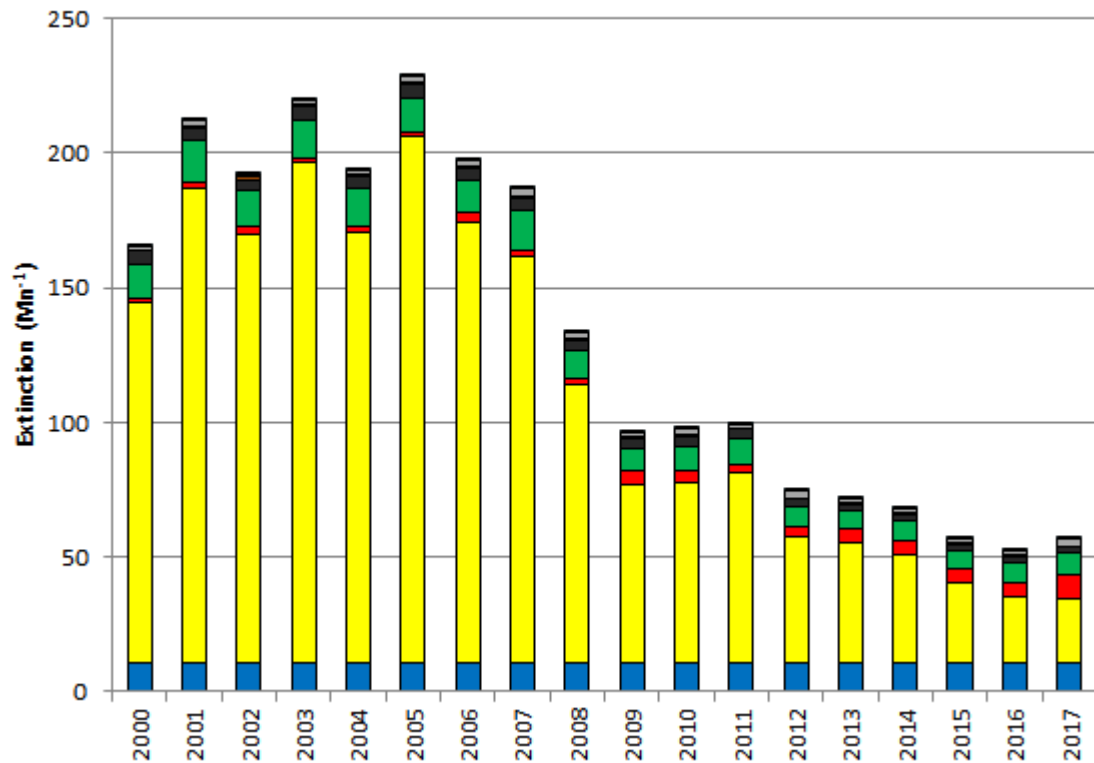
Reasonable Progress Goal for 2028 determined via air quality modeling and long-term strategy evaluation.

