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National Park Service Air Quality Monitoring Program: Status & Future Directions

Presentation to NASA Air Quality Team

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Air Resources Division, NPS

Air Quality in National Parks and Wilderness Areas: Relevant Mandates



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“...conserve the scenery and the natural and historic objects and wild life therein...as will **leave them unimpaired** for the enjoyment of future generations.”
(NPS Organic Act)



“Wilderness areas...shall be administered for the use of the American people in such a manner as will **leave them unimpaired** for future use and enjoyment as wilderness...” (Wilderness Act of 1964)

“...**preserve, protect and enhance the air quality** in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value.” (Clean Air Act as amended in 1977)



“...Congress declares as a national goal the **prevention of any future, and the remedying of any existing, impairment of visibility** in mandatory class I Federal areas which impairment results from manmade air pollution.” (Clean Air Act as amended in 1977)



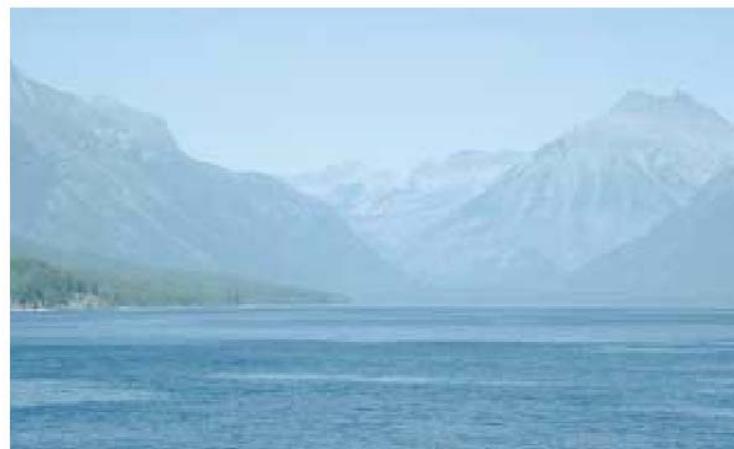
Visibility Impairment in all parks



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(a)



(b)



(c)



(d)

Fig. 3.2 The effect of regional or uniform haze on a Glacier National Park vista. The view is of the Garden Wall from across Lake McDonald. Atmospheric particulate concentrations associated with photographs (a), (b), (c), and (d) correspond to 7.6, 12.0, 21.7, and $65.3 \mu\text{g}/\text{m}^3$.

Ozone Effects to Vegetation



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How does ozone affect sensitive species?

- Visible symptoms
- Physiological symptoms
 - Reduced photosynthesis
 - Reduced growth
- Acute vs. chronic injury

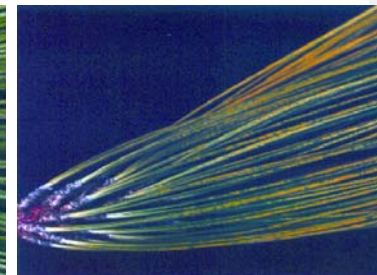
Normal leaf



Ozone-injured leaf



Aspen



Ponderosa
pine



ATMOSPHERIC DEPOSITION

Sulfur and
nitrogen

Acidify
surface waters
& soils

Change community
composition

Eutrophication



Current Network: What, Where & How



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- Monitoring in 69 park areas
 - Ozone
 - Particle and optical (visibility)
 - Atmospheric deposition



- Data broadly available
 - EPA “AQS” database
 - NPS website, including real-time presentation (AIRnow and web cameras)
 - IMPROVE/VIEWS
 - Deposition data available thru NADP
- Follow EPA or other standard protocols at most sites
 - exception – passive and portable ozone monitors

Priceless, but...



