FEDERAL LAND MANAGERS' AQRV Activities and Issues EPA Region 4 Workshop March 28, 2007

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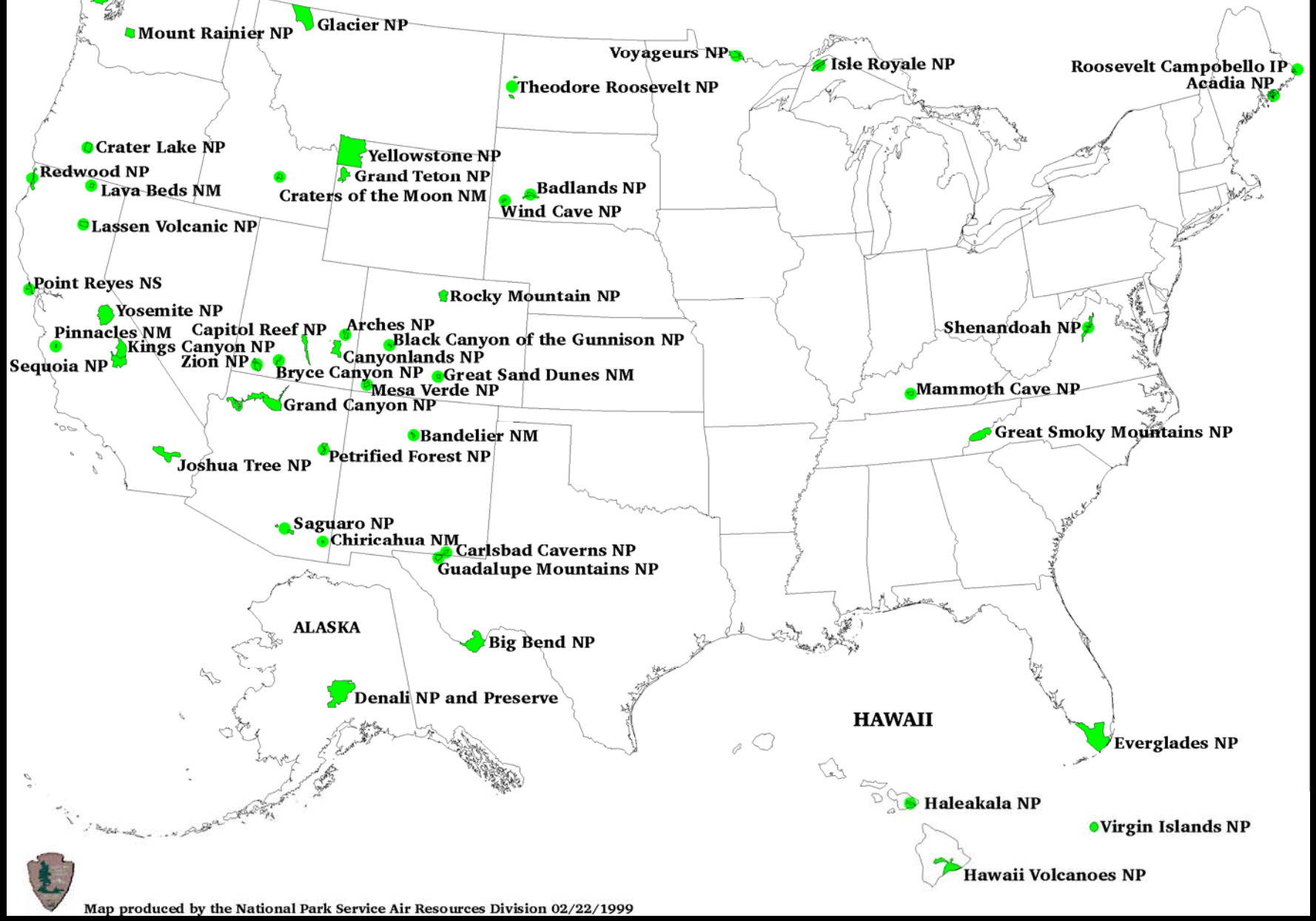
NATIONAL PARK SERVICE CLASS I AREAS



Map produced by the National Park Service Air Resources Division 02/22/1999

FISH AND WILDLIFE SERVICE CLASS I AREAS

Map produced by the Fish and Wildlife Service Air Quality Branch 2/27/1998

FOREST SERVICE CLASS 1 WILDERNESS AREAS

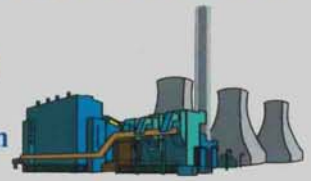
Map produced by the National Park Service Air Resources Division 01/04/1999

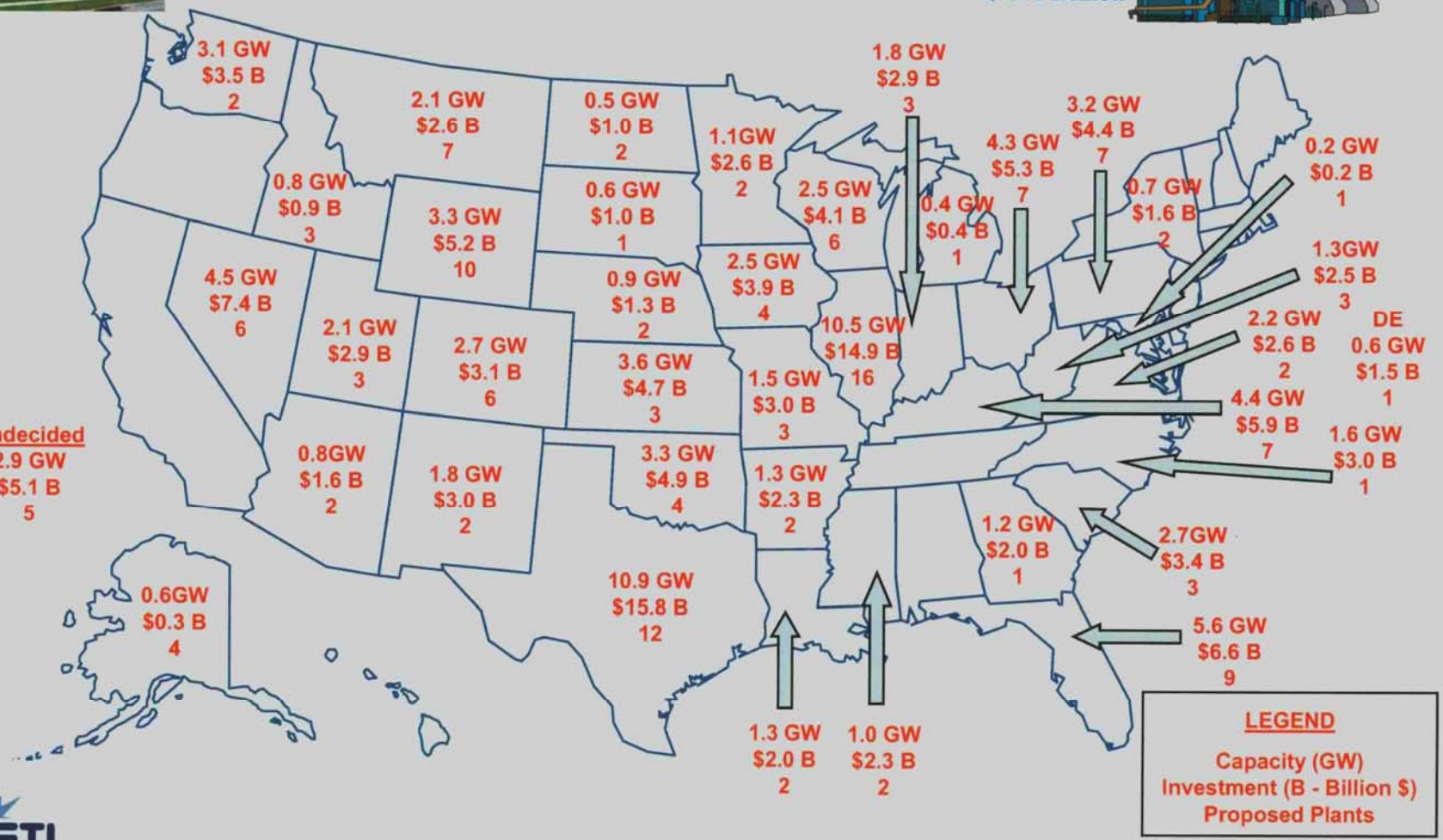
Coal's Resurgence in Electric Power Generation

Proposed New Plants

Equivalent Power
for
96 Million Homes

159 Plants
96GW
$ 141 Billion





NETL

NETL Contacts: Scott Klara, klara@netl.doe.gov

NPS / FWS PERMIT ACTIVITIES

- 150 coal fired power plants on the drawing boards to be built by 2030.
- NPS has 67 power plant permits in house at various stages.(mostly coal fired)
- FWS has 14 power plant permits in house at various stages.
- Only 6 are IGCC plants
- For PSD permits ONLY accepting the EPA Guideline version of the CALPUFF system

THE CLEAN AIR ACT

- Some purposes of PSD are to:
  - **preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, and other areas of special value**
  - FLMs and Class I area managers are given an **"affirmative responsibility"** to protect air quality related values (AQRVs), including visibility, of Class I areas. (Section 165(d)(2))

FLAG

- A screening tool to assess potential impacts on AQRVs
- Provides certainty (i.e., “bright lines”) for those sources with impacts below established significant impact levels (i.e., no adverse impact)
- Does not establish “bright lines” for adverse impact decisions
- Maintains and recognizes the role of the “FLM” in making project-specific adverse impact decisions