IMPROVE Monitor Data for 20% Most Impaired

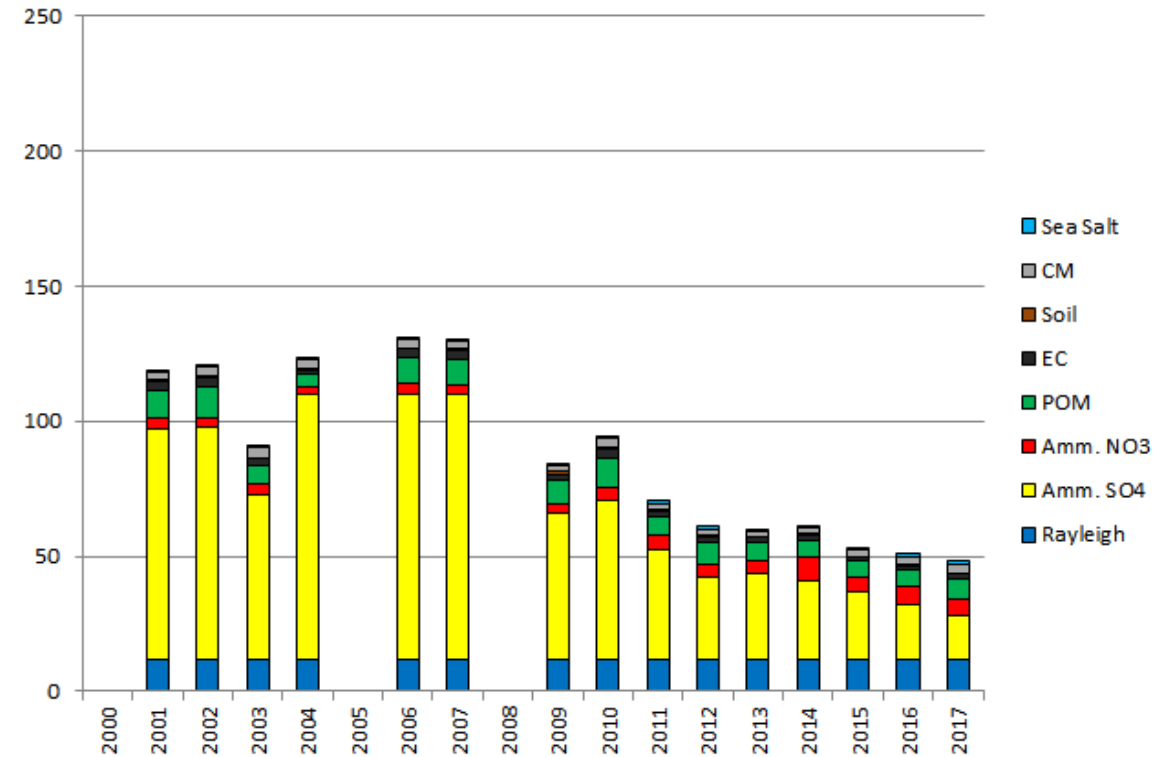
Great Smoky Mountains National Park

Swanquarter Wilderness Area

Most Impaired Results - Annual Contributions to Light Extinction

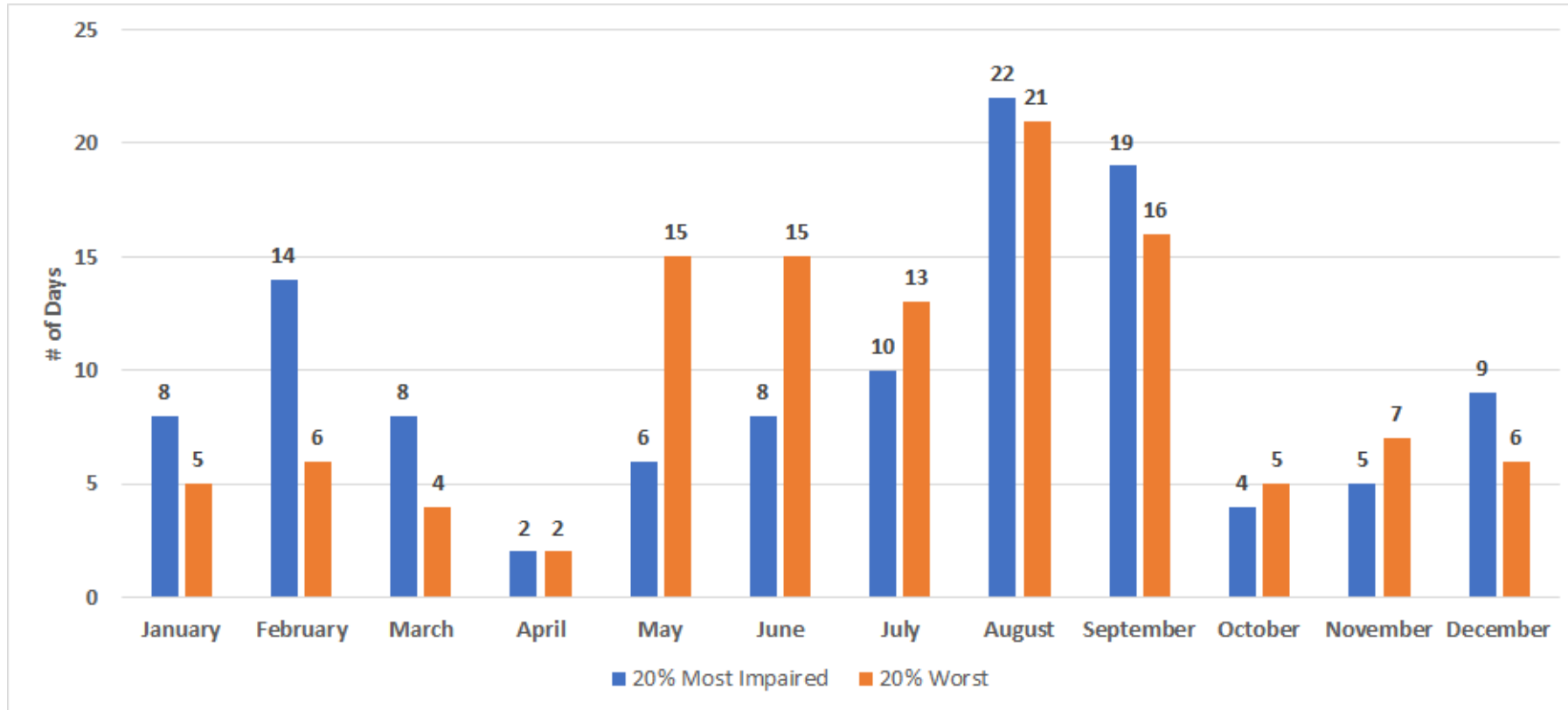


Most Impaired Results - Annual Contributions to Light Extinction



Source: Interagency Monitoring of Protected Visual Environments (IMPROVE) website, <http://vista.cira.colostate.edu/Improve/rhr-summary-data/>

Great Smoky Mountains National Park 20% Most Impaired vs. Worst Days, 2013 - 2017



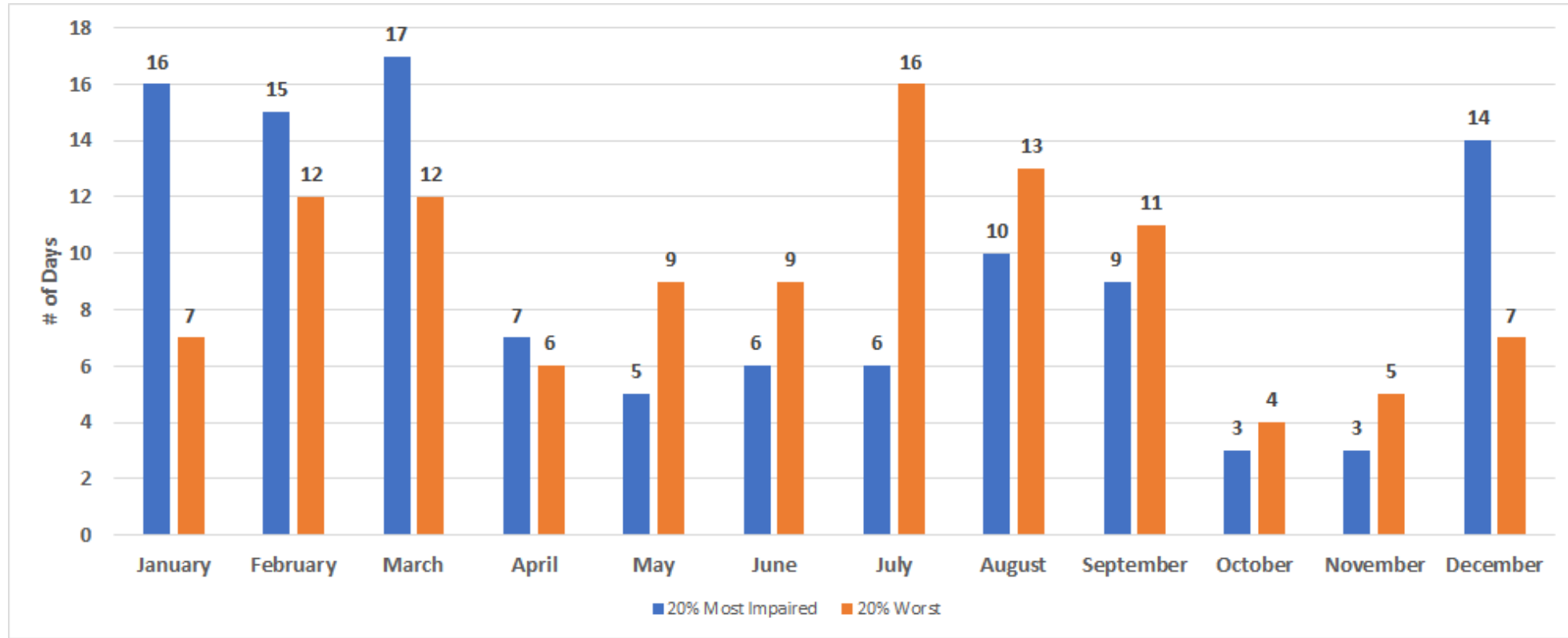
Year	2013	2014	2015	2016	2017
In	16	15	12	11	12
Out	7	8	11	12	11

“In” represents the number of daily observations that are in both the 20% worst and 20% most impaired data sets.

