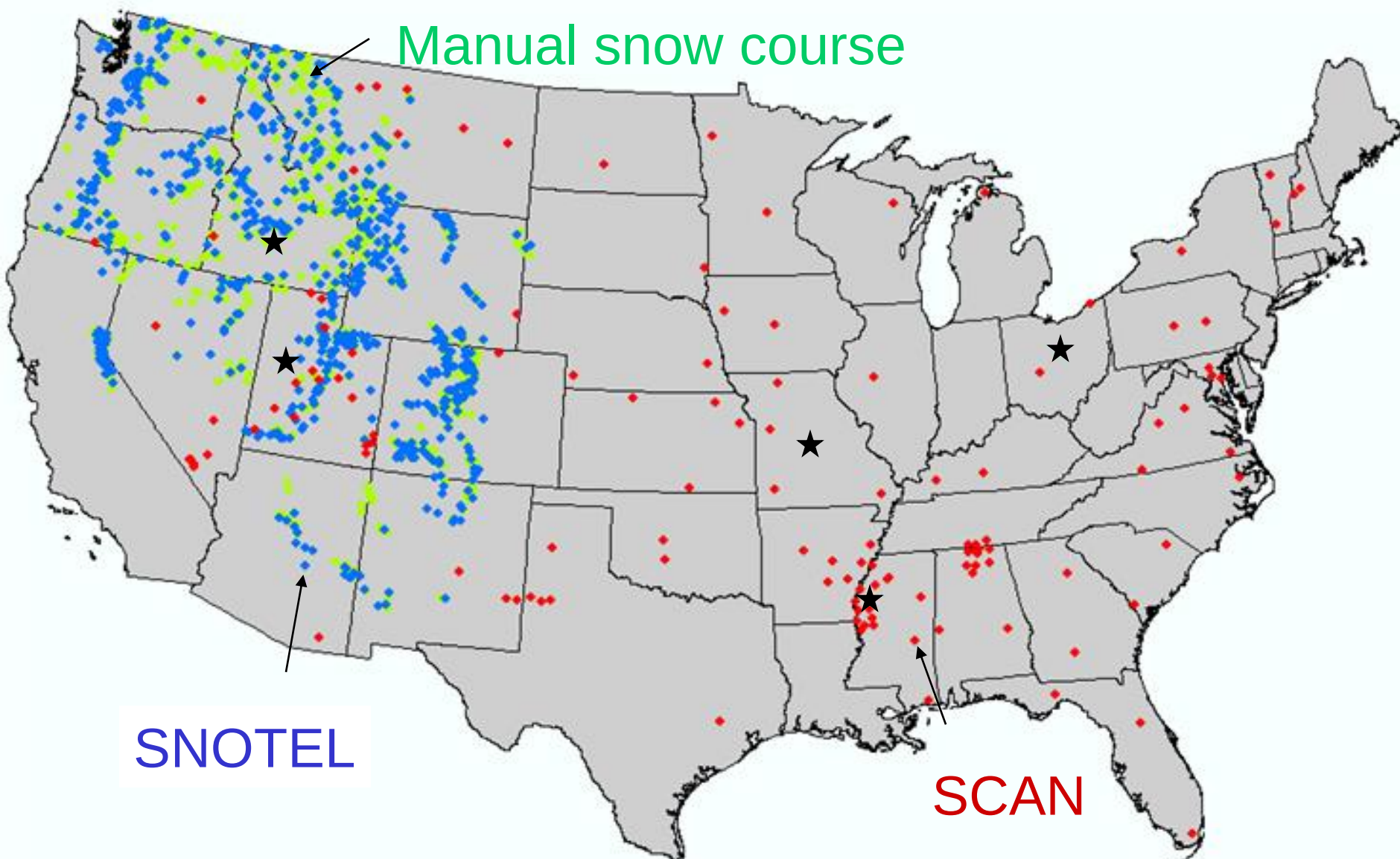


National Water and Climate Center Snow Survey and Water Supply Forecasting Program and SCAN

Michael L. Strobel, Director
USDA-NRCS National Water and Climate Center
Portland, OR



★ Master stations in Utah, Idaho, Ohio, Missouri, and Mississippi.