Reasons for Revisions

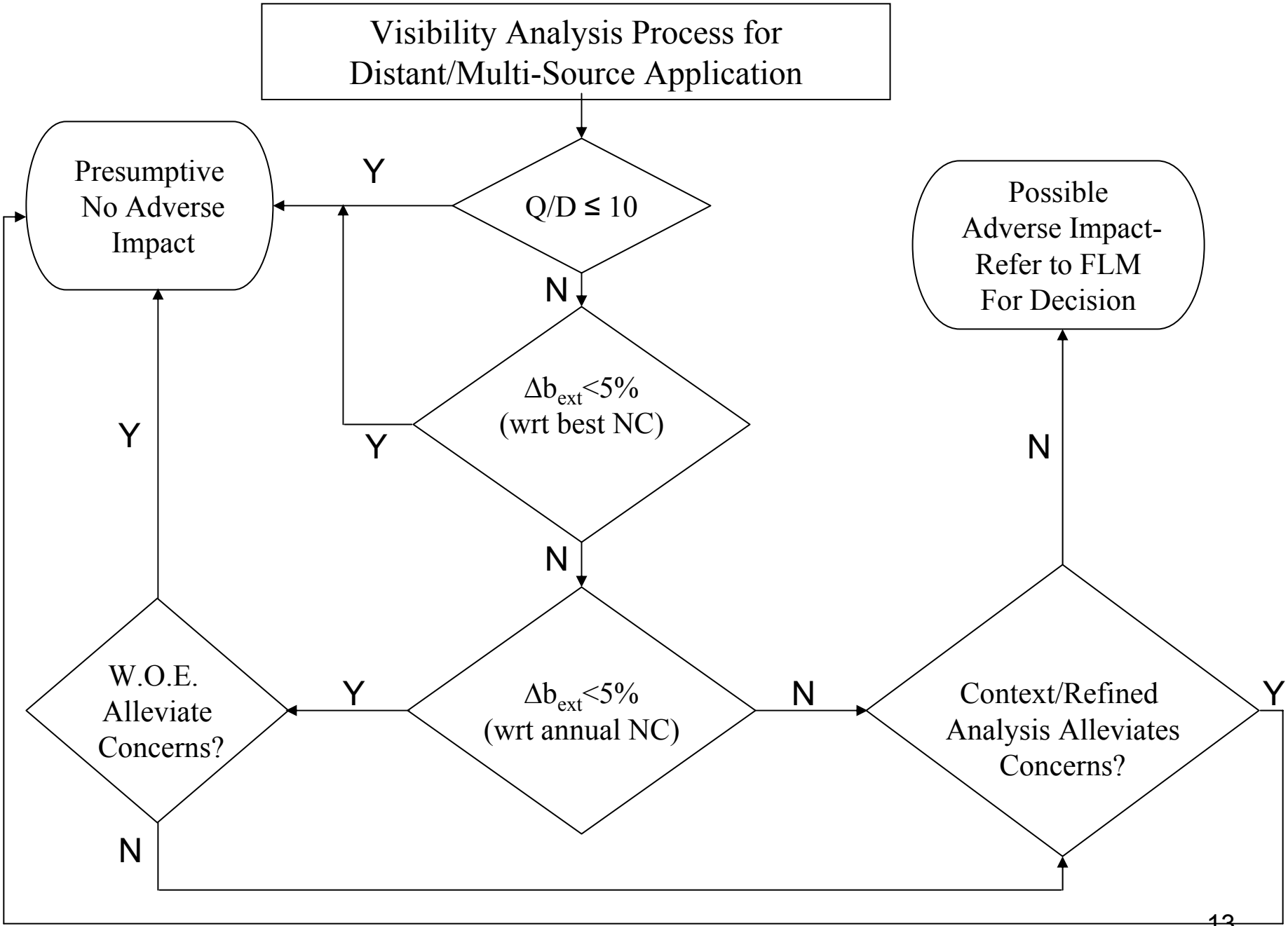
- FLAG 2000—A useful tool; intended to be a working document and revised as necessary
- FLMs have gained knowledge on how to better assess impacts on AQRVs
- New regulatory developments over past seven years (e.g., BART rule)
- Input from applicants and permitting authorities suggest both technical and policy changes are warranted
- Not a “comprehensive” revision, but instead we focus on the visibility analysis, the deposition levels, and the factors FLMs will consider in their decision-making process.

Existing FLAG Haze-like Analysis

- Run CALPUFF (3 years of met. data)
- Concentrations of SO_4; NO_3;PMF; PMC;EC;OC
- Calculate a visibility index – b_{ext}
  - 24-hour average
  - Hour-by-hour b_{ext} using hourly f(RH) concentration (95% rollback)
- Compare change in b_{ext} against annual average natural conditions
- Use maximum modeled values

Potential FLAG Visibility Changes

- Initial Screen: Q/D ≤ 10 (TPY of SO2; SO4; NOx; PM-all)
- Use monthly average f(RH)
- 98th percentile 5% Δb_{ext} (i.e. 8th high)
  - Any 1 year fails test
- Two tiered test
  - Against 20% best natural conditions
  - Against annual average natural conditions
- If fail test look at context and mitigation, then refined analysis (if necessary)
- Adverse impact determination process more explicit; considers regulatory and contextual factors


Visibility Analysis Process for Distant/Multi-Source Application
Q/D ≤ 10
Y
N
Presumptive No Adverse Impact
Δb_ext<5% (wrt best NC)
Y
N
Possible Adverse Impact- Refer to FLM For Decision
Y
N
W.O.E. Alleviate Concerns?
Y
Δb_ext<5% (wrt annual NC)
N
Context/Refined Analysis Alleviates Concerns?
Y
N

Default Average Natural Conditions for the East

Component	Average Concentration, $\mu g/m^3$	Error Factor	Dry Extinction Efficiency,* m^2/g	Dry Extinction,* $Mm^{Š1}$
Ammonium sulfate	0.23	2	3	0.69
Ammonium nitrate	0.1	2	3	0.3
POM	1.4	2	4	5.6
Elemental carbon	0.02	2-3	10	0.2
Fine soil	0.5	1.5-2	1	0.5
Coarse matter	3.0	1.5-2	0.6	1.8
Sum	Fine = 2.25 Coarse = 3.0			9.09

* "Official" IMPROVE Algorithm

Table V.1-1. 20% Best Natural Conditions – Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m^3	NH_4NO_3 µg/m^3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	**Type**
Acadia NP	0.12	0.04	0.75	0.01	0.09	0.67	0.03	12	B20%
Agua Tibia Wilderness	0.03	0.06	0.29	0.01	0.18	0.95	0.12	11	B20%
Alpine Lakes Wilderness	0.03	0.04	0.17	0.01	0.04	0.19	0.04	11	B20%
Anaconda Pintler Wilderness	0.04	0.03	0.14	0.01	0.06	0.22	0.00	10	B20%
Ansel Adams Wilderness	0.02	0.01	0.15	0.01	0.07	0.27	0.01	9	B20%
Arches NP	0.09	0.10	0.28	0.01	0.11	0.62	0.01	9	B20%
Badlands NP	0.09	0.11	0.29	0.01	0.19	0.59	0.00	11	B20%
Bandelier NM	0.08	0.10	0.38	0.02	0.13	0.60	0.01	9	B20%
Bering Sea Wilderness									B20%
Big Bend NP	0.06	0.04	0.31	0.01	0.09	0.63	0.00	10	B20%
Black Canyon of the Gunnison NP	0.07	0.06	0.27	0.01	0.12	0.68	0.01	9	B20%
Bob Marshall Wilderness	0.05	0.07	0.21	0.01	0.06	0.23	0.00	10	B20%
Bosque del Apache Wilderness	0.08	0.09	0.37	0.01	0.12	0.60	0.04	10	B20%
Boundary Waters Canoe Area Wilderness	0.13	0.02	0.56	0.01	0.11	0.55	0.02	11	B20%
Breton Wilderness[1]	0.17	0.08	1.08	0.02	0.21	1.31	0.00	11	B20%
Bridger Wilderness	0.06	0.05	0.16	0.01	0.07	0.23	0.00	9	B20%

[1] There were no data available for Breton Wilderness concentrations; Saint Marks Wilderness data were substituted.

Table V.1-2. Annual Average Natural Conditions - Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m^3	NH_4NO_3 µg/m^3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	**Type**
Acadia NP	0.23	0.10	1.67	0.02	0.24	2.14	0.14	12	Annual
Agua Tibia Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.14	11	Annual
Alpine Lakes Wilderness	0.12	0.10	0.60	0.02	0.23	1.30	0.06	11	Annual
Anaconda Pintler Wilderness	0.12	0.10	0.60	0.02	0.38	1.79	0.01	10	Annual
Ansel Adams Wilderness	0.12	0.10	0.60	0.02	0.44	2.82	0.03	9	Annual
Arches NP	0.12	0.10	0.60	0.02	0.50	2.92	0.01	9	Annual
Badlands NP	0.12	0.10	0.60	0.02	0.50	3.00	0.01	11	Annual
Bandelier NM	0.12	0.10	0.60	0.02	0.50	2.87	0.02	9	Annual
Bering Sea Wilderness									Annual
Big Bend NP	0.12	0.10	0.60	0.02	0.50	3.00	0.03	10	Annual
Black Canyon of the Gunnison NP	0.12	0.10	0.60	0.02	0.49	2.60	0.01	9	Annual
Bob Marshall Wilderness	0.12	0.10	0.60	0.02	0.44	2.34	0.00	10	Annual
Bosque del Apache Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.04	10	Annual
Boundary Waters Canoe Area Wilderness	0.23	0.10	1.72	0.02	0.34	2.82	0.02	11	Annual
Breton Wilderness[1]	0.23	0.10	1.80	0.02	0.50	3.00	0.04	11	Annual
Bridger Wilderness	0.12	0.10	0.60	0.02	0.44	1.88	0.01	9	Annual
Brigantine Wilderness	0.23	0.10	1.80	0.02	0.47	3.00	0.22	12	Annual

[1] There were no data available for Breton Wilderness concentrations; Saint Marks Wilderness data were substituted.