“Out” represents the number of daily observations that are in 20% most impaired data set but not the 20% worst set.

Swanquarter Wilderness Area

20% Most Impaired vs. Worst Days, 2013 - 2017



Year	2013	2014	2015	2016	2017
In	12	10	8	8	7
Out	10	12	14	14	16

“In” represents the number of daily observations that are in both the 20% worst and 20% most impaired data sets.

“Out” represents the number of daily observations that are in 20% most impaired data set but not the 20% worst set.

Element 2
Calculate Reasonable Progress Goals (RPGs) for each
Class I Federal Area

Air Quality and Source Apportionment Modeling

Air Quality Modeling with CAMx

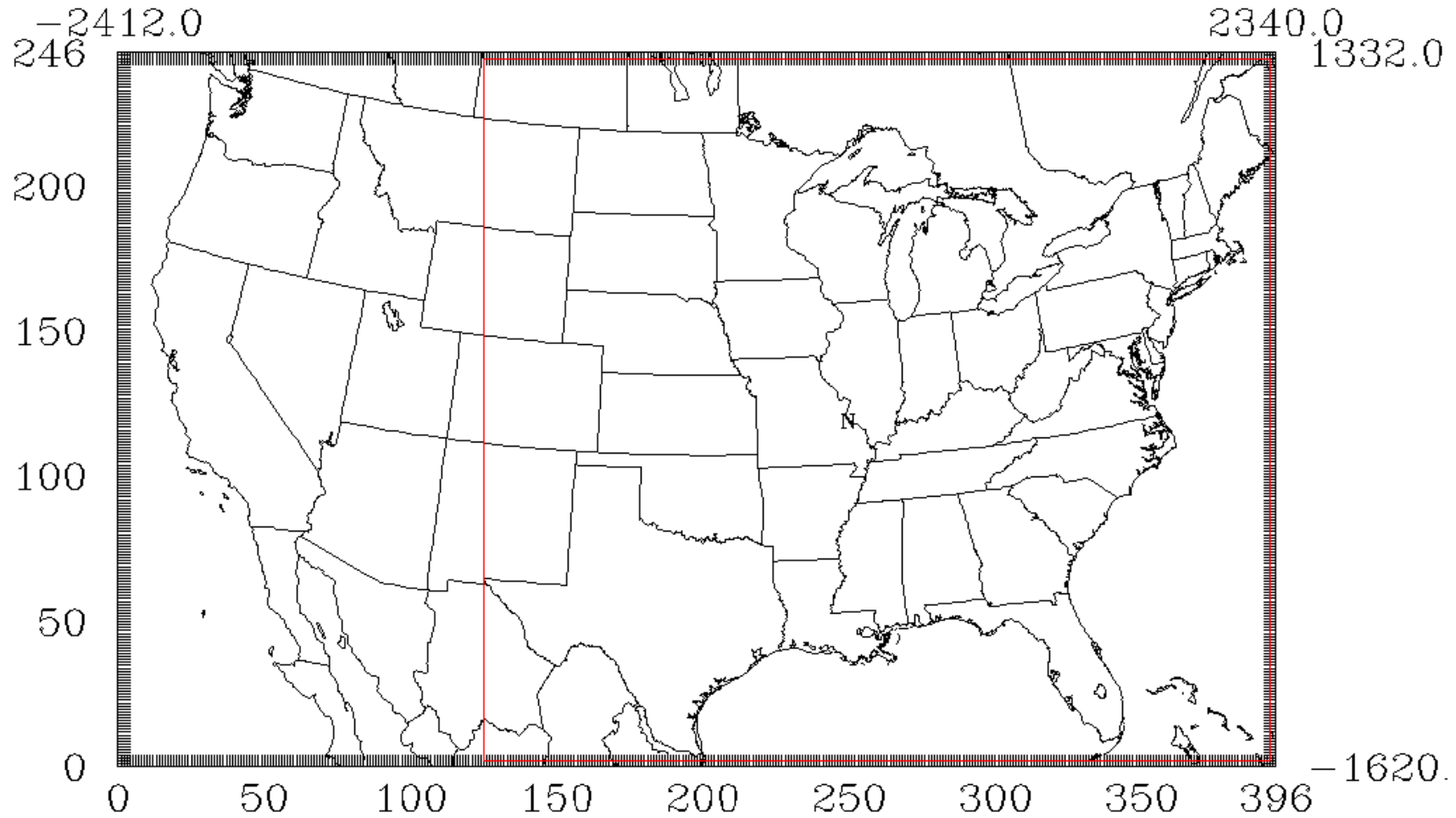
- Provide initial RPGs for 2028 for each Class I Area
- Calculate Relative Response Factors (RRFs)
- Using EPA's 2011/2028 modeling platform (v6.3el) with CAMx v6.32 (2011 meteorology)
- Replaced CAMx v6.32 with CAMx v 6.40
- Adjusted 2028 point source emissions
- Reasons for using EPA's platform:
 - Timing - will not meet SIP deadline with any other option
 - Budget - significantly less for Round 2 vs. Round 1
 - Source sectors are reasonably well represented in EPA's platform (i.e., SIP quality)