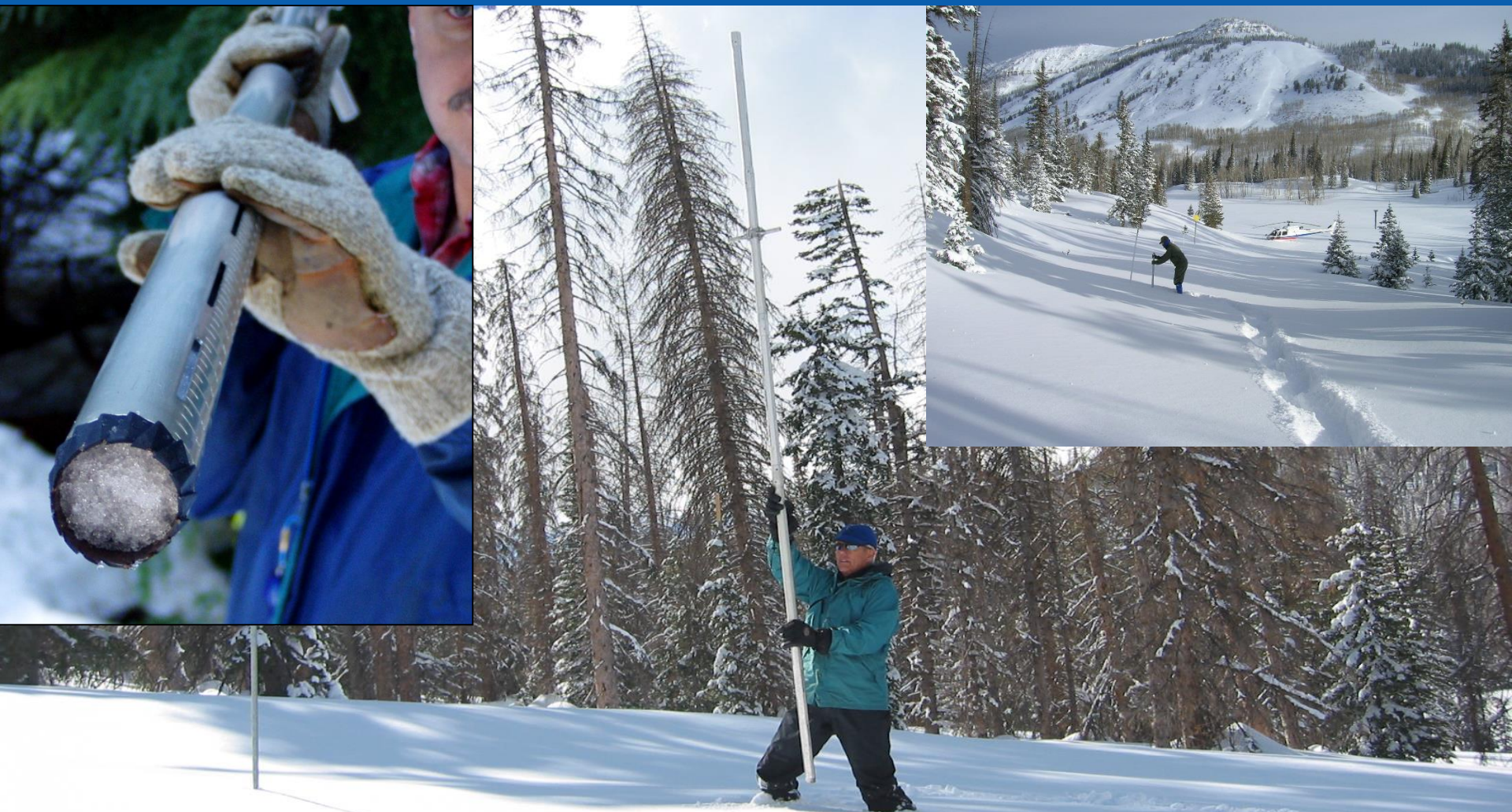
A Century Of Progress

- 1906 - Initial snow studies by Dr. Church at Lake Tahoe
- 1906-1909 - Snow survey sampler perfected
- 1909-1910 - First water supply forecast issued
- Soil Conservation Service Program since 1939



Critical commitments for providing data and forecasts

- Columbia River Treaty (U.S.- Canada)
- Colorado River Compact (U.S. – Mexico)
- Bonneville Power (Oregon – Washington)
- Salt River Project (Arizona)
- U.S. Forest Service
- NOAA (NIDIS and National Weather Service)
- Denver Water
- City of Seattle
- Portland Water Bureau
- Idaho Power
- Many more



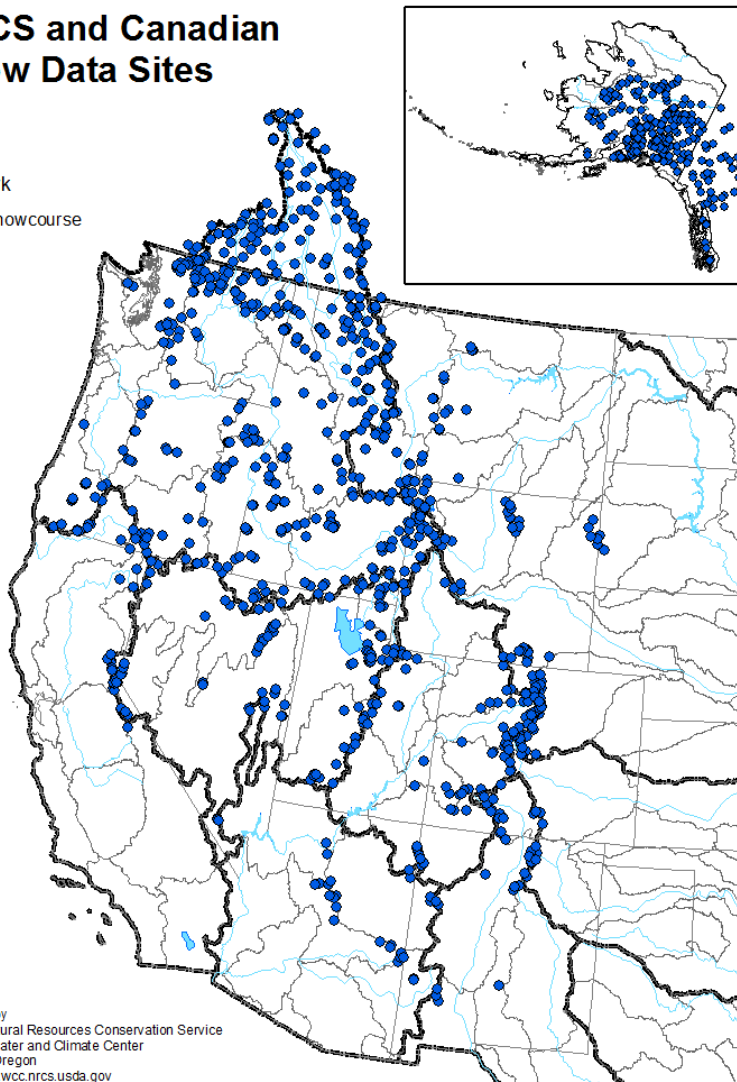
Manual Snow Surveys

Metal tube inserted into snow and weighed to measure water content.
+300,000 snow course measurements to date