IMPROVE Algorithms

- **Old**
  - $b_{ext} = 3f(RH)[sulfates] \quad +3f(RH)[nitrates]$
    $+4[organics] +10[elemental\ carbon]$
    $+1[fine\ soil] +0.6[coarse\ matter] + 10$
- **New** (changes in blue)
  - $b_{ext} = 2.2f_S(RH)[small\ sulfates] + 4.8f_L(RH)[large\ sulfates] \quad +2.4f_S(RH)[small\ nitrates] + 5.1f_L(RH)[large\ nitrates]$
    $+2.8[small\ organics] + 6.1[large\ organics]$
    $+10[elemental\ carbon] +1[fine\ soil]$
    $+1.7f_{SS}(RH)[sea\ salt] +0.6[coarse\ matter]$
    $+Rayleigh\ scattering\ (site\ specific)$
    $+0.33[NO_2(ppb)]$

Auxiliary Formulas for Applying New IMPROVE Algorithm

- For sulfates:
  - *[large sulfates] = {[total sulfates]/20}[total sulfates]* if [total sulfates] < 20 μg^3
  - *[large sulfates] = [total sulfates]* if [total sulfates] ≥ 20 $\mu g/m^3$
  - *[small sulfates] = [total sulfates] – [large sulfates]*
- Use same formulas for nitrates and organics; just substitute the appropriate words instead of sulfates
- *Organics = 1.8[OC]*, vs. 1.4 with the old algorithm
- *Sea salt = 1.8[Cl^-]*
- *Site specific Rayleigh scattering*

f(RH) Curves

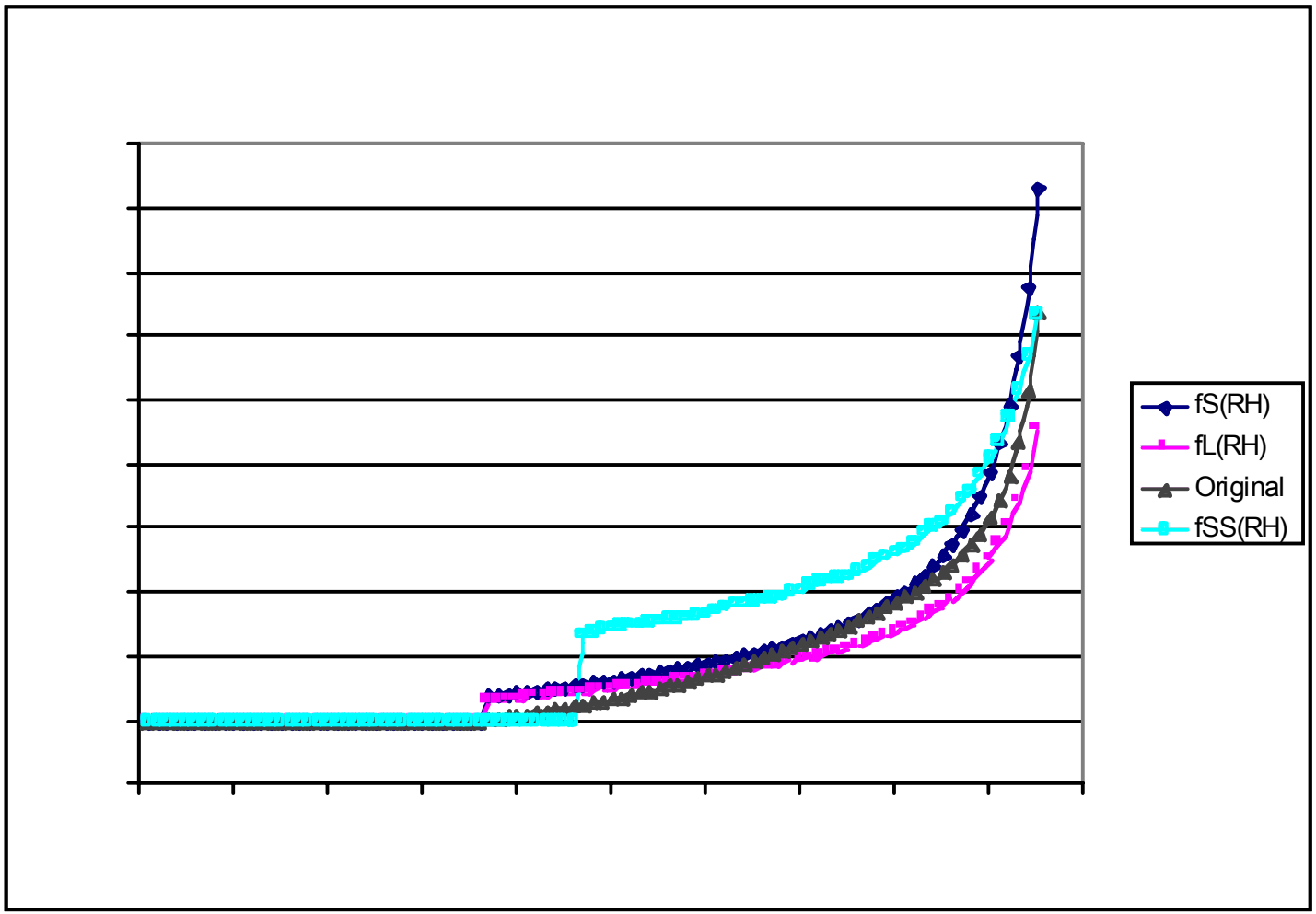


Table V.1-3. Monthly $f_L(RH)$ – Large $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	2.74	2.46	2.45	2.66	2.67	2.73	2.99	3.03	3.16	2.91	2.89	2.96
Agua Tibia Wilderness	2.10	2.08	2.11	1.98	1.98	1.93	1.93	2.01	2.02	1.99	1.87	1.95
Alpine Lakes Wilderness	3.86	3.58	3.04	2.92	2.99	2.58	2.62	2.67	2.97	3.60	4.00	3.99
Anaconda Pintler Wilderness	2.75	2.46	2.24	2.08	2.06	2.01	1.76	1.72	1.88	2.22	2.66	2.74
Ansel Adams Wilderness	2.56	2.34	2.20	1.88	1.79	1.59	1.52	1.52	1.59	1.70	2.01	2.34
Arches NP	2.28	2.12	1.73	1.57	1.50	1.28	1.34	1.47	1.51	1.56	1.90	2.13
Badlands NP	2.31	2.31	2.31	2.21	2.34	2.25	2.08	2.05	2.02	2.05	2.38	2.33
Bandelier NM	2.10	1.90	1.72	1.51	1.53	1.38	1.63	1.87	1.80	1.59	1.87	2.04
Bering Sea Wilderness	3.02	3.17	3.20	3.19	3.23	3.34	3.78	4.16	3.64	3.19	3.12	3.13
Big Bend NP	1.72	1.61	1.44	1.38	1.47	1.48	1.58	1.74	1.83	1.63	1.63	1.70
Black Canyon of the Gunnison NP	2.15	2.05	1.83	1.75	1.74	1.51	1.59	1.78	1.80	1.68	1.96	2.06
Bob Marshall Wilderness	2.82	2.54	2.35	2.22	2.21	2.19	1.98	1.92	2.15	2.43	2.78	2.81
Bosque del Apache Wilderness	2.03	1.82	1.55	1.37	1.36	1.27	1.61	1.79	1.73	1.54	1.73	2.00
Boundary Waters Canoe Area Wilderness	2.50	2.25	2.28	2.09	2.20	2.43	2.57	2.71	2.78	2.38	2.64	2.64
Breton Wilderness	2.91	2.76	2.74	2.72	2.83	2.94	3.10	3.07	2.97	2.82	2.83	2.90
Bridger Wilderness	2.22	2.10	2.04	1.95	1.95	1.67	1.46	1.44	1.68	1.83	2.19	2.16
Brigantine Wilderness	2.49	2.32	2.38	2.28	2.50	2.56	2.69	2.81	2.82	2.71	2.45	2.50

Table V.1-4. Monthly $f_S(RH)$ – Small $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	3.80	3.28	3.30	3.71	3.72	3.81	4.28	4.34	4.58	4.10	4.06	4.19
Agua Tibia Wilderness	2.68	2.61	2.63	2.42	2.40	2.33	2.33	2.45	2.49	2.46	2.29	2.42
Alpine Lakes Wilderness	5.87	5.35	4.34	4.13	4.30	3.50	3.61	3.69	4.27	5.43	6.15	6.08
Anaconda Pintler Wilderness	3.72	3.23	2.87	2.62	2.60	2.52	2.14	2.07	2.33	2.87	3.60	3.71
Ansel Adams Wilderness	3.51	3.11	2.87	2.34	2.18	1.86	1.75	1.76	1.88	2.05	2.55	3.12
Arches NP	2.96	2.70	2.09	1.84	1.75	1.40	1.49	1.69	1.76	1.83	2.33	2.69
Badlands NP	2.94	2.96	3.01	2.87	3.10	2.91	2.64	2.59	2.56	2.58	3.11	2.98
Bandelier NM	2.66	2.36	2.10	1.77	1.80	1.55	1.93	2.30	2.21	1.87	2.32	2.60
Bering Sea Wilderness	4.16	4.48	4.52	4.50	4.64	4.86	5.71	6.43	5.40	4.52	4.36	4.37
Big Bend NP	2.11	1.92	1.65	1.56	1.67	1.67	1.83	2.07	2.22	1.92	1.92	2.04
Black Canyon of the Gunnison NP	2.71	2.56	2.23	2.12	2.12	1.75	1.87	2.17	2.21	2.00	2.42	2.57
Bob Marshall Wilderness	3.84	3.35	3.06	2.86	2.86	2.84	2.49	2.39	2.77	3.22	3.81	3.83
Bosque del Apache Wilderness	2.56	2.23	1.83	1.54	1.54	1.39	1.90	2.16	2.09	1.79	2.09	2.53
Boundary Waters Canoe Area Wilderness	3.23	2.81	2.93	2.63	2.89	3.22	3.44	3.71	3.83	3.08	3.49	3.49
Breton Wilderness	4.08	3.82	3.79	3.74	3.94	4.12	4.41	4.37	4.18	3.92	3.93	4.06
Bridger Wilderness	2.78	2.60	2.55	2.43	2.45	1.99	1.65	1.63	2.03	2.25	2.78	2.68
Brigantine Wilderness	3.34	3.07	3.17	2.99	3.37	3.45	3.68	3.90	3.91	3.73	3.27	3.36