2028 Point Source Emissions Adjustments

- Electricity Generating Units (EGUs)
 - EPA 2028 forecast included Clean Power Plan (CPP) controls
 - VISTAS States adjusted EPA 2028 EGU emissions up/down using:
 - ERTAC EGU forecast for 2028, v2.7 (2011 base year)
 - 2023 “en” emissions (2016 base year) or other state-specific data
 - Non-VISTAS States:
 - Replaced EPA 2028 emissions with ERTAC v2.7 forecast
 - For small EGUs in IPM but not ERTAC, used 2023 “en” emissions
- Non-EGUs
 - VISTAS States adjusted emissions up/down based on best available data

Modeling Domains

12-kilometer (km) grid



Element 3
Develop Long-Term Strategy (LTS) for 2028

***Area of Influence (AOI) Screening Analysis and Source
Apportionment Modeling***

AOI Methodology

- Method for initial prioritization of facilities for 4-factor analysis
- Combines the following for 20% most impaired days:
 - 2011 base year and 2028 projection year emissions
 - 2011-2017 meteorology
 - 2011-2017 sulfate and nitrate concentrations from IMPROVE monitors
- Calculate facility's contribution to light extinction in each Class I Area
- Rank facilities from highest to lowest contribution
- Facilities with highest contribution to be evaluated further
- County-level contributions for onroad, nonroad, point, area, and prescribed fires also evaluated

*AOI Metric (Q/d*EWRT)*

- Emissions/Distance * Extinction Weighted Residence Time
- Emissions (tons/year) – calculated for both 2011 and 2028
- Distance (km):
 - For facility, distance from facility to IMPROVE monitor
 - For sector, distance from county centroid to IMPROVE monitor
- RT (%) - HYSPLIT back-trajectories re-projected to 12-km grid to calculate residence time for each grid cell
 - 12-km North American Mesoscale (NAM) meteorology data at 100; 500; 1,000; and 1,500 meter heights
- EW (Mm^{-1}) – sulfate and nitrate extinction values from IMPROVE data

Example AOI Results by Sector

Example Class I Federal Area

Sector	SO₂	NO_x	Total
Non-Point	4.17%	3.56%	7.73%
Non-Road (Marine, Aircraft, and Railroads)	0.30%	3.51%	3.81%
Non-Road (Other)	0.16%	8.69%	8.85%
Onroad	0.23%	4.14%	4.37%
Point	66.91%	7.18%	74.09%
Point Prescribed Fires	0.81%	0.33%	1.14%
Total			100.0%

Example AOI Results by Facility (Sorted on Sulfate Fraction Only)