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Type	# Sites NPS/Other	NPS \$/ Partner \$	Part of
Ozone	26/10	\$1,500k/ \$1,200k	CASTNET (ozone)
Deposition (wet, dry, Hg)	36/13	\$1,300k/ \$100k (wet/Hg)	NADP/MDN/ CASTNET
PM2.5 (continuous)	0 /9	\$90k	AIRNOW
Visibility	6 / 44 (particle) 18 / 1 (optical)	\$1,300k/ \$1,750	IMPROVE

Monitoring Objectives



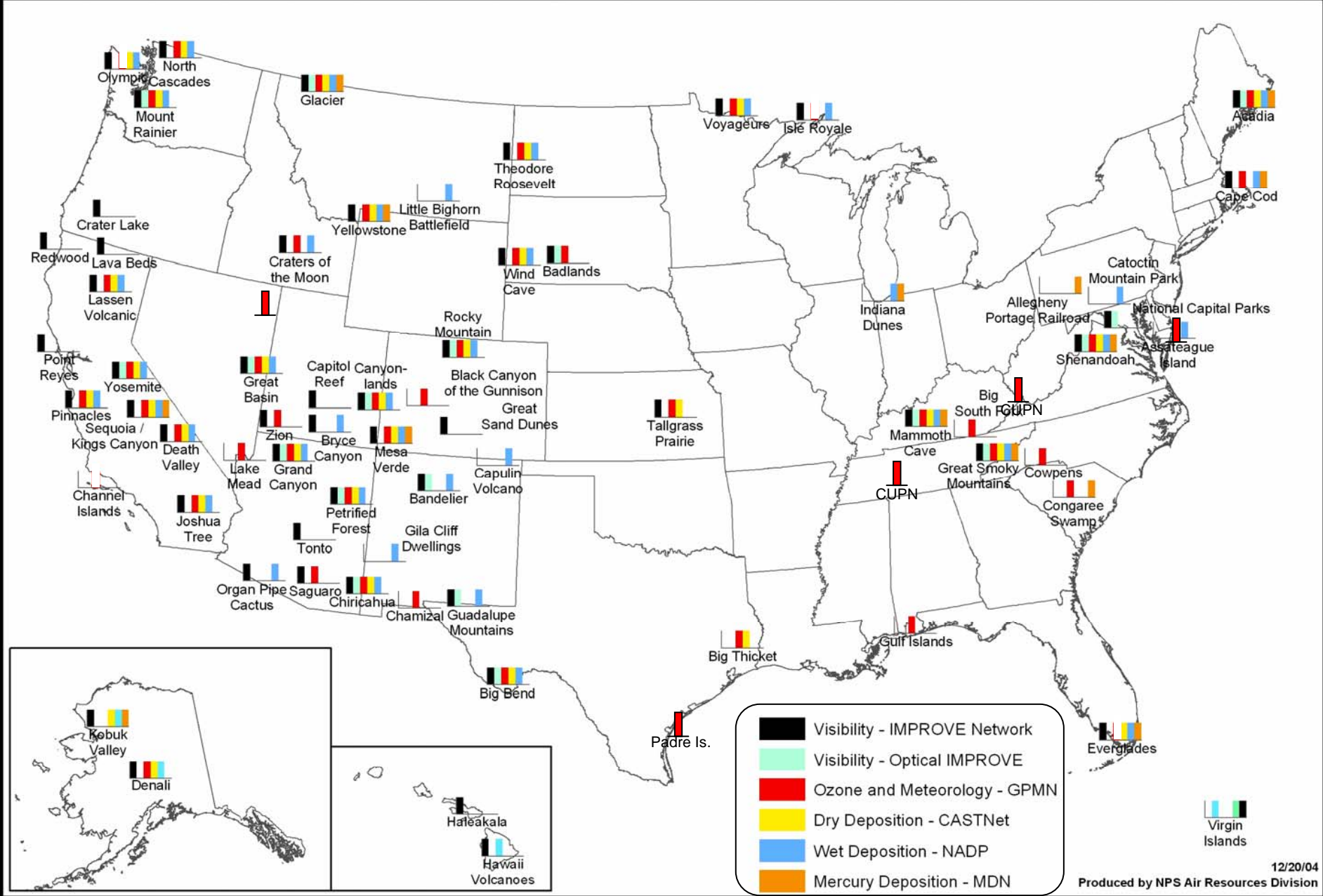
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Inform public and decisionmakers about:

- Conditions and trends
- Potential for impacts on health and resources
- Cause-effect relationships (e.g., impact thresholds)
- Source-receptor relationships (e.g., model input)
- Effectiveness of mitigation measures

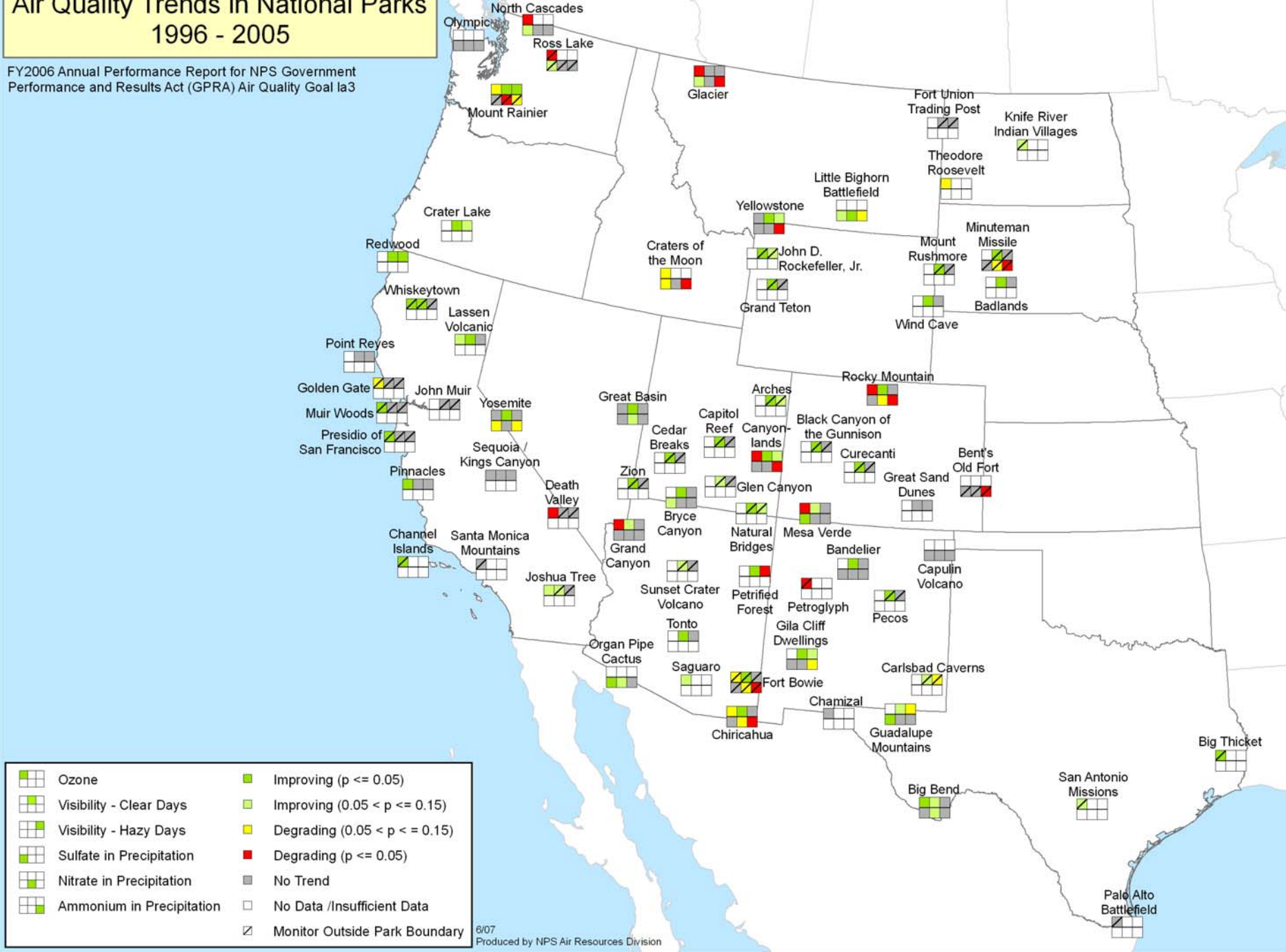
Air Quality Monitoring in NPS Units

by network for 2005



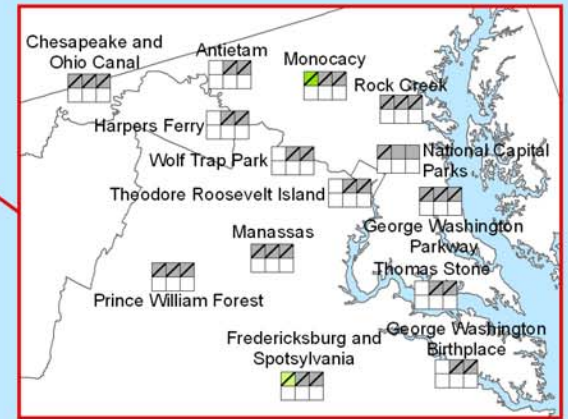
Air Quality Trends in National Parks 1996 - 2005

FY2006 Annual Performance Report for NPS Government
Performance and Results Act (GPRA) Air Quality Goal Ia3



Air Quality Trends in National Parks 1996 - 2005

FY2006 Annual Performance Report for NPS Government Performance and Results Act (GPRA) Air Quality Goal Ia3



	Ozone		Improving ($p \leq 0.05$)
	Visibility - Clear Days		Improving ($0.05 < p \leq 0.15$)
	Visibility - Hazy Days		Degrading ($0.05 < p \leq 0.15$)
	Sulfate in Precipitation		Degrading ($p \leq 0.05$)
	Nitrate in Precipitation		No Trend
	Ammonium in Precipitation		No Data /Insufficient Data
			Monitor Outside Park Boundary

NPS Air Atlas



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GIS-based method to estimate air quality

- Interpolated pollutant values from national networks
- Focus on rural pollutant values, area estimates
- Interactive web-based map viewers
- Trends estimates from 5-year period changes