Table V.1-5. Monthly $f_{SS}(RH)$ – Sea Salt Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	3.90	3.48	3.40	3.66	3.71	3.81	4.19	4.27	4.44	4.13	4.10	4.19
Agua Tibia Wilderness	2.94	2.95	3.02	2.85	2.88	2.81	2.78	2.90	2.90	2.83	2.56	2.69
Alpine Lakes Wilderness	5.35	4.96	4.27	4.11	4.18	3.64	3.68	3.73	4.12	4.98	5.51	5.53
Anaconda Pintler Wilderness	4.00	3.56	3.18	2.90	2.85	2.75	2.33	2.25	2.52	3.10	3.81	3.97
Ansel Adams Wilderness	3.55	3.25	3.04	2.54	2.38	2.05	1.91	1.91	2.03	2.21	2.72	3.21
Arches NP	3.25	2.99	2.26	1.97	1.86	1.48	1.59	1.82	1.88	1.96	2.60	3.02
Badlands NP	3.37	3.33	3.27	3.05	3.25	3.15	2.89	2.81	2.74	2.82	3.41	3.38
Bandelier NM	2.91	2.59	2.22	1.87	1.90	1.67	2.11	2.54	2.37	2.00	2.49	2.78
Bering Sea Wilderness	4.39	4.57	4.60	4.58	4.57	4.70	5.26	5.73	5.11	4.59	4.52	4.54
Big Bend NP	2.20	2.03	1.75	1.67	1.84	1.87	2.03	2.34	2.47	2.09	2.10	2.22
Black Canyon of the Gunnison NP	3.05	2.89	2.47	2.31	2.28	1.89	2.04	2.36	2.37	2.18	2.71	2.92
Bob Marshall Wilderness	4.08	3.66	3.35	3.11	3.08	3.04	2.68	2.59	2.94	3.42	3.98	4.05
Bosque del Apache Wilderness	2.77	2.43	1.95	1.62	1.62	1.47	2.06	2.40	2.29	1.92	2.27	2.71
Boundary Waters Canoe Area Wilderness	3.73	3.35	3.29	2.91	3.00	3.44	3.68	3.88	3.98	3.45	3.89	3.91
Breton Wilderness	4.10	3.89	3.87	3.85	4.02	4.21	4.44	4.38	4.23	3.99	4.01	4.11
Bridger Wilderness	3.25	3.05	2.90	2.67	2.62	2.17	1.81	1.79	2.17	2.43	3.15	3.17
Brigantine Wilderness	3.53	3.24	3.30	3.15	3.49	3.63	3.84	4.02	4.02	3.82	3.48	3.55

Example Calculation of Natural Conditions and Change in Light Extinction

The annual average concentration and the relative humidity adjustment factors ($f_{\{L,S,SS\}}(RH)$) for the Alpine Lakes Wilderness for January will be used for illustration of the calculations.

1. Look up the Alpine Lakes Wilderness annual average concentration values in Table V.1-2 for sulfate ($(NH_4)_2SO_4$), nitrate (NH_4NO_3), organic mass (OM), Elemental Carbon (EC), soil, coarse mass (CM), sea salt, and Rayleigh scattering.

Class I Area	$(NH_4)_2SO_4$ µg/m^3	NH_4NO_3 µg/m^3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}
Acadia NP	0.23	0.10	1.67	0.02	0.24	2.14	0.14	12
Agua Tibia Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.14	11
Alpine Lakes Wilderness	0.12	0.10	0.60	0.02	0.23	1.30	0.06	11
…	…	…	…	…	…	…	…	…

2. Look up the f(RH) terms for the large sulfate/nitrate, small sulfate/nitrate, and sea salt; January in this example.
   a. $f_L(RH) = 3.86$
   b. $f_S(RH) = 5.87$
   c. $f_{SS}(RH) = 5.35$
3. Calculate the large and small sulfate, nitrate, and organic mass

	Total	Large	Small
Sulfate	0.12	0.00072	0.11928
Nitrate	0.10	0.0005	0.0995
Organic Mass	0.60	0.018	0.582

1. Apply to b_{ext} equation in Figure V.1-1:

$$
\begin{aligned}
b_{ext} = \; & 2.2 \times 5.87 \times 0.11928 + 4.8 \times 3.86 \times 0.00072 && \{\text{Sulfate}\} \\
& + 2.4 \times 5.87 \times 0.0995 + 5.1 \times 3.86 \times 0.0005 && \{\text{Nitrate}\} \\
& + 2.8 \times 0.582 + 6.1 \times 0.018 && \{\text{Organic Mass}\} \\
& + 10 \times 0.02 && \{\text{Elemental Carbon}\} \\
& + 1 \times 0.23 && \{\text{Soil}\} \\
& + 0.6 \times 1.30 && \{\text{Coarse Mass}\} \\
& + 1.7 \times 5.35 \times 0.06 && \{\text{Sea Salt}\} \\
& + 11 && \{\text{Rayleigh}\} \\
& + 0.33 \times 0 && \{NO_2\} \\
b_{ext} = \; & 17.46 \text{ Mm}^{-1}
\end{aligned}
$$

To calculate the change in light extinction from the impacts from an air pollution source, the species concentrations from the source are added to the total species concentrations in steps 3 and 4 above and the new total light extinction is calculated. Therefore, if a source contributed 0.05 $\mu g/m^3$ of sulfate ($(NH_4)_2SO_4$) and 0.01 $\mu g/m^3$ of nitrate (NH_4NO_3) at a receptor, the total, large and small sulfate and nitrate values would be:

	Total	Large	Small
Sulfate	0.17 (0.12+0.05)	0.001445	0.168555
Nitrate	0.11 (0.10+0.01)	0.000605	0.109395

The other concentrations and the relative humidity adjustment factors would remain as in step 4 of the natural condition example. After recalculating the light extinction accounting for the effect of the source ($b_{ext(source+nat\ cond)}$), the new light extinction would be 18.25 Mm^{-1}.

The change in light extinction (Δb_{ext}) would simply be:

$$\Delta b_{ext} = (b_{ext(source+nat\ cond)} - b_{ext(nat\ cond)}) / b_{ext(nat\ cond)} \text{ or:}$$

$$\Delta b_{ext} = (18.25 - 17.46) / 17.46$$

$$\Delta b_{ext} = 0.045 \; (4.5\%)$$

The example provided here is to illustrate the process. Usually the concentrations and relative humidity adjustment factors would be extracted from the appropriate tables and input to one of the air quality model post processing programs.

Extinction Efficiency (1/Mm per ug/m**3)

MODELED particulate species:

PM COARSE (EEPMC) -- Default: 0.6 ! EEPMC = 0.6 !

PM FINE (EEPMF) -- Default: 1.0 ! EEPMF = 1.0 !

BACKGROUND particulate species:

PM COARSE (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !

Other species:

LARGE AMMONIUM SULFATE (EESO4) -- Default: 4.8 ! EESO4 = 4.8 !

SMALL AMMONIUM SULFATE (EESO4) -- Default: 2.2 ! EESO4 = 2.2 !

LARGE AMMONIUM NITRATE (EENO3) -- Default: 5.1 ! EENO3 = 5.1 !

SMALL AMMONIUM NITRATE (EENO3) -- Default: 2.4 ! EENO3 = 2.4 !

LARGE ORGANIC CARBON (EEOC) -- Default: 6.1 ! EEOC = 6.1 !

SMALL ORGANIC CARBON (EEOC) -- Default: 2.8 ! EEOC = 2.8 !

SOIL (EESOIL)-- Default: 1.0 ! EESOIL = 1.0 !

ELEMENTAL CARBON (EEEC) -- Default: 10. ! EEEC = 10.0 !

Background extinction coefficients are computed from monthly CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and elemental carbon (BKEC). Month 1 is January.
(ug/m**3)
(BKSO4) -- No default ! BKSO4 = 12*0.23 !
(BKNO3) -- No default ! BKNO3 = 12*0.10 !
(BKPMC) -- No default ! BKPMC = 12*1.40 !
(BKOC) -- No default ! BKOC = 12*1.40 !
(BKSOIL) -- No default ! BKSOIL= 12*0.50 !
(BKCOARSE)-- No default ! BKEC = 12*3.00 !
(BKEC) -- No default ! BKEC = 12*0.02 !
Additional inputs used for MVISBK = 2,3,5,6,7:

Extinction due to Rayleigh scattering is added (1/Mm)
(BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10.0 !