Facility	Distance (km)	2028 SO2 Emissions (Tons)	2028 NOx Emissions (Tons)	Sulfate Fraction	Cumulative Sulfate Fraction	Nitrate Fraction
1	53	4,846	496	37.59%	37.59%	0.57%
2	640	56,939	6,578	2.98%	40.57%	0.08%
3	69	687	1,796	2.25%	42.82%	1.01%
4	283	6,665	4,528	2.03%	44.86%	0.18%
5	651	41,596	8,123	1.76%	46.61%	0.06%
6	415	10,943	4,388	1.75%	48.36%	0.16%
7	88	608	201	1.30%	49.67%	0.05%
8	513	22,660	3,607	0.99%	50.65%	0.02%
9	626	16,817	5,497	0.83%	51.49%	0.07%
10	977	25,226	9,448	0.83%	52.32%	0.04%
11	87	288	722	0.74%	53.05%	0.24%
12	330	3,737	895	0.72%	53.78%	0.03%
13	569	10,083	11,831	0.66%	54.44%	0.08%
14	807	22,134	7,150	0.65%	55.08%	0.05%
15	602	10,984	4,878	0.62%	55.71%	0.04%
16	427	4,281	3,273	0.55%	56.26%	0.07%
17	620	11,866	5,216	0.54%	56.80%	0.05%
18	865	10,169	7,940	0.52%	57.32%	0.07%
19	1,345	41,740	9,685	0.51%	57.83%	0.03%
20	772	13,038	1,902	0.46%	58.29%	0.01%

Sulfate Fraction = $\text{EWRT.Qd_SO2_2028} / (\text{Total_NO3_2028} + \text{Total_SO4_2028})$

Nitrate Fraction = $\text{EWRT.Qd_NO3_2028} / (\text{Total_NO3_2028} + \text{Total_SO4_2028})$

Example AOI Results by Facility (Sorted on Sulfate + Nitrate Fraction)

Facility	Distance (km)	2028 SO2 Emissions (Tons)	2028 NOx Emissions (Tons)	Sulfate Fraction	Nitrate Fraction	Sulfate + Nitrate Fraction	Cumulative Sulfate + Nitrate Fraction
1	53	4,846	496	37.59%	0.57%	38.24%	38.21%
2	640	56,939	6,578	2.25%	1.01%	3.27%	41.48%
3	69	687	1,796	2.98%	0.08%	3.06%	44.54%
4	283	6,665	4,528	2.03%	0.18%	2.22%	46.75%
5	651	41,596	8,123	1.75%	0.16%	1.91%	48.66%
6	415	10,943	4,388	1.76%	0.06%	1.82%	50.48%
7	88	608	201	1.30%	0.05%	1.36%	51.84%
8	513	22,660	3,607	0.99%	0.02%	1.00%	52.84%
9	626	16,817	5,497	0.74%	0.24%	0.98%	53.82%
10	977	25,226	9,448	0.83%	0.07%	0.91%	54.72%
11	87	288	722	0.83%	0.04%	0.87%	55.60%
12	330	3,737	895	0.72%	0.03%	0.76%	56.35%
13	569	10,083	11,831	0.66%	0.08%	0.74%	57.10%
14	807	22,134	7,150	0.65%	0.05%	0.70%	57.79%
15	602	10,984	4,878	0.62%	0.04%	0.67%	58.46%
16	427	4,281	3,273	0.55%	0.07%	0.62%	59.07%
17	620	11,866	5,216	0.52%	0.07%	0.59%	59.67%
18	865	10,169	7,940	0.54%	0.05%	0.59%	60.26%
19	1,345	41,740	9,685	0.51%	0.03%	0.54%	60.80%
20	772	13,038	1,902	0.42%	0.06%	0.49%	61.28%

Sulfate Fraction = $\text{EWRT.Qd_SO2_2028} / (\text{Total_NO3_2028} + \text{Total_SO4_2028})$

Nitrate Fraction = $\text{EWRT.Qd_NO3_2028} / (\text{Total_NO3_2028} + \text{Total_SO4_2028})$

Source Apportionment Modeling with PSAT

- Quantify visibility impacts from individual point sources and/or geographic source sectors
- Used to evaluate AOI results and refine facility/sector contributions to visibility impairment
- Can be used to adjusted future year visibility projections to account for additional emission controls
 - No need to re-run photochemical model for final RPGs
- Contract allows for 250 tags; with option to increase number of tags

State Perspectives

- Selection of Emissions Sources for 4-Factor Analysis
 - AOI Screening Threshold Options
 - Facility and/or sector
 - Individual or cumulative impacts
 - PSAT results
- Degree of detail and difficulty
 - Where is a Class I Area on the URP?
 - Resources vs. results – less effort for Class I Areas below URP?