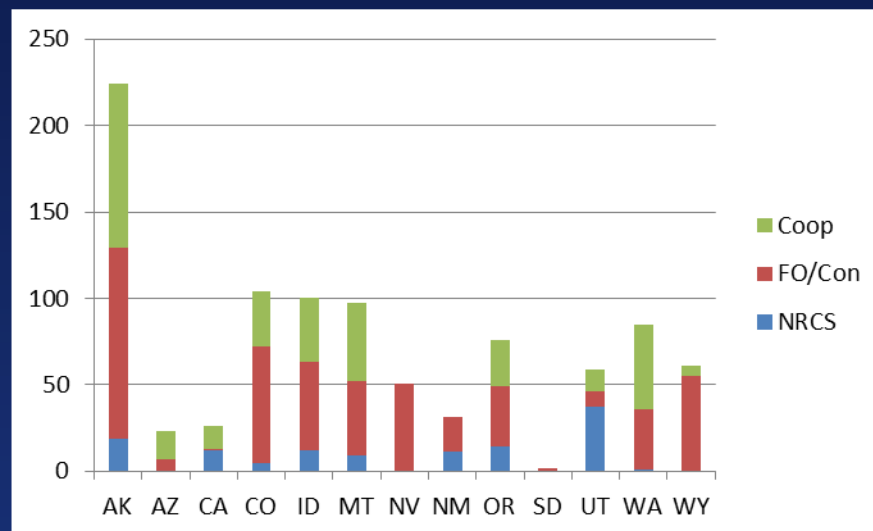
NRCS and Canadian Snow Data Sites

Network

- Snowcourse



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<http://www.wcc.nrcs.usda.gov>



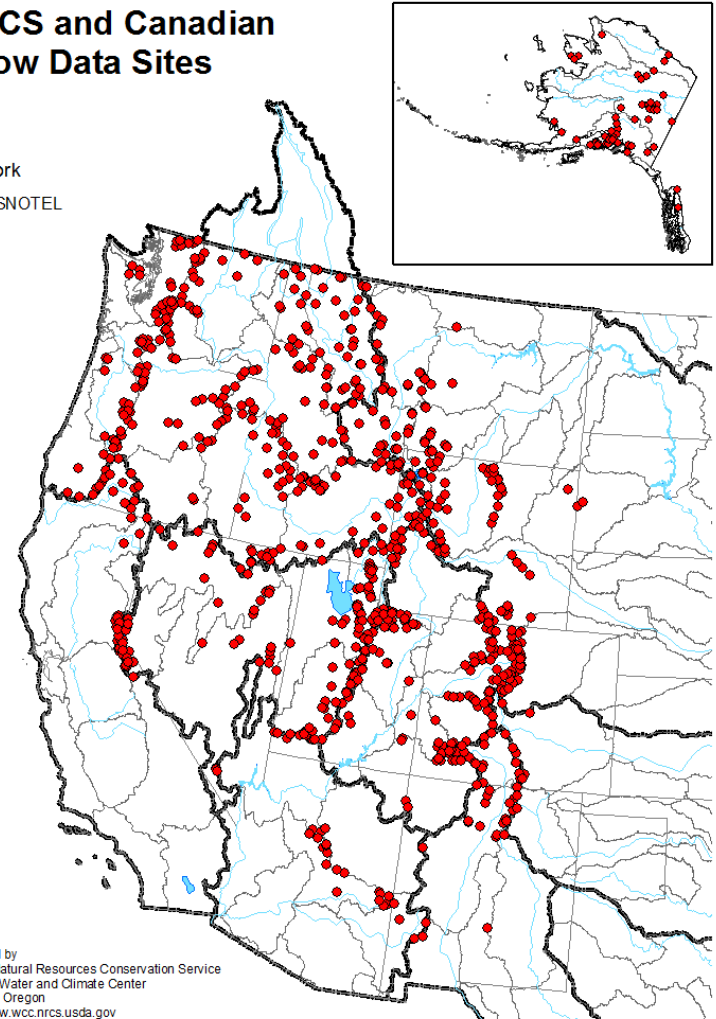
NRCS SNOTEL Network

- SNOTEL network
 - 13 Western States
 - 885 sites (includes SnoLite)
 - More than 16 million observations/year
 - Data transmitted in near real time every hour for most stations
- Snow courses = 1 measurement/month SWE and depth
- SNOTEL = 720 transmissions/month of multiple sensors
- Safety