ADVERSE IMPACT

An unacceptable effect, as identified by an FLM, that results from current, or would result from predicted, deterioration of air quality in a Federal Class I area. A determination of unacceptable effect shall be made on a case-by-case basis for each area taking into account existing air quality conditions. It should be based on a demonstration that the current or predicted deterioration of air quality will cause or contribute to a diminishment of the area's national significance, impairment of the structure and functioning of the area's ecosystem, or impairment of the quality of the visitor experience in the area.

FLM Adverse Impact Determination

- Made on a project-specific basis
- Based on air quality impact modeling performed by the applicant and verified by the FLM
- Considers magnitude, frequency, duration, location, geographic extent, timing of expected impacts (and other factors)

What Does “Weight of Evidence” (W.O.E.) Mean?

- If here you have failed the 20% best natural condition test, but passed the annual natural condition test
- If BACT in question, or multiple Class I areas impacted, or if State using 20% best background in its BART analysis, may jump to context, mitigation, further analysis
- In many cases, with resolution of BACT, probably pass without further analysis

Further Considerations

- Regulatory Factors
  - Geographic extent, intensity, duration, frequency, time of visitor use, natural conditions that affect visibility
- Contextual Considerations
  - Current pollutant concentrations and AQRV impacts in the Class I area
  - Air Quality trends in the Class I area
  - Emission offsets obtained or other mitigation offered by the permit applicant
  - Enforceable emission changes that have occurred or would occur before source operation date
  - Whether there are approved SIPs that account for new source growth and demonstrate “reasonable progress” toward visibility goals
  - Expected life of the source
  - Stringency of proposed emission limits (BACT?)
  - Ancillary environmental benefits proposed by applicant (e.g., reduced toxics emissions, pollution prevention investments, CO2 sequestration, purchase of “green” power
  - Comments from the public and other agencies

Further Considerations (cont)

- Mitigation strategies
  - Emission offsets
  - Emission rate reductions
  - Monitoring/special studies leading to future permit revision (monitoring alone NOT a mitigation strategy)
- Results of refined analysis (if necessary)

Deposition Analysis

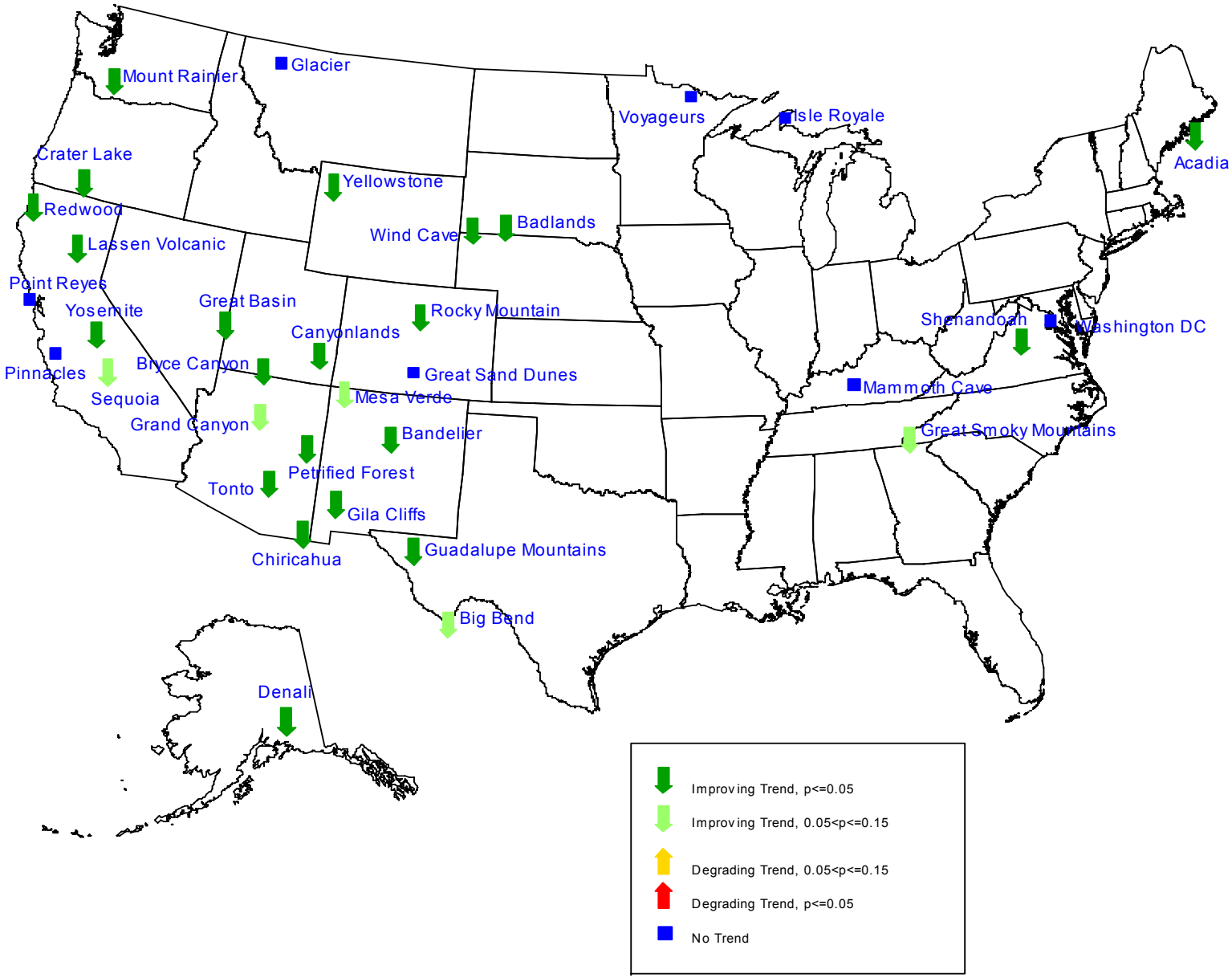
- Included concern thresholds, pollutant exposures, and deposition analysis thresholds (DATs) for sulfur and nitrogen deposition
- EAST-Total Sulfur; Total Nitrogen=0.01 Kg/HA/Yr
- WEST-Total Sulfur; Total Nitrogen=0.005 Kg/HA/Yr
- Expanded discussion of “Critical Loads” to reflect developments since FLAG 2000
- Replaced dated deposition maps with reference to NADP website for current trends data
- Replaced old deposition data with links to agency websites

Ozone Analysis

- Updated ozone sensitive species lists, but replaced the lists with links to agency websites to help keep info more current
- Deleted old/outdated ozone effects data

Trends in Haze Index (Deciview) on Clearest Days, 1996-2005

FY2006 Annual Performance Report for NPS Government Performance and Results Act (GPRA)