Air Atlas Interpolations

5-Year Average: 1999-2003

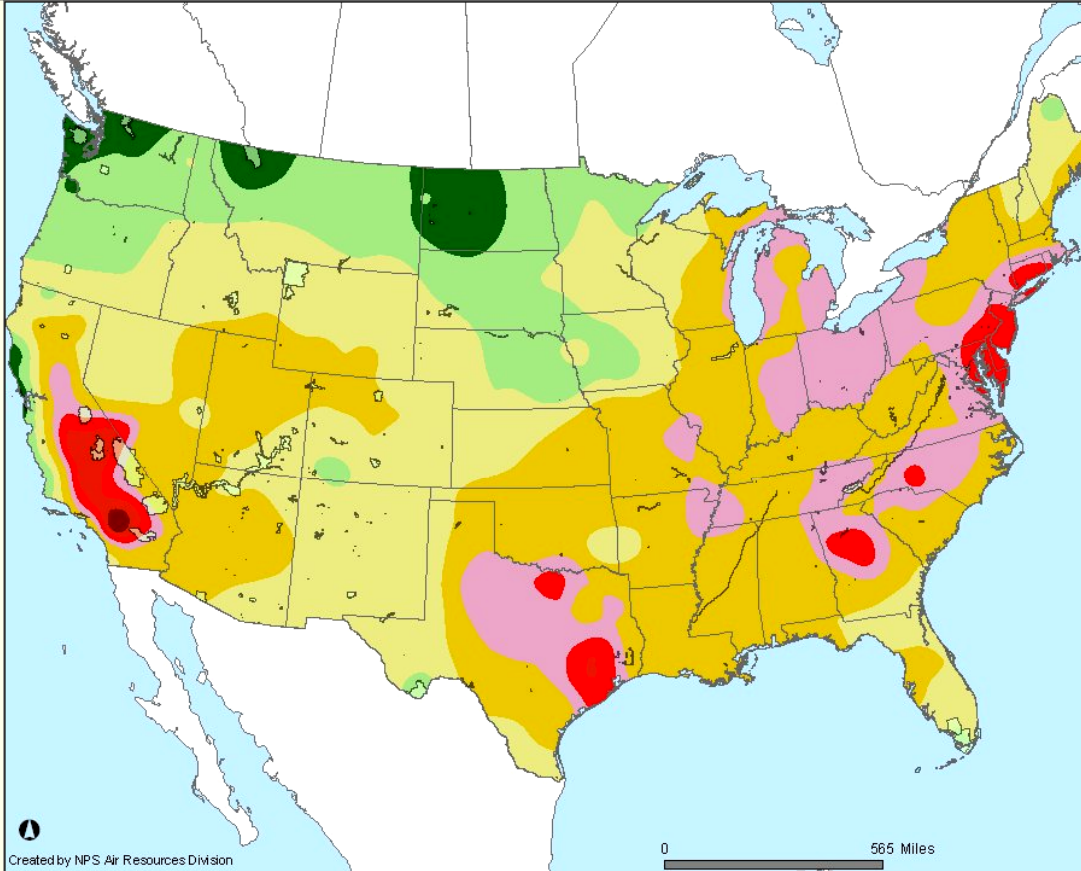


National Park Service
U.S. Department of the Interior



- Tools
- Show Legend
- Overview Map
- Zoom In
- Zoom Out
- Full Extent
- Zoom Active
- Last Extent
- Pan
- Identify
- Query
- Find
- Measure
- Set units
- Buffer
- Select w/ Rect.
- Print
- Clear

Tools Help



Created by NPS Air Resources Division

0 565 Miles

LAYERS

Interpolations

Ozone

- 4th Highest 8-Hour
- 2nd Highest Daily Max.
- Number of Hours Greater Than
- 5 Year Average
- SUM06
- w126

NADP Air Quality Estimates

CASTNet / IMPROVE Dry Depos

- Nitrate
- Sulfate

PM 2.5

Visibility

- 20% Clearest Days
- 20% Hazeiest Days

Monitoring Networks (2004)

- GPMN
- CASTNet
- Ozone
- NADP
- MDN
- IMPROVE

EPA Designated Nonattainment C

- Early Action Counties
- Ozone Maintenance Counties
- 8-hr Ozone Nonattainment Cou
- PM 2.5 Nonattainment Counties

NPS Units / Pollutant Estimates

Base Layers

- NPS Units
- US States
- Water
- Cities
- Highways
- Avg. Annual Precip. 1971-2000
- Elevation