NRCS and Canadian Snow Data Sites

Network

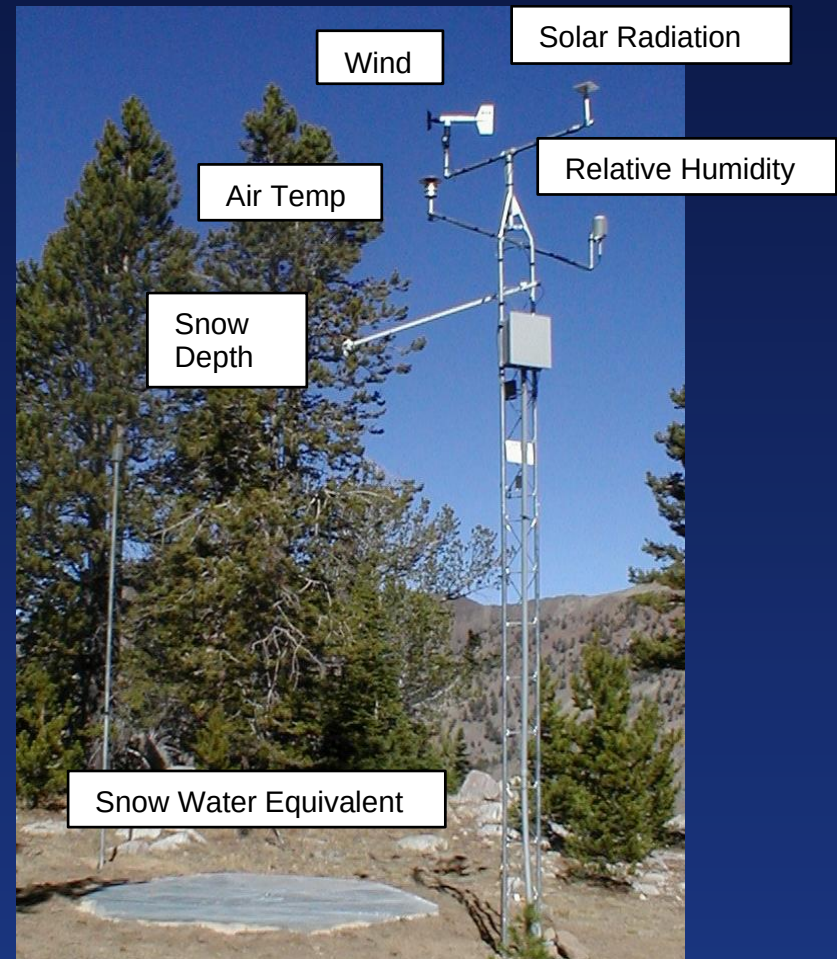
• SNOTEL



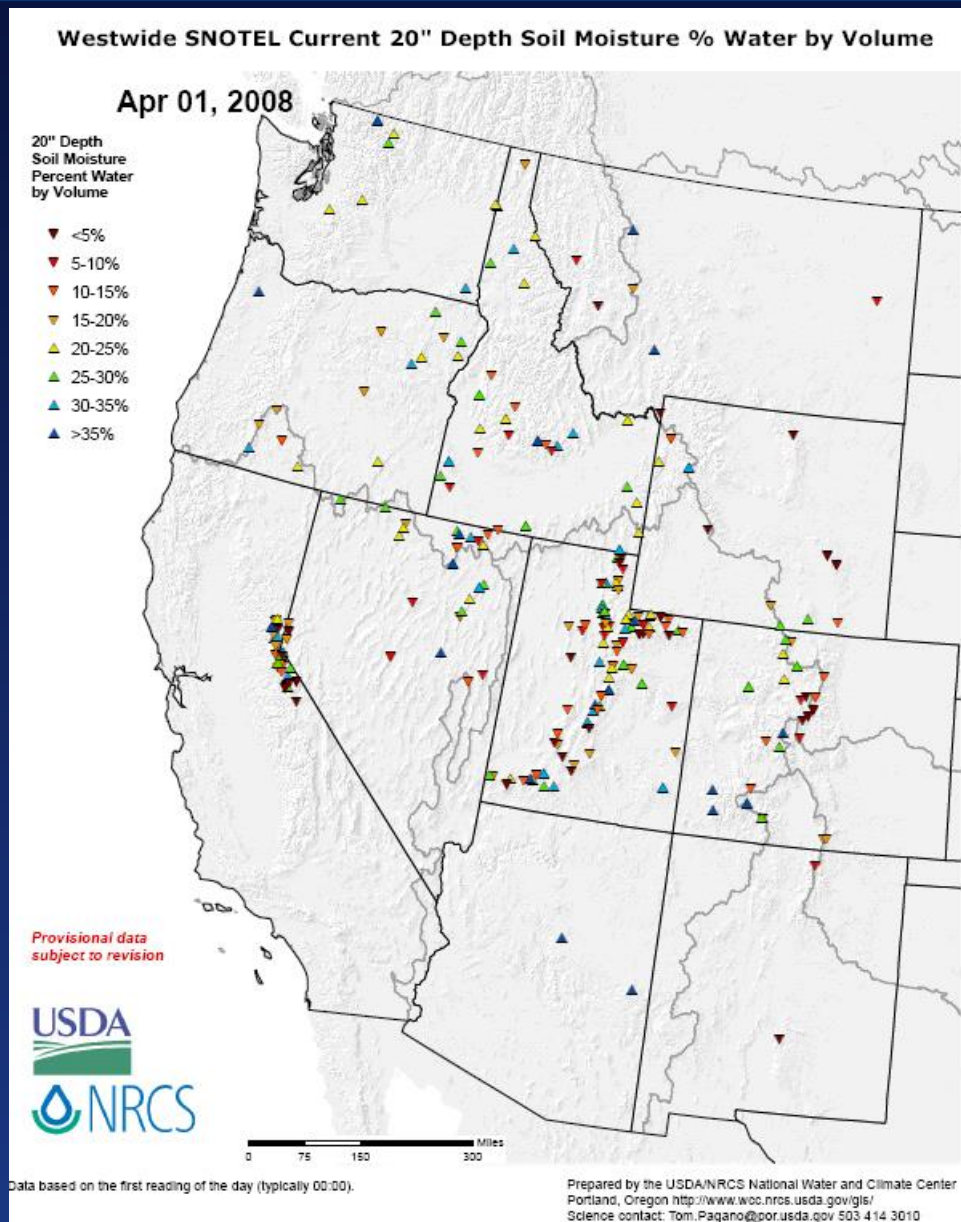
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SNOTEL Site - Augmented Data Array