03/26/2007

Trends in Haze Index (Deciview) on Haziest Days, 1996-2005

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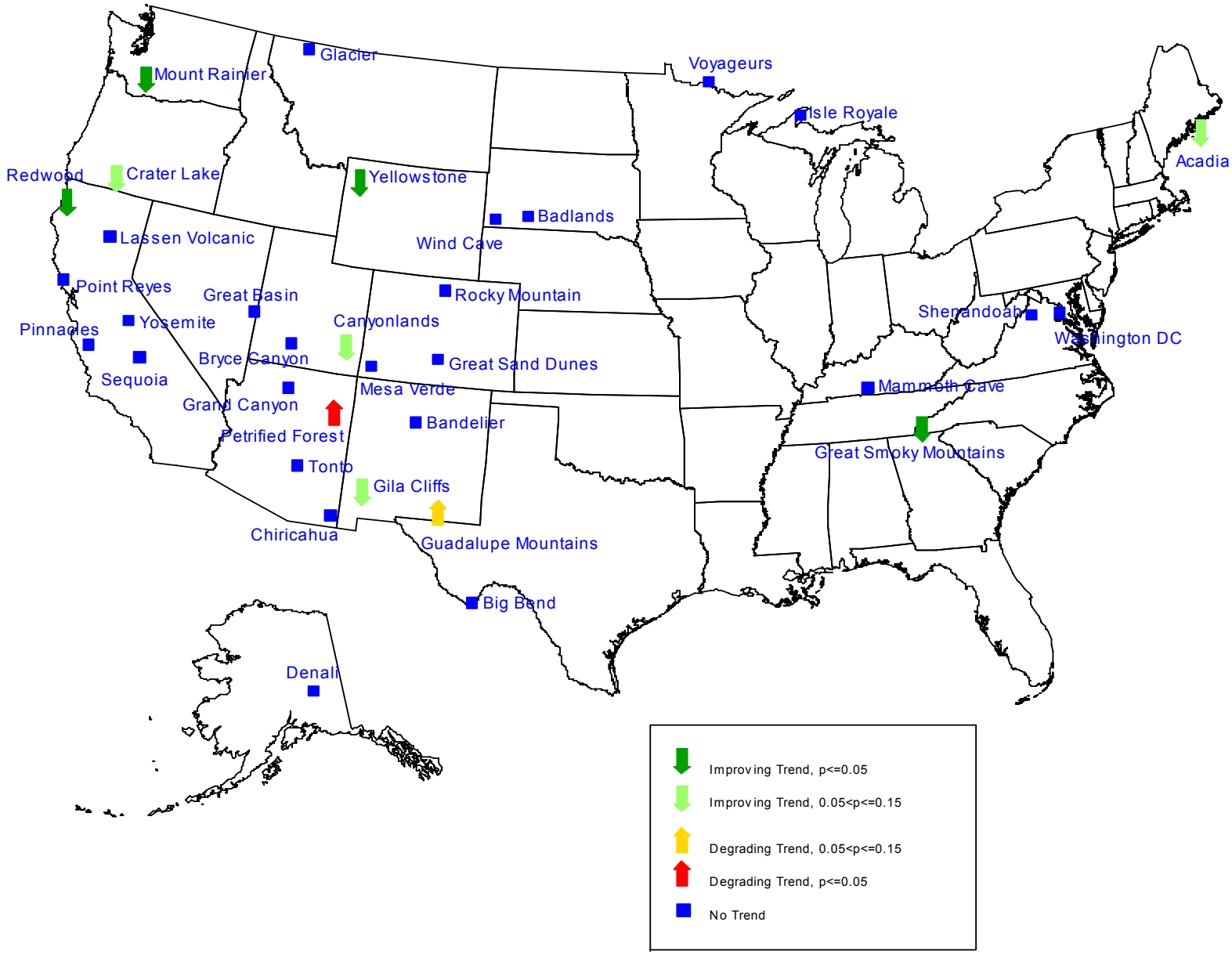
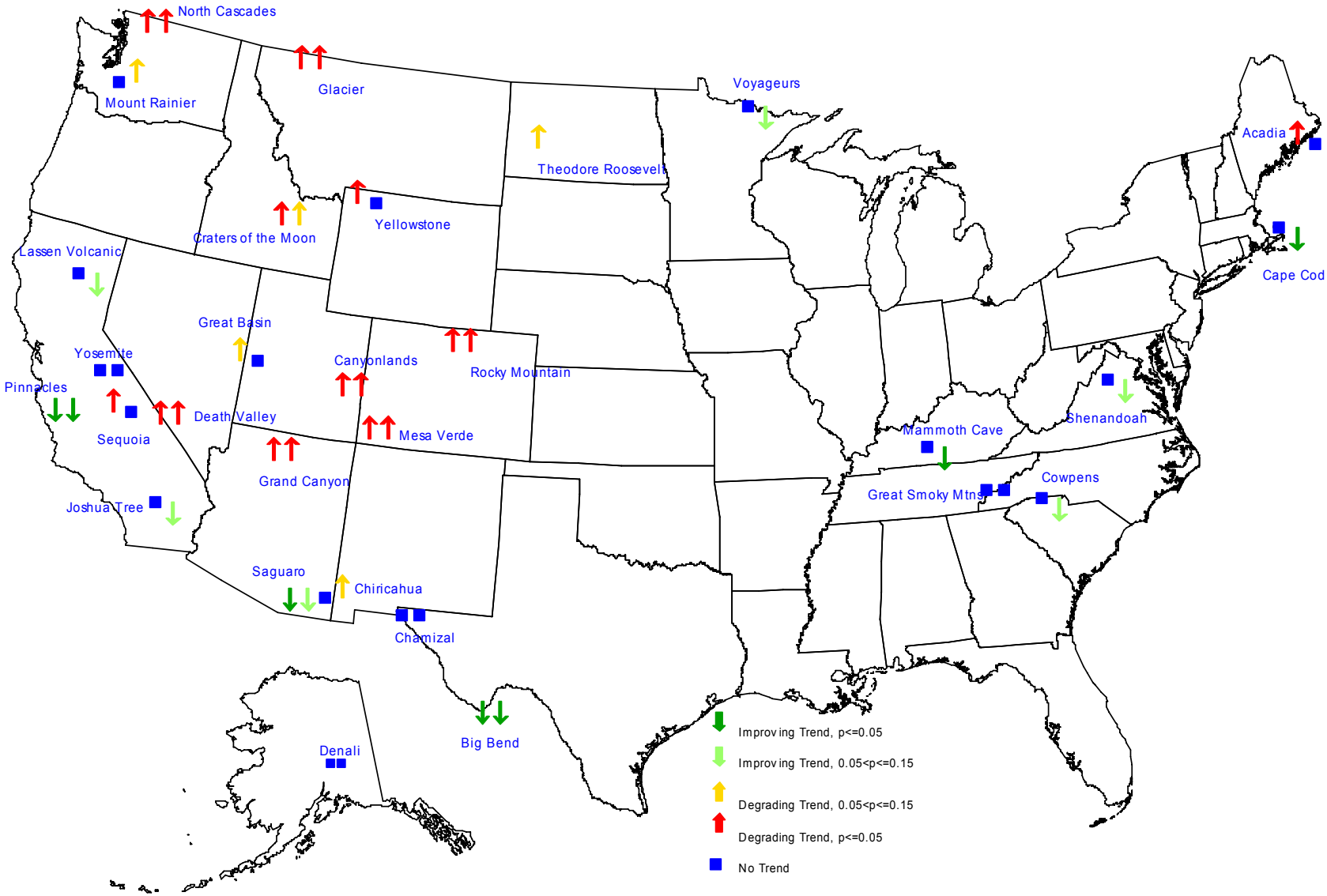


03/26/2007

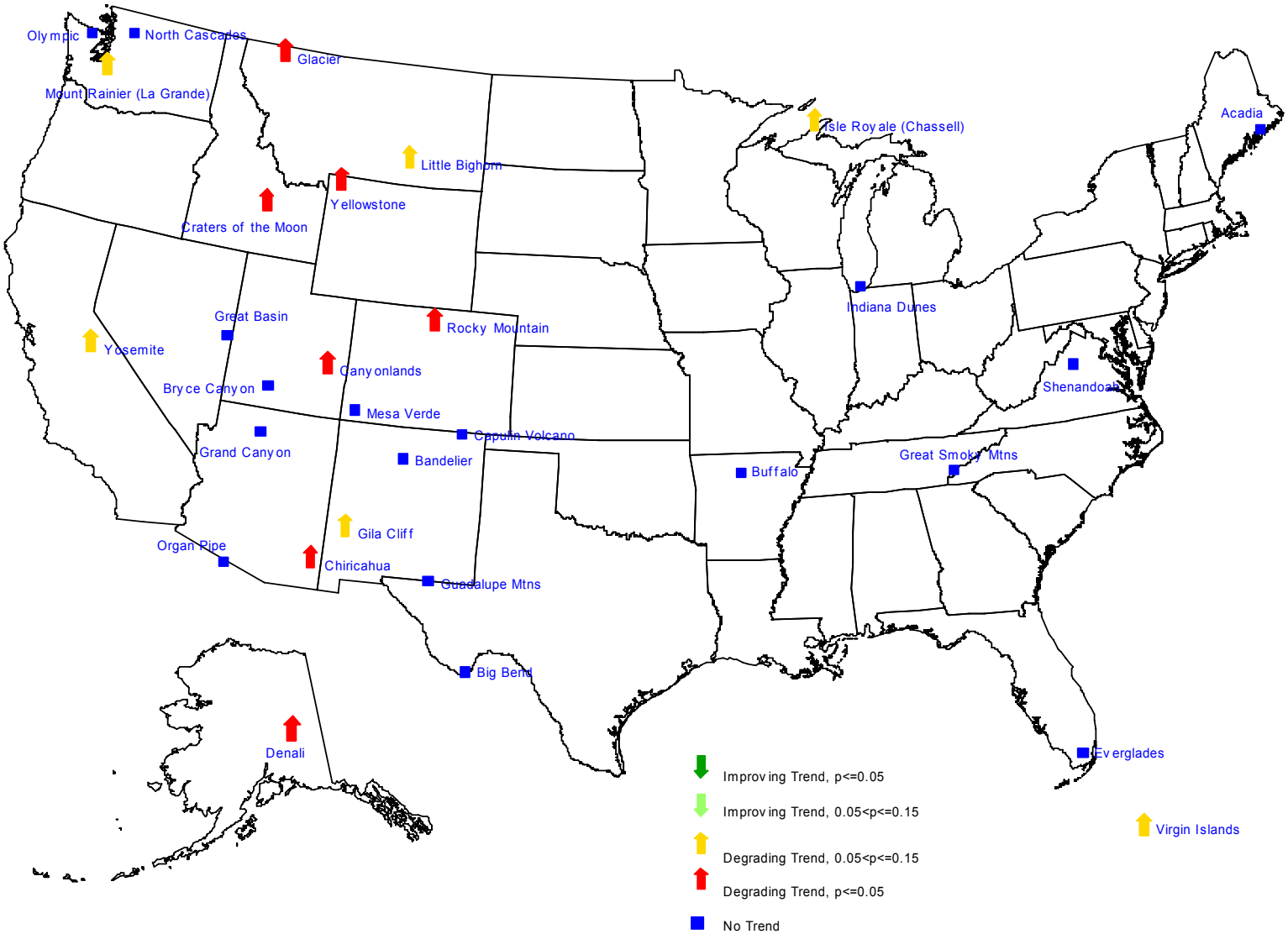
GPRA Trends in 3-Year Average Annual 4th-Highest 8-Hour Ozone Concentrations