Refresh Map

Auto Refresh

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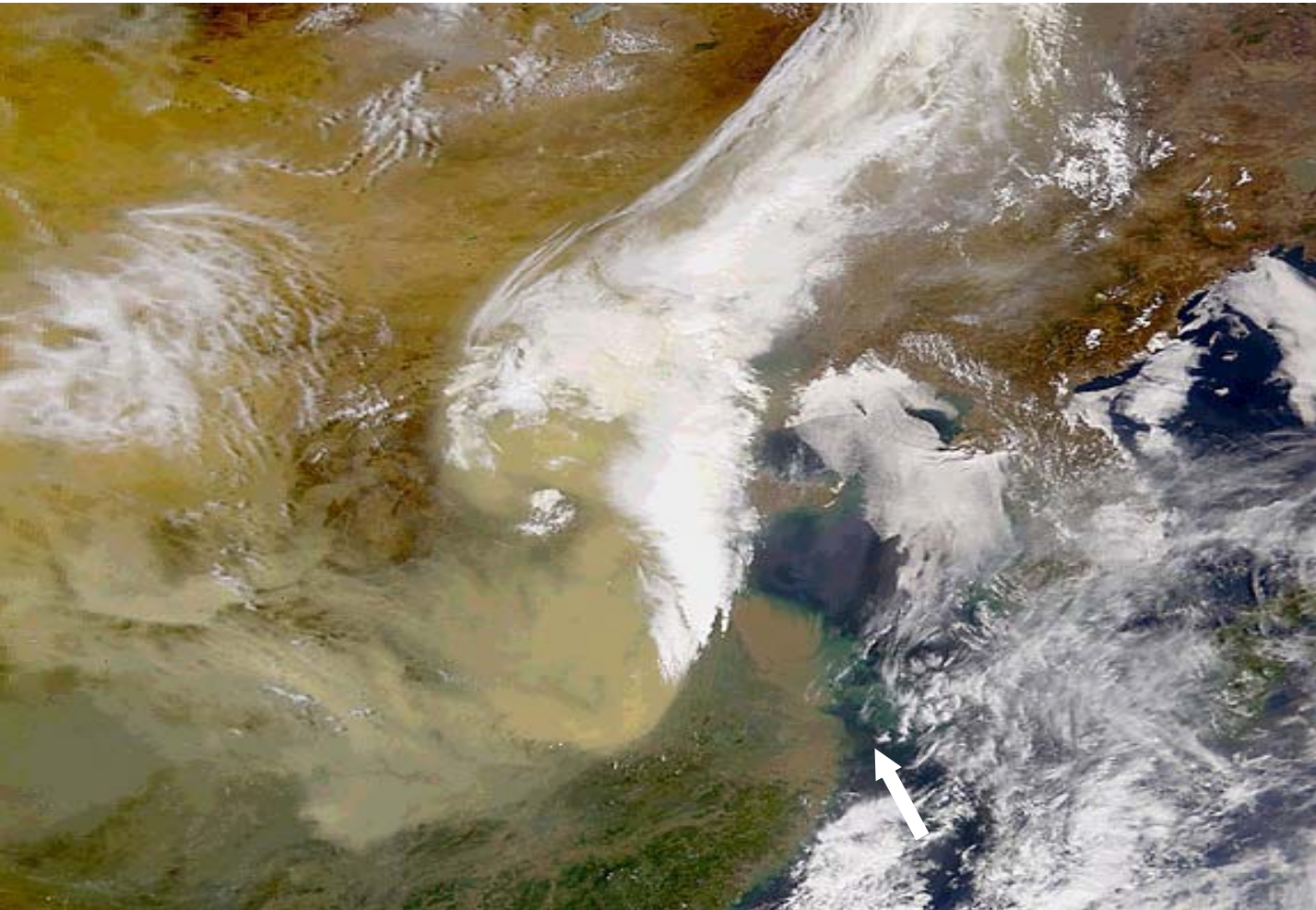
Zoom In

<http://www2.nature.nps.gov/air/Monitoring/network.cfm>

Trans-Pacific Imports from Asia



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On April 16, 1998, a huge dust cloud formed over China and was pushed eastward by a frontal system

[NASA SeaWIFS]