Element 4

Communications / Consultation Strategy

- Shared responsibility
- VISTAS will provide forums for general stakeholder calls
 - Federal Land Managers (FLMs), U.S. Environmental Protection Agency (EPA), and non-VISTAS states
- Each state will work with its stakeholders on more specific considerations germane to its Class I Federal areas
- Each state responsible for FLM and EPA consultation during SIP development (after technical work ends)

Schedule for Completing Technical Work

- AOI Analysis:
 - Completed in February 2019
 - States reviewing results and briefing management
- 2028 Air Quality Modeling Results: April – May 2019
- PSAT Modeling Results: April – September 2019
- Final VISTAS Project Report: Fall 2019
- Final SIPs are due to EPA by July 31, 2021

What we need from EPA

- Completion of the final regional haze guidance document will be most helpful to ensure technical work is on target
- Establish a website to serve as a Clearinghouse for posting State SIPs and other information
 - States should have the opportunity to review and comment on other state's SIPs before a state submits its final SIP to EPA
- EPA expectations for use of its forthcoming 2028 regional haze modeling platform and results?



Summary / Conclusions

- Following similar approach to methods used for Round 1 SIPs
- Round 1 SIP (2000 – 2018)
 - All SE Class I Federal areas all are well below the URP for 2018 and 2028
- Round 2 SIP (2018 – 2028)
 - SO₂ is primary cause of visibility impairment in SE's Class I Federal areas
 - Evaluate methods for controlling SO₂ but also evaluate NO_x
 - Impact of changing from the 20% worst to the 20% most impaired days
 - Lowers URP for NC Class I Federal areas from 1 to 2 deciviews
 - For 2013-2017, shifts most impaired days from primarily summer to summer/winter months

Look Rock (Great Smoky Mountains NP)