Left Arrow: 2005 Trend Right Arrow: 2006 Trend



Trends in NH4 Concentrations in Precipitation, 1996-2005

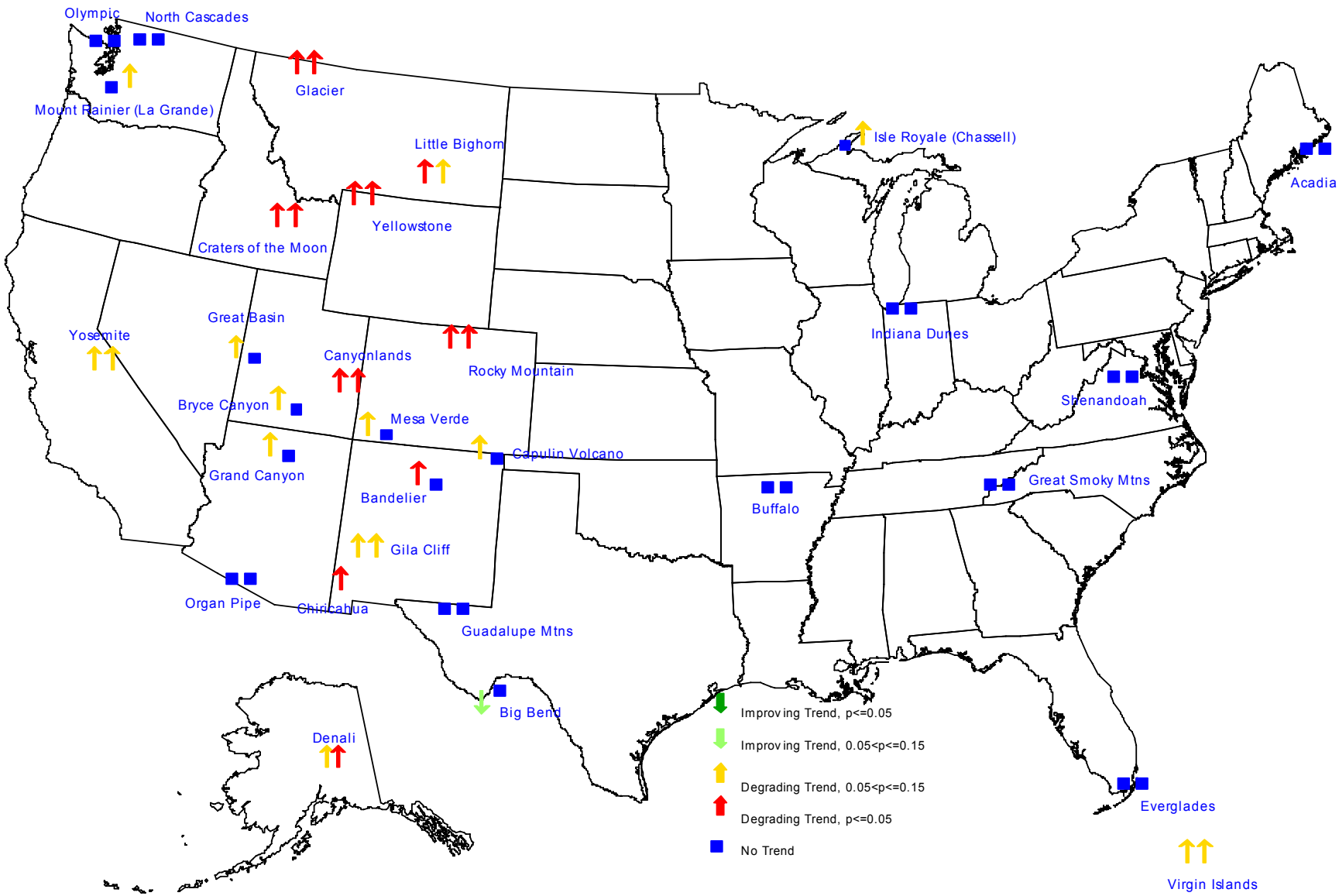
FY2006 Annual Performance Report for NPS Government Performance and Results Act (GPRA)



10/04/2006

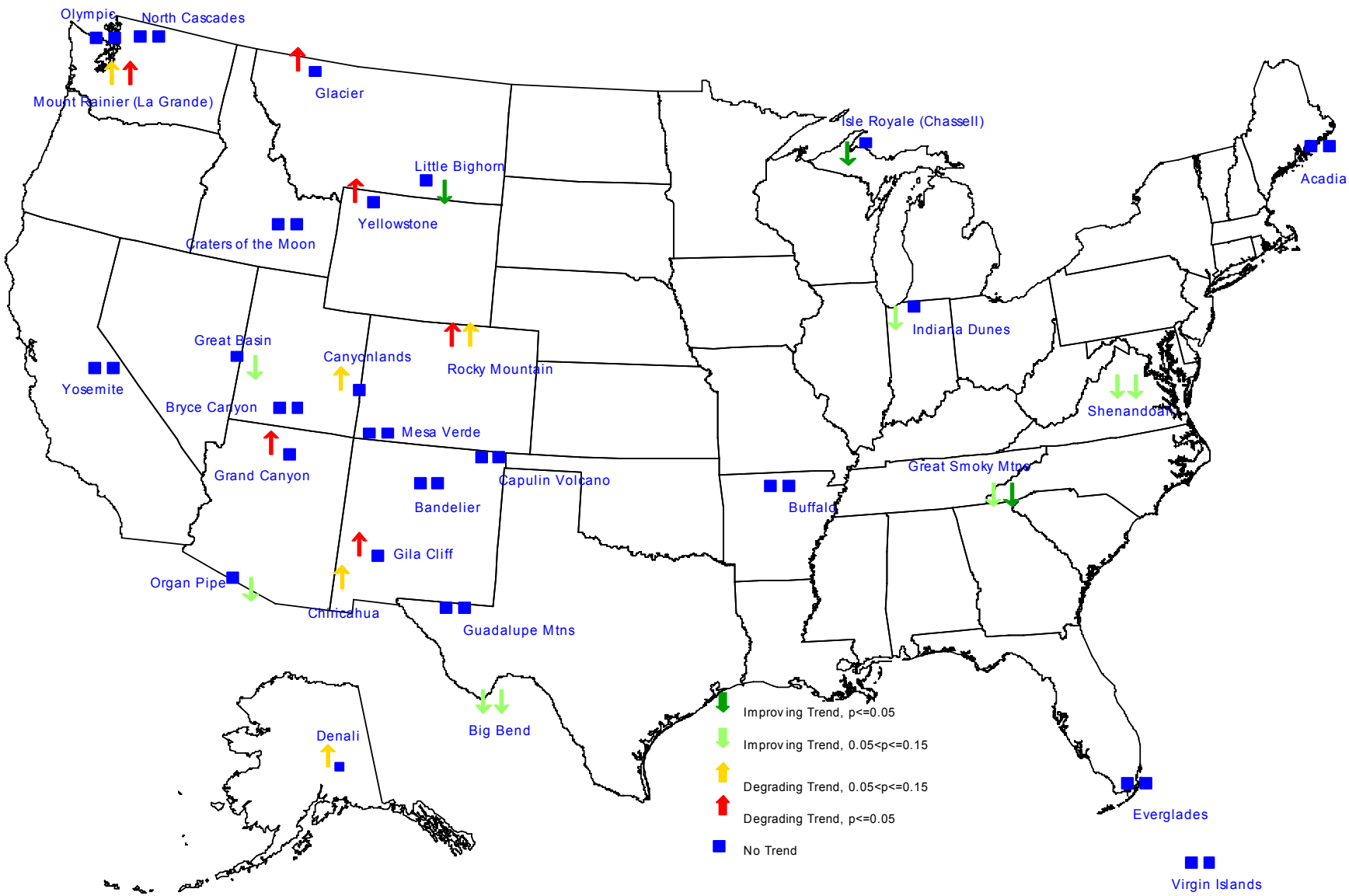
GPRA Trends in NH4 Concentrations in Precipitation