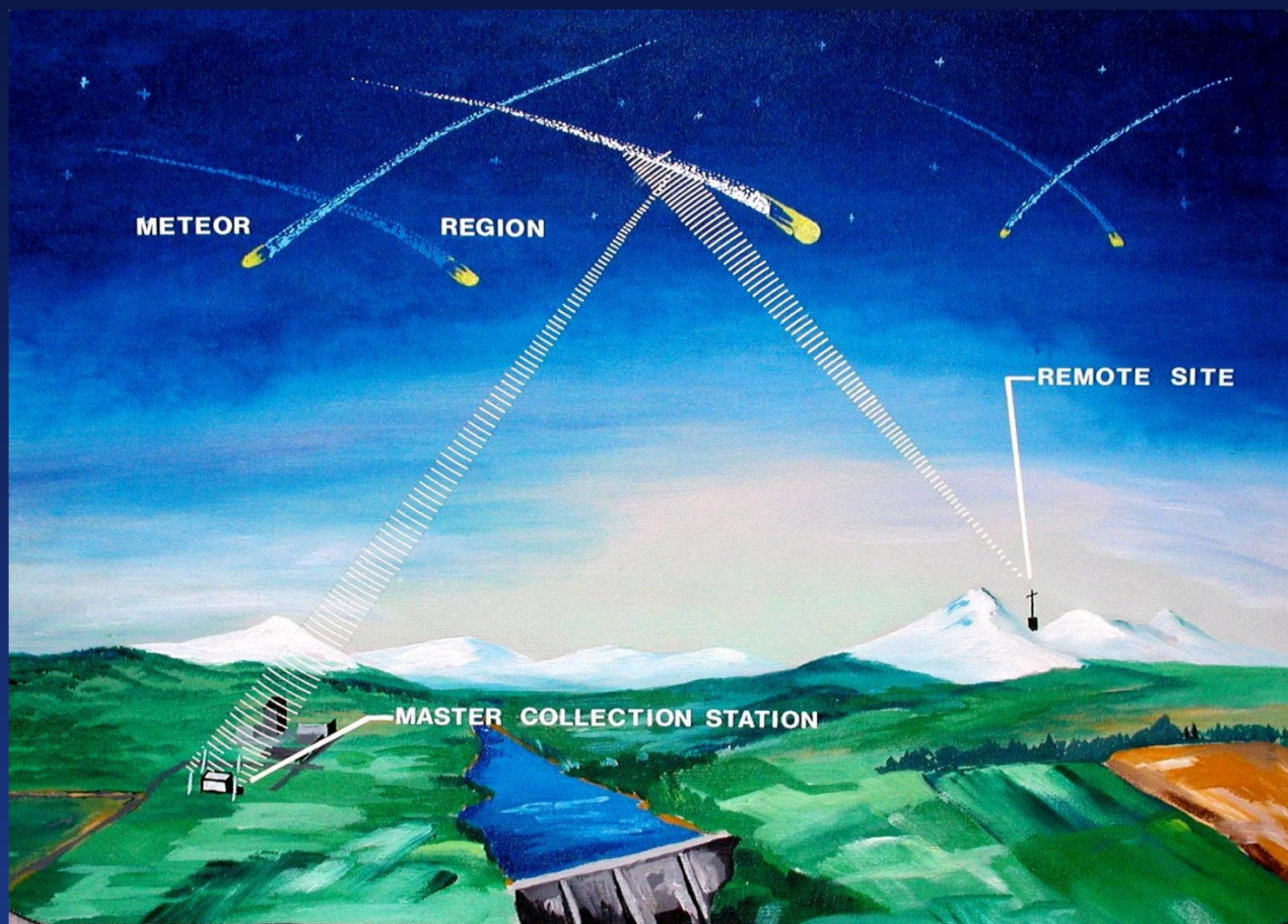
- **Snow water content**
- **Precipitation**
- **Temperature**
- **Snow depth**
- **Relative humidity**
- **Wind speed/direction**
- **Solar radiation**
- **Soil moisture / temperature**