Western Airborne Contaminants Assessment

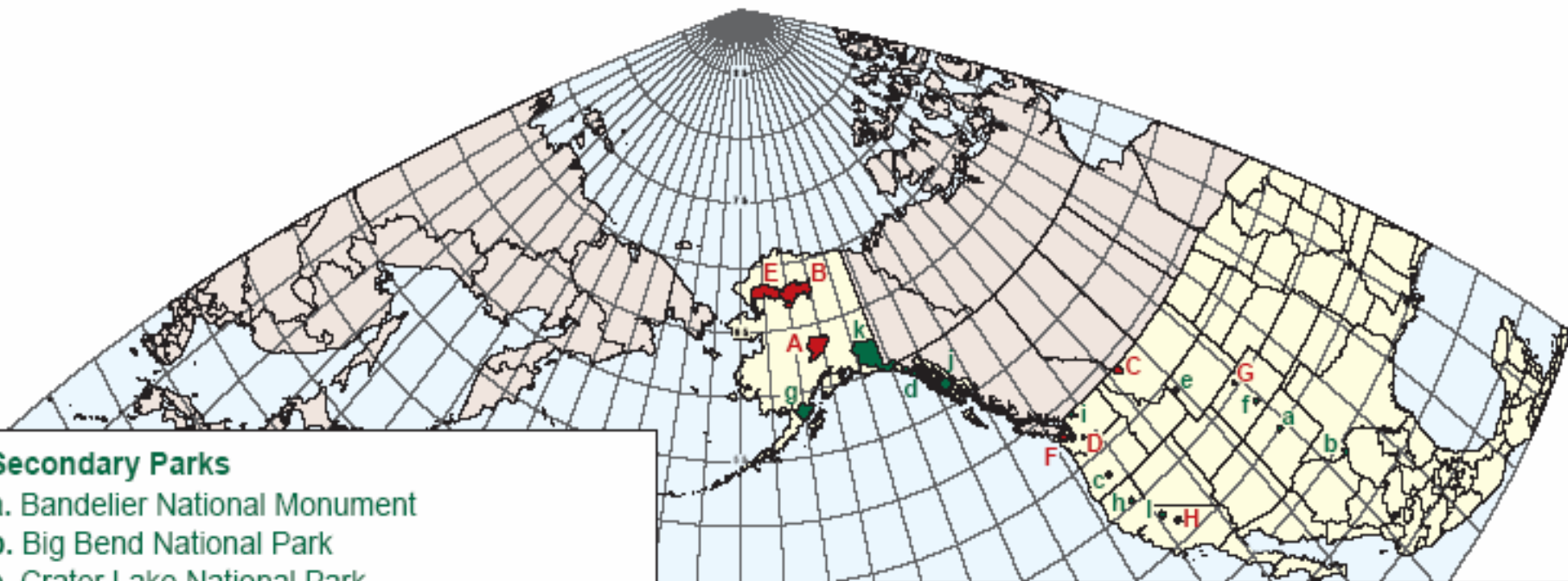
Burial Lake, NOATAK National Preserve

WACAP GOAL:

TO ASSESS THE DEPOSITION OF AIRBORNE CONTAMINANTS IN WESTERN NATIONAL PARKS, PROVIDING REGIONAL AND LOCAL INFORMATION ON EXPOSURE, ACCUMULATION, IMPACTS AND PROBABLE SOURCES



National Parks Selected for Inclusion in the WACAP



Secondary Parks

- a. Bandelier National Monument
- b. Big Bend National Park
- c. Crater Lake National Park
- d. Glacier Bay National Park and Preserve
- e. Grand Teton National Park
- f. Great Sand Dunes National Monument
- g. Katmai National Park and Preserve
- h. Lassen Volcanic National Park
- i. North Cascades National Park
- j. Petersburg District Tongass National Forest
- k. Wrangell-St. Elias National Park and Preserve
- l. Yosemite National Park

Primary Parks

- A. Denali National Park and Preserve
- B. Gates of the Arctic National Park and Preserve
- C. Glacier National Park
- D. Mount Rainier National Park
- E. Noatak National Preserve
- F. Olympic National Park
- G. Rocky Mountain National Park
- H. Sequoia National Park

Monitoring Priorities



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- Long-term network of core sites
- Ensure adequate monitoring of pertinent pollutants in each ecosystem-based network
- Class I area emphasis
- Value-added to decision-making (regulatory, State planning, standard-setting)
- Information for emerging ecosystem-based approaches

For More Information



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- Join 1 million other people a week at <http://www2.nature.nps.gov/air/>
- Julie_Thomas@nps.gov or
- Chris_shaver@nps.gov