Left Arrow: 2005 Trend Right Arrow: 2006 Trend



GPRA Trends in NO3 Concentrations in Precipitation

Left Arrow: 2005 Trend Right Arrow: 2006 Trend



Trends in NO3 Concentrations in Precipitation, 1996-2005

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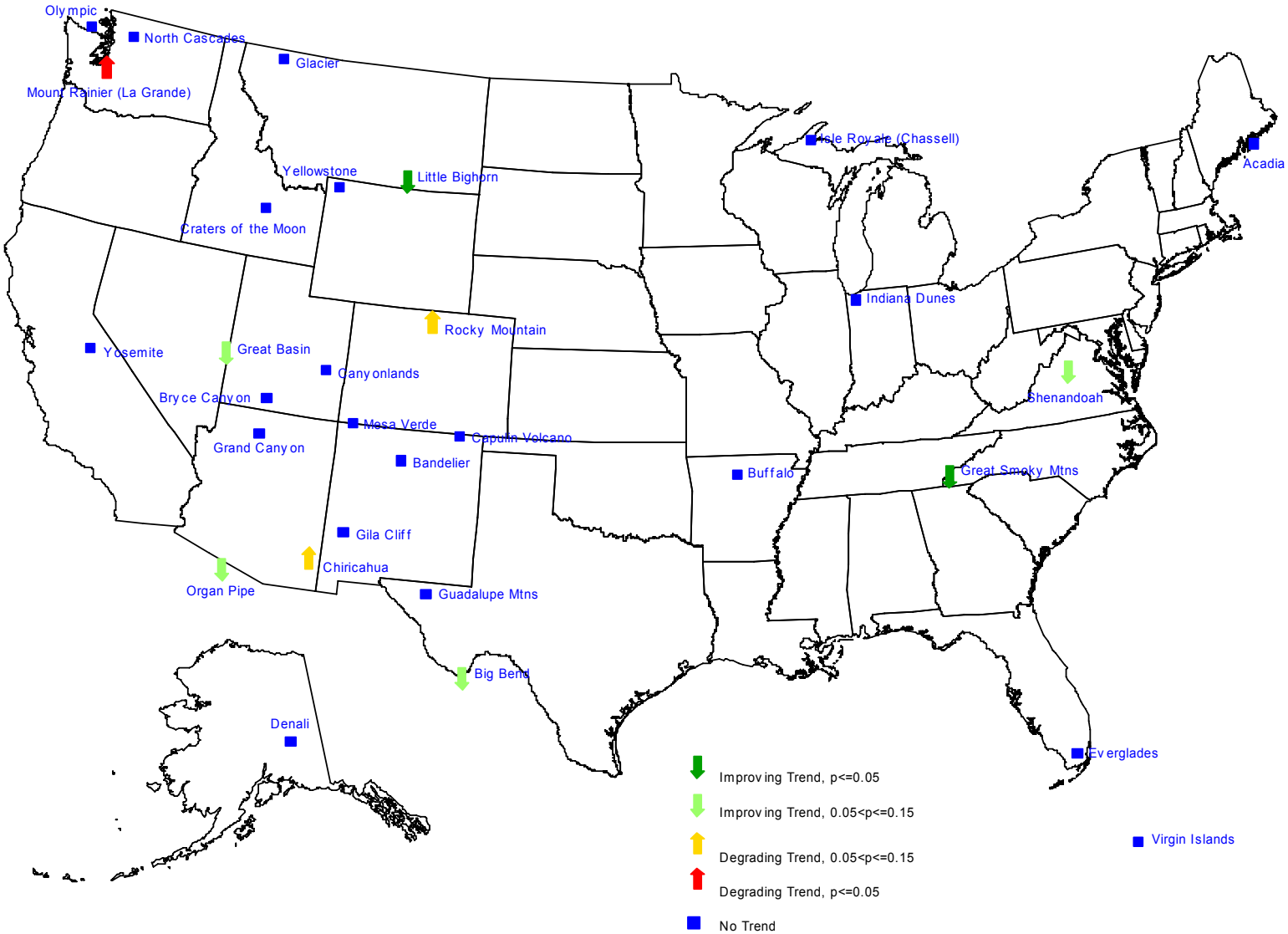
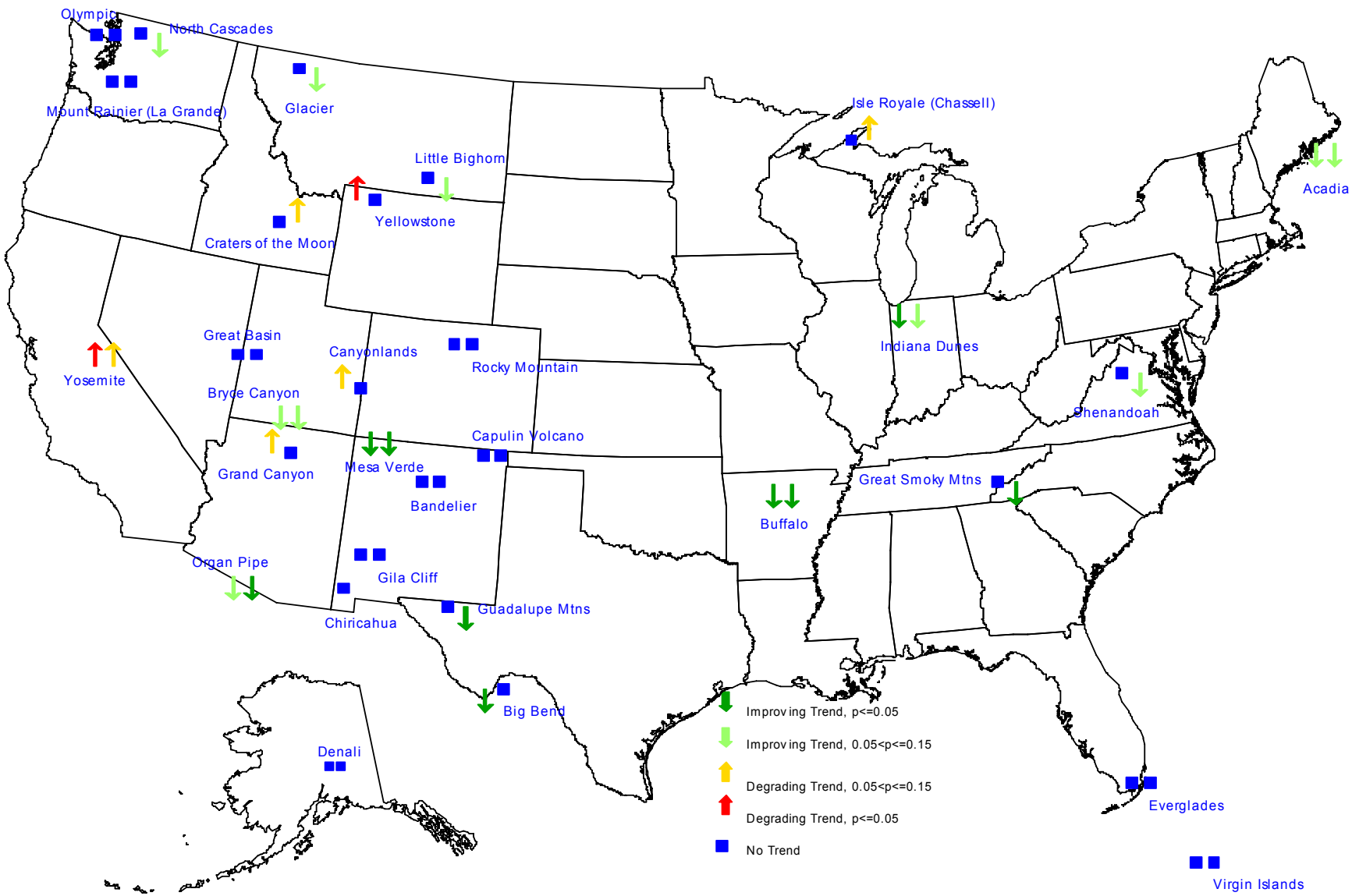


10/04/2006

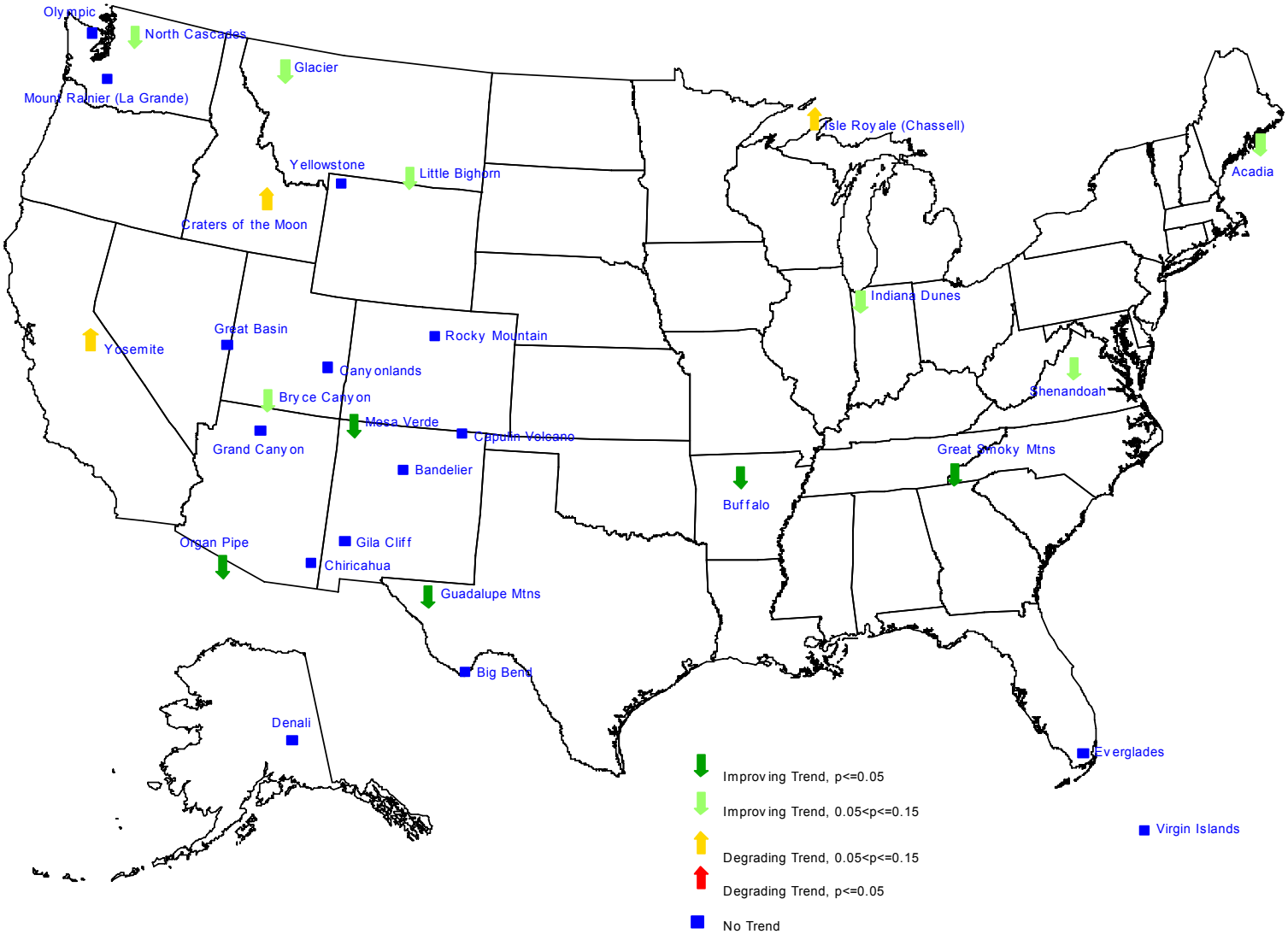
GPRA Trends in SO4 Concentrations in Precipitation

Left Arrow: 2005 Trend Right Arrow: 2006 Trend



Trends in SO4 Concentrations in Precipitation, 1996-2005

FY2006 Annual Performance Report for NPS Government Performance and Results Act (GPRA)



10/04/2006

FLAG INFORMATION/QUESTIONS?

- Contact: Tim Allen (FWS)
  - Tim_Allen@fws.gov
  - (303) 914-3802
- Contact: John Notar

  John_Notar@nps.gov

  (303) 969-2079
- Websites:

  http://www2.nature.nps.gov/air/permits/flag/index.cfm

  http://www.nature.nps.gov/air

  http://www.fws.gov/refuges/habitats/airQuality.html

  http://fs.fed.us/air

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Grand Canyon
National Geographic magazine, January 2006