2010 Wilderness Lakes Monitoring Meeting

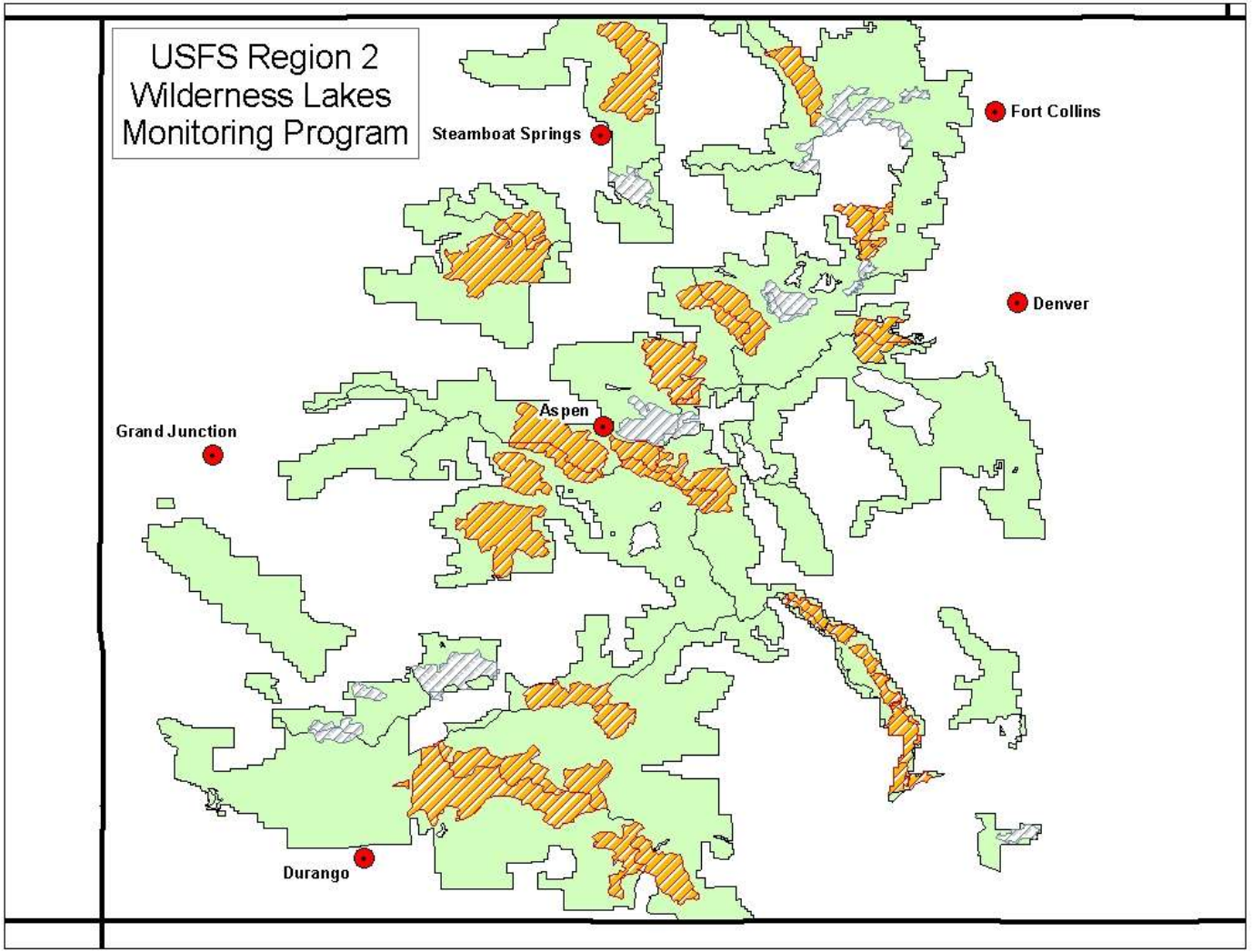
REGION 2 PROGRAM SUMMARY

Presented by:
Andrea Holland
Hydrologist
White River National Forest

Study Objectives

- Define natural variance in lake chemistry
- Determine trends in lake chemistry
- Provide data for input into air quality modeling of project impacts to ANC (PSD and internal projects)

Region 2 Study Area



Program Description

- USFS
  - Monitoring generally began in mid-1980's
  - Currently monitoring about 40 lakes in 16 Wilderness areas (Class I and Class II)
  - Lakes sampled 3 times in summer months
- USGS
  - Monitoring began in mid-1980's
  - Currently monitoring about 10 lakes in 3 Class I Wilderness areas
  - Lakes sampled 3 times in summer months

Lake Selection Criteria

Lakes sensitive to Acid Deposition

- Headwaters location
- Low ANC
- Slow weathering bedrock (i.e. quartzite, granite, basalt)
- Minimal inputs of alluvium, glacial till

General Sampling Methods

- Three samples per lake per year (generally between late June and early September)
- Grab samples from or near mouth of lake (using protective gloves)
- Generally no field filtering – samples are filtered in the lab
- Samples mailed immediately to Air Resource Mgt Lab – Fort Collins

Lab Analyses

- pH
- Conductivity
- Major Anions
  - Chloride
  - Fluoride
  - Nitrate
  - Sulfate
  - Phosphate
- Major Cations
  - Calcium
  - Magnesium
  - Potassium
  - Sodium
  - Ammonium
- ANC

Wilderness Lake Data Uses

- State Government and Industry in PSD permit application process – protection of AQRV's
- Forests in NEPA process to assess impacts to AQRV's and determine mitigation if needed (USFS, BLM, FERC, BIA managed lands)
- Adaptive management of natural gas fields as indicator of change to air quality.

Lessons Learned

- Quality control issues with field filtered samples. Water samples now filtered in the lab.
- Obtaining 3 samples per year not always possible on some Forests.
- Volunteers not always ideal for obtaining lake samples.
- Annual to bi-annual training of veteran and new lake samplers critical to quality assurance.

Things to Work On

- Include more detail of science behind R2's "Screening Methodology for Calculating ANC Change to High Elevation Lakes".
- Publish LAC thresholds for ANC on ARM website
- Provide lake data needed for modeling on ARM website
- Provide link to lake monitoring protocol on Regional ARM website.