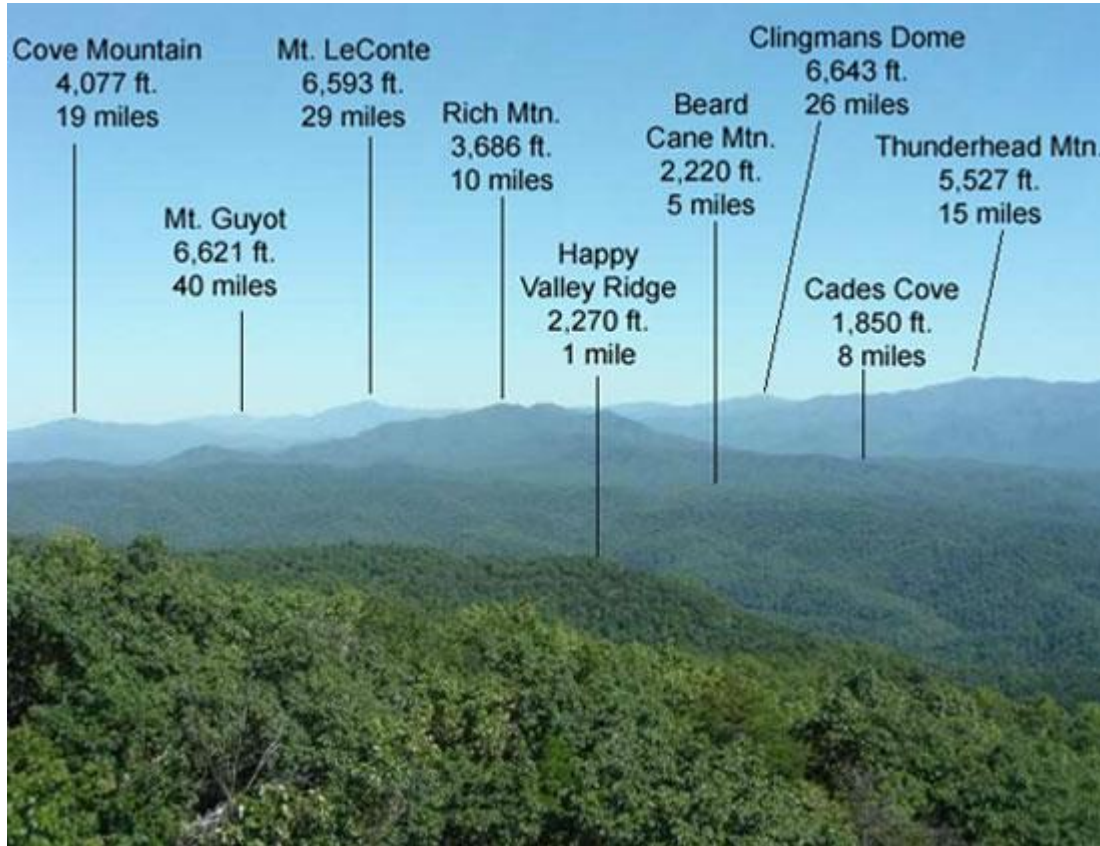


September 17, 2002, 12:30PM
6th most impaired day in 2002
Visibility: 31.9 DV or 11 miles

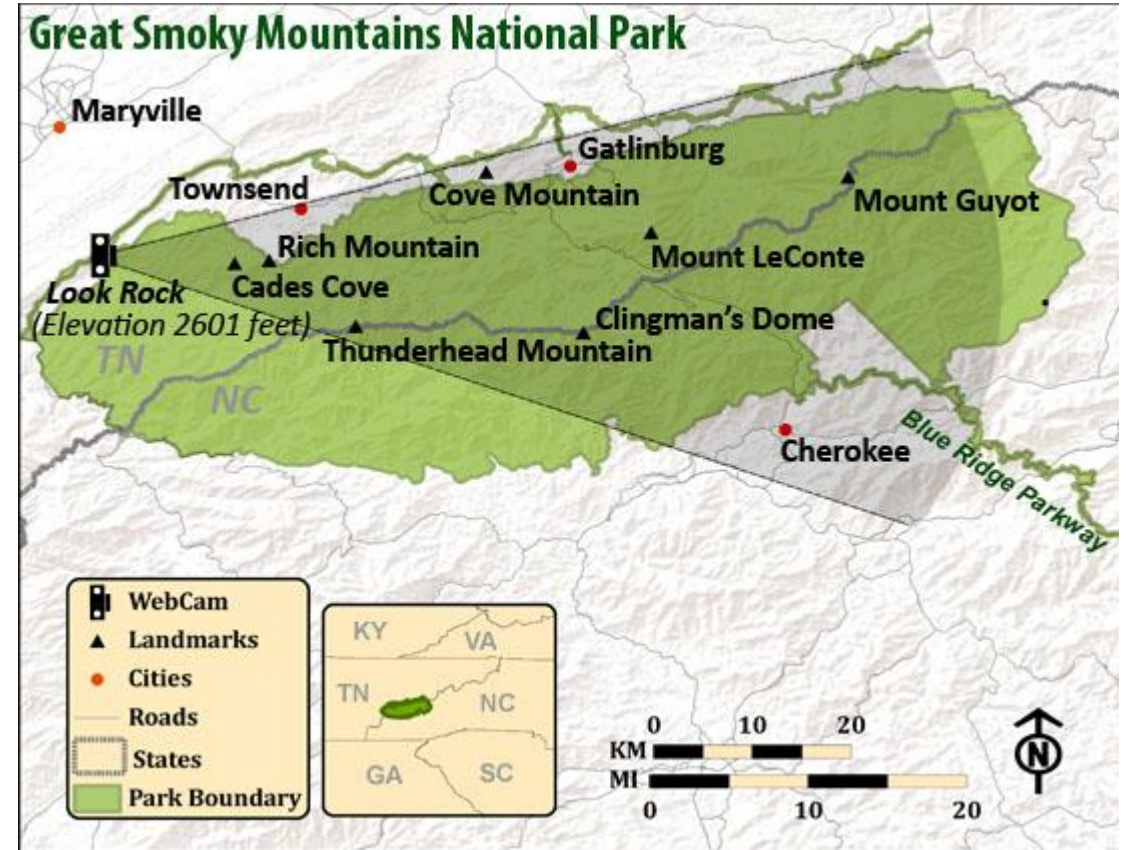


September 19, 2017, 12:30PM
6th most impaired day in 2017
Visibility: 18.5 DV or 38 miles

Look Rock Webcam



Landmarks on a clear day



Webcam location

Source: National Park Service Webcam Archives - <https://npgallery.nps.gov/AirWebCams/grpk>

Acknowledgements

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 - John Hornback, Executive Director, Metro 4/SESARM
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