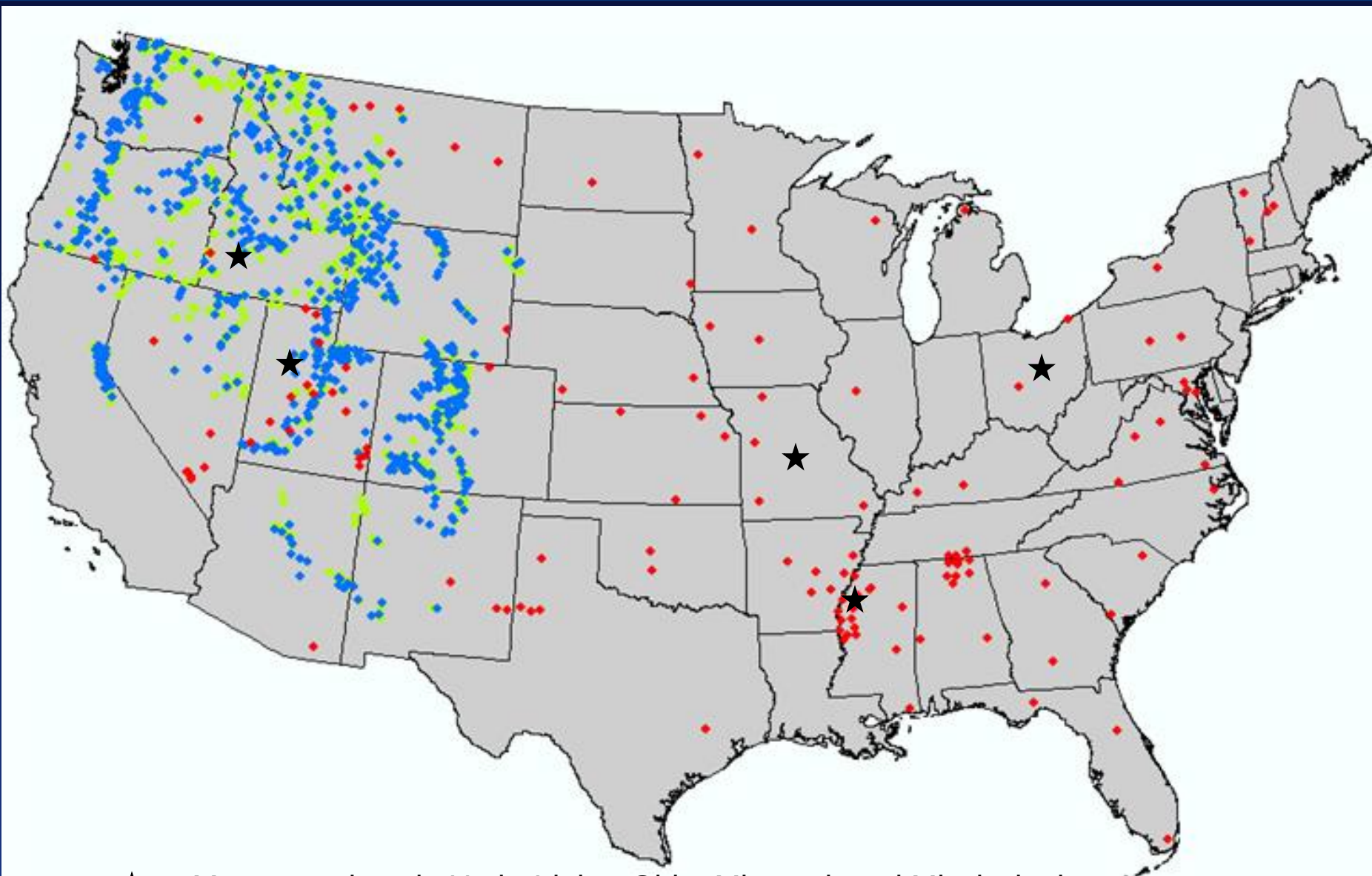


Expansion of soil moisture to SNOTEL network (data starts 2003)



Meteor Burst Technology





★ Master stations in Utah, Idaho, Ohio, Missouri, and Mississippi.









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- ▶ Forecasts
- ▶ Reservoirs
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- ▶ Snow Course Data
- ▶ Data Search

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- ▶ Snow Survey Programs by State

- ▶ Find a Service Center

- ▶ National Centers, States and Regions

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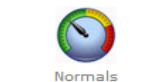
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Web Service
Resources



Normals



Snow School



Snow Report

Report Generator 1.3

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View Station Information

Create/Modify Report

View Report

Select Stations

Select network: Enter station(s): [Advanced Search](#)

Selected Stations (1)

Station Id	Name	State	Network	Actions
335	BERTHOUD SUMMIT	CO	SNTL	Remove
Remove All		Sort By: Name		

Select Columns

Data

Metadata

Element

Filter: Sort Standard ▾

air temperature average

air temperature maximum

air temperature minimum

air temperature observed

battery

battery maximum

precipitation accumulation

Depth

None

Value Type

Value

Previous Year's Value

Delta from Previous Value

Collection Date

Normal (1981-2010)

% of Normal (1981-2010)

Average (1981-2010)

% of Average (1981-2010)

Function

None

Sum

Mean

Max

Min

Manage Selected Columns

✓	Data Type	Element Depth	Function	Value Type
☐	air temperature average			Value
☐	air temperature maximum			Value
☐	air temperature minimum			Value

[Remove Selected Columns](#) [Remove All](#)

Select Time Period, Layout, and Units

Frequency

Daily

Monthly

Semi-Monthly

Hourly

Water Year

Calendar Year

Time Period

Today

Last 7 Days

Last 30 Days

Current Water Year

Current Calendar Year

Period of Record

All Months

Jan

Feb

Mar

Apr

May

All Days

1

2

3

4

5

Layout

☐ Standard - No Grouping

☐ Water Year - Group by Month

☐ Calendar Year - Group by Month

☒ Chart (Single station only)

Units

☒ English

☐ Metric

Custom Begin Date: Custom End Date:



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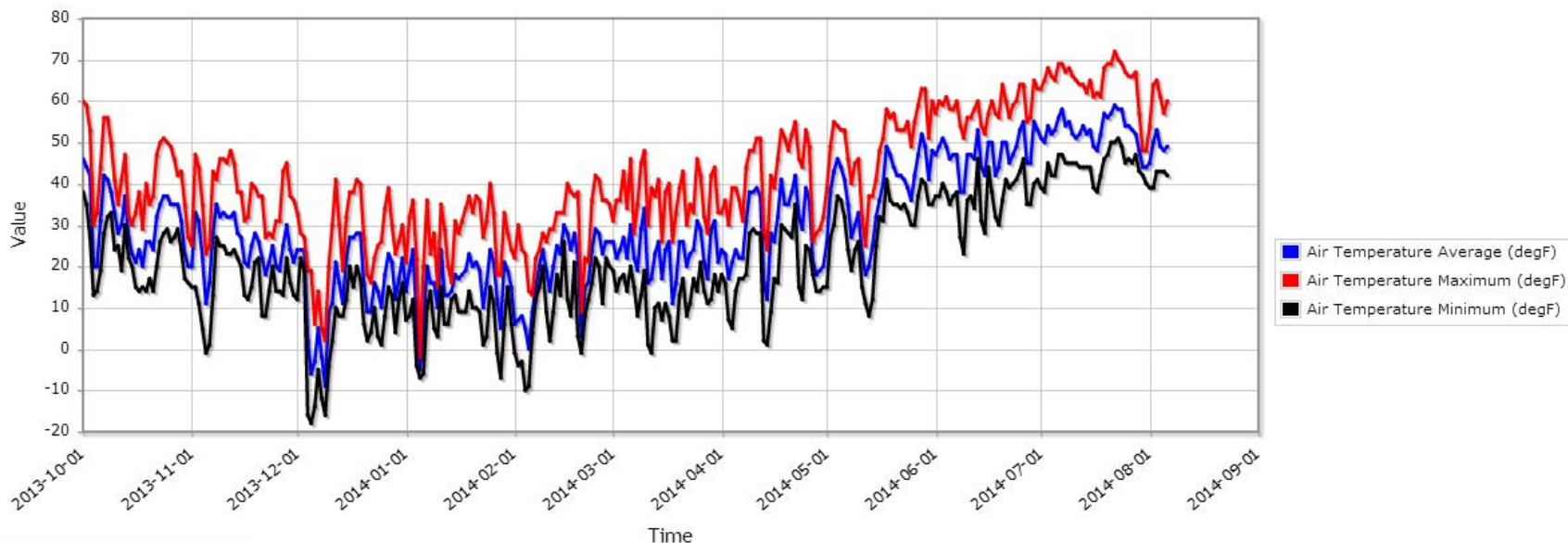
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Output Format Layout Units Time Period Fit Chart To Screen ☒

Chart Help

Berthoud Summit (335) Colorado SNOTEL Site - 11300 ft



Export Chart As Image

Generated on 08/07/14 13:26:05

Select Stations

Select network:

Enter station(s):

[Advanced Search](#)

Selected Stations (1)

Station Id	Name	State	Network	Actions
651	Mt Hood Test Site	OR	SNTL	Remove
Remove All Sort By: Name				

Select Columns

Data

Metadata

Element

Filter: Sort Standard

☐ air temperature minimum
☐ air temperature observed
☐ battery
☐ precipitation accumulation
☐ precipitation increment
☐ precipitation increment - snow-adj
☐ snow depth
☒ snow water equivalent

Depth

Value Type

☒ Previous Year's Value
☐ Delta from Previous Value
☐ Collection Date
☐ Normal (1981-2010)
☐ % of Normal (1981-2010)
☐ Average (1981-2010)
☐ % of Average (1981-2010)
☐ Median (1981-2010)

Function

☐ Sum
☐ Mean
☐ Max
☐ Min

Manage Selected Columns

☒	Data Type	Element Depth	Function	Value Type
☐	snow water equivalent			Value
☐	snow water equivalent			Normal (1981-2010)
☐	snow water equivalent			Previous Year's Value

[Remove Selected Columns](#) [Remove All](#)

Select Time Period, Layout, and Units

Frequency

☒ Daily
☐ Monthly
☐ Semi-Monthly
☐ Hourly
☐ Water Year
☐ Calendar Year

Time Period

☐ Last 7 Days
☐ Last 30 Days
☒ Current Water Year
☐ Current Calendar Year
☐ Period of Record
☐ Custom

Custom Begin Date Custom End Date

☐ Make custom dates relative to today

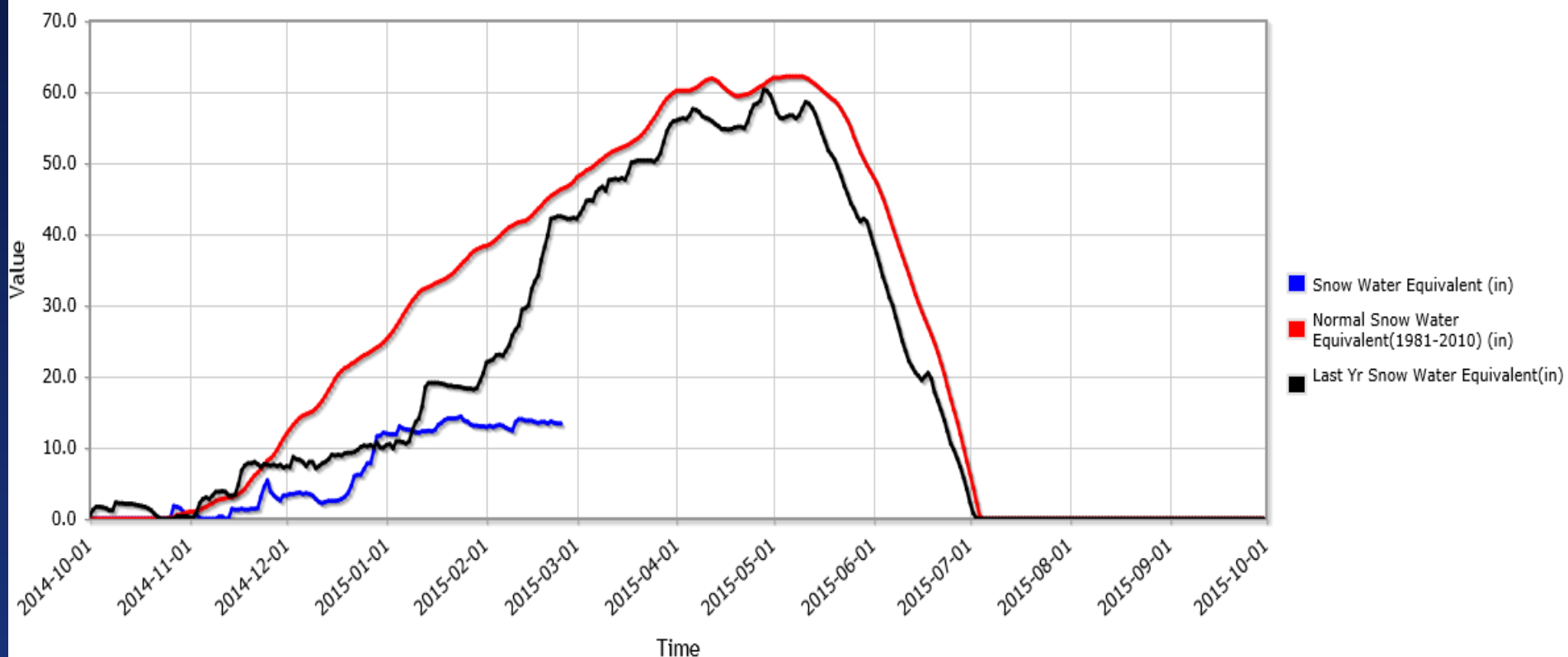
Layout

☐ Standard - No Grouping
☐ Water Year - Group by Month
☐ Calendar Year - Group by Month
☒ Chart (Single station only)

Units

☒ English
☐ Metric

Mt Hood Test Site (651) Oregon SNOTEL Site - 5370 ft



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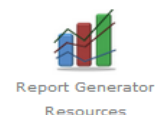
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Snow School

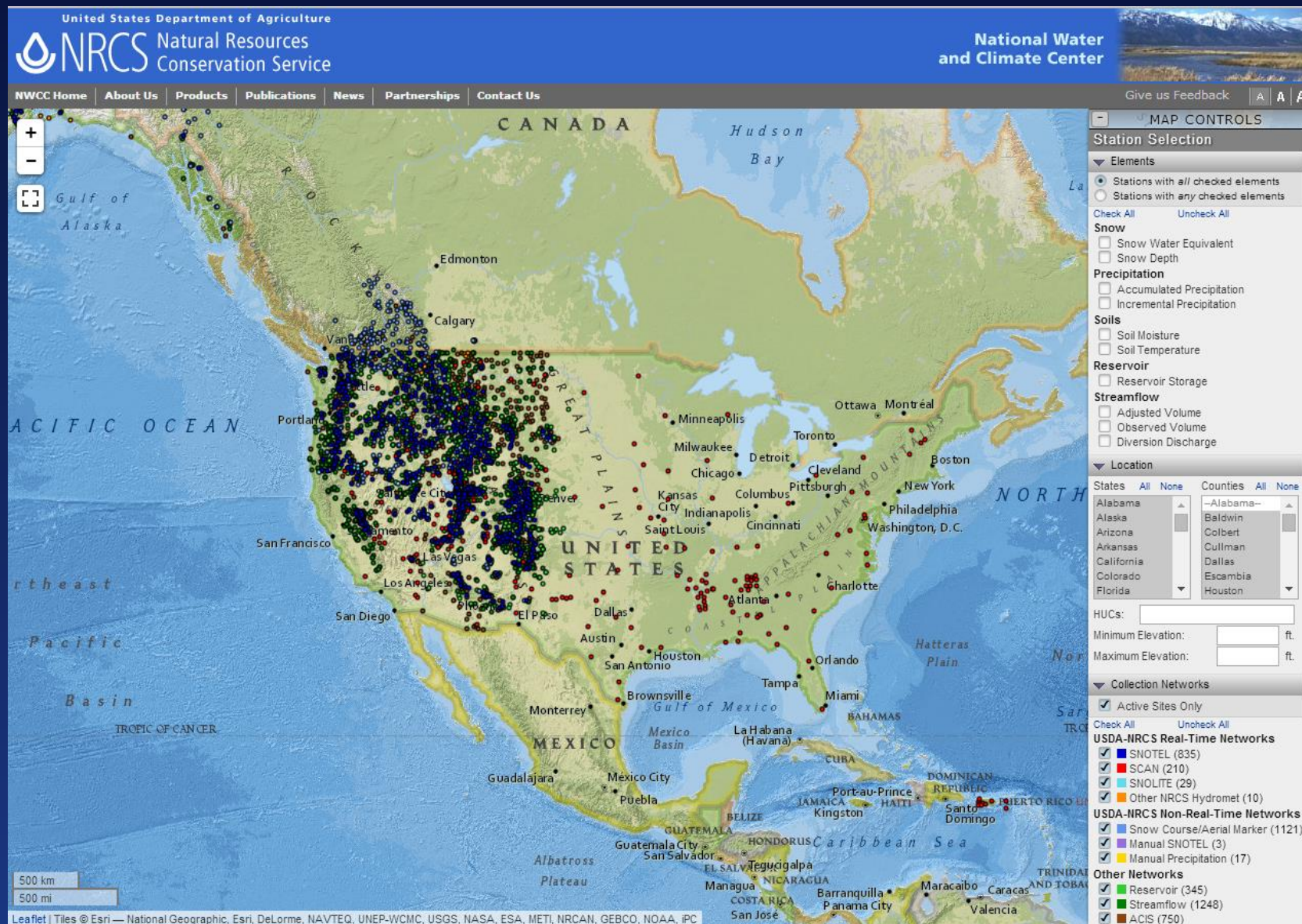


Snow Report