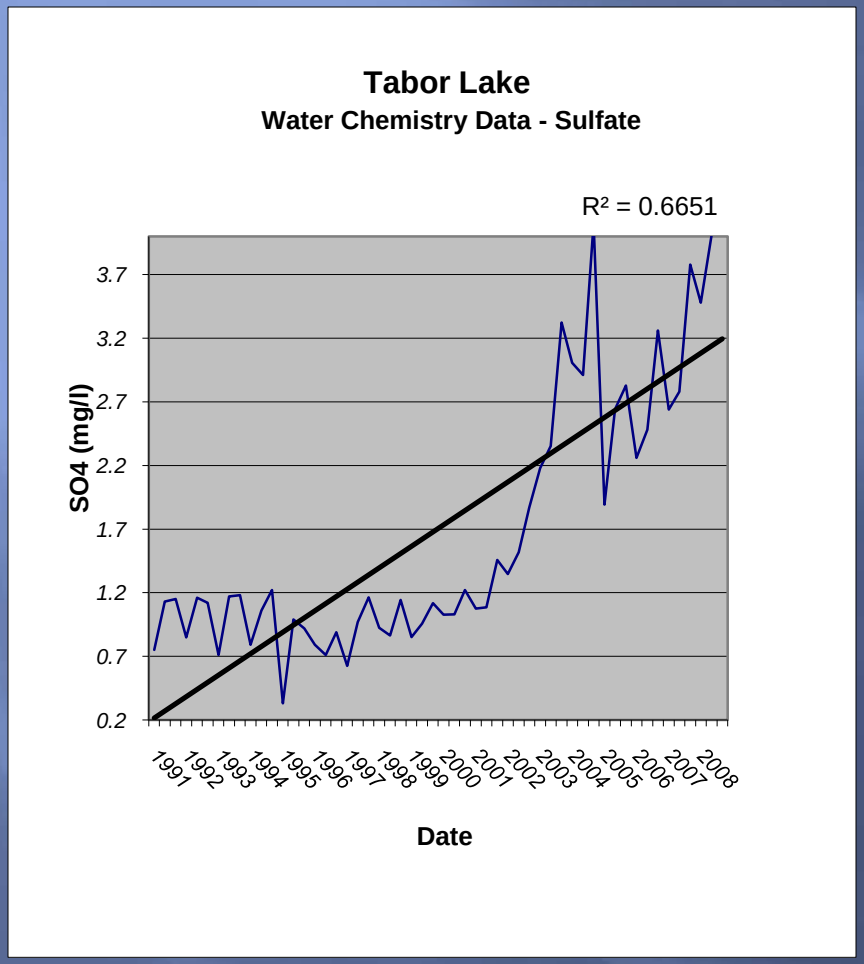
Regionwide Analysis

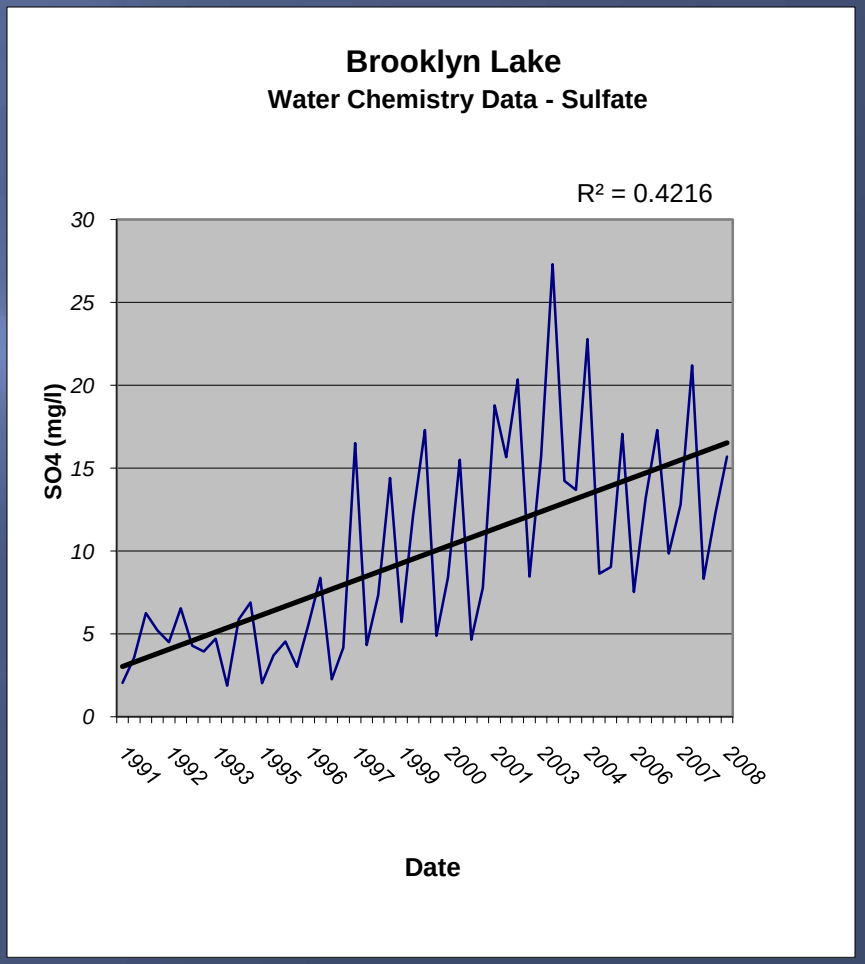
Starting in 2010
Contract with USGS

White River NF Data

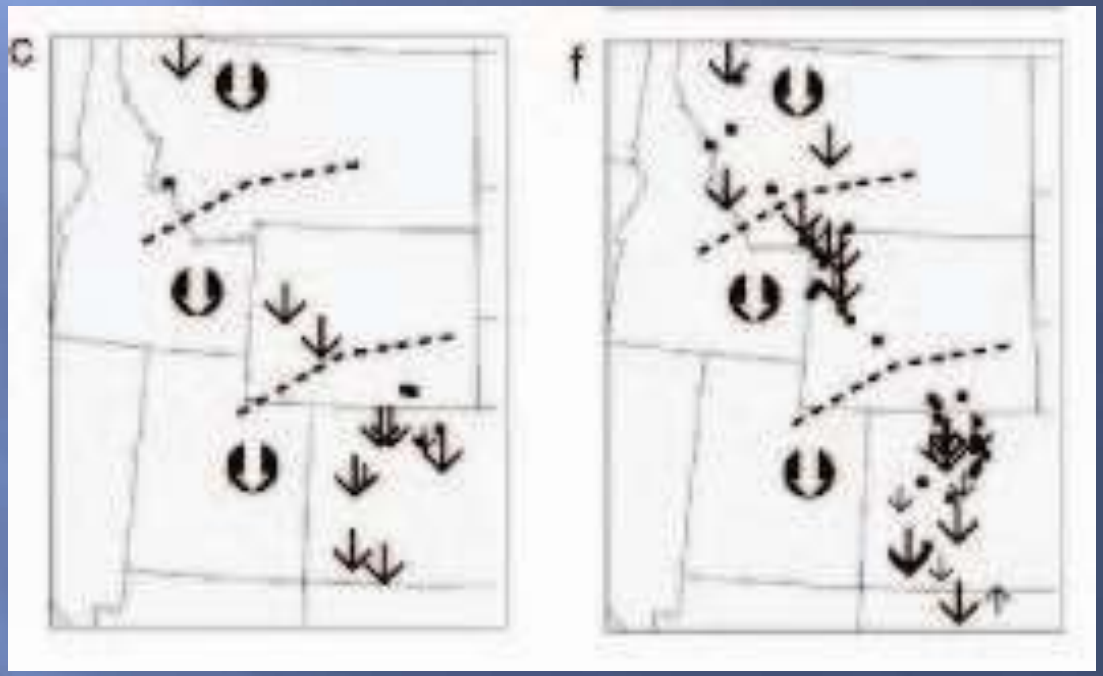
- Analysis of data collected between (generally) 1991 to 2008
- Trend Analysis
  - Kruskall-Wallis Test for seasonality
  - Mann-Kendall Test /Sen's Slope if no seasonality
  - Seasonal Kendall Test if seasonality shown
- Interesting results

Sulfate trends





SO_4 Deposition Trends*



NADP data USGS snowpack data

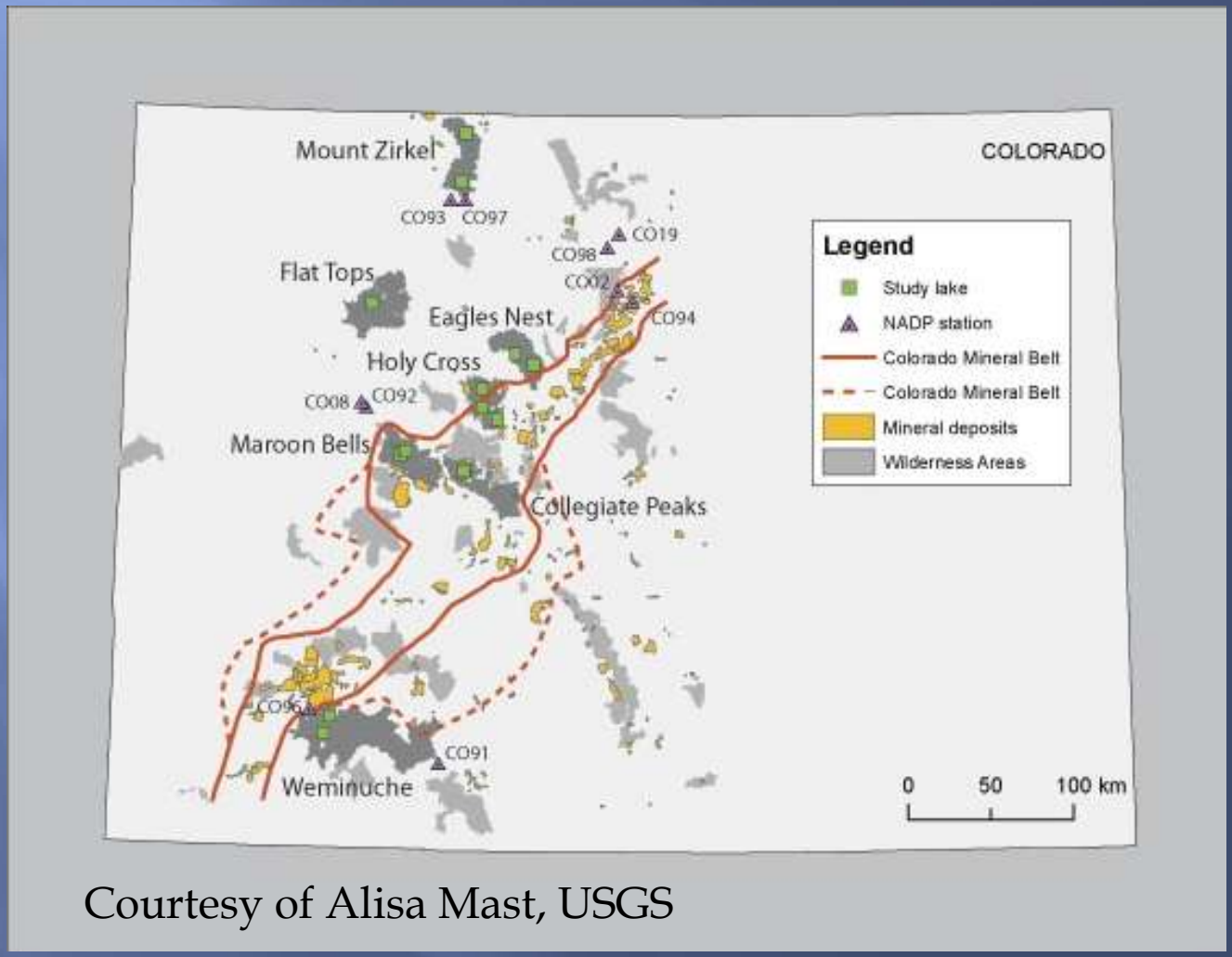
*From: Ingersoll, G.P. , et al. 2008. Trends in snowpack chemistry and comparison to National Atmospheric Deposition Program results for the Rocky Mountains, US, 1993-2004. Atmospheric Environment 42 (2008) 6098-6113.

Trend Analyses Summary

Lake Name	ANC	pH	Cond.	Na	NH4	K	Mg	Ca	Cl	NO3	SO4
Avalanche	+	+	+	+	NT	+	+	+	NT	NT	+
Capitol	NT	+	NT	+	+	+	+	+	+	+	+
Moon	+	+	+	+	NT	+	+	+	NT	NT	NT
Brooklyn	+	+	+	+	-	+	+	+	-	NT	+
Tabor	+	+	+	+	+	NT	+	+	-	-	+
Booth	NT	+	+	+	NT	NT	+	+	NT	NT	-
Willow	+	+	+	+	NT	+	+	+	+	NT	+
Blodgett	+	+	+	+	NT	+	+	+	NT	NT	+
Up.W. TN	+	?	+	+	NT	+	+	+	NT	NT	+
Up.Turquoise	+	+	+	+	NT	+	+	+	NT	NT	+

+ = statistically significant increasing trend
- = statistically significant decreasing trend

Colorado Mineral Belt



Courtesy of Alisa Mast, USGS

Brooklyn Lake

Contact Information

Jeff Sorkin

Region 2 Air Resource Specialist

303-275-5759

jasorkin@fs.fed.us

Andrea Holland

White River National Forest

970-945-3256

ahollandsears@fs.fed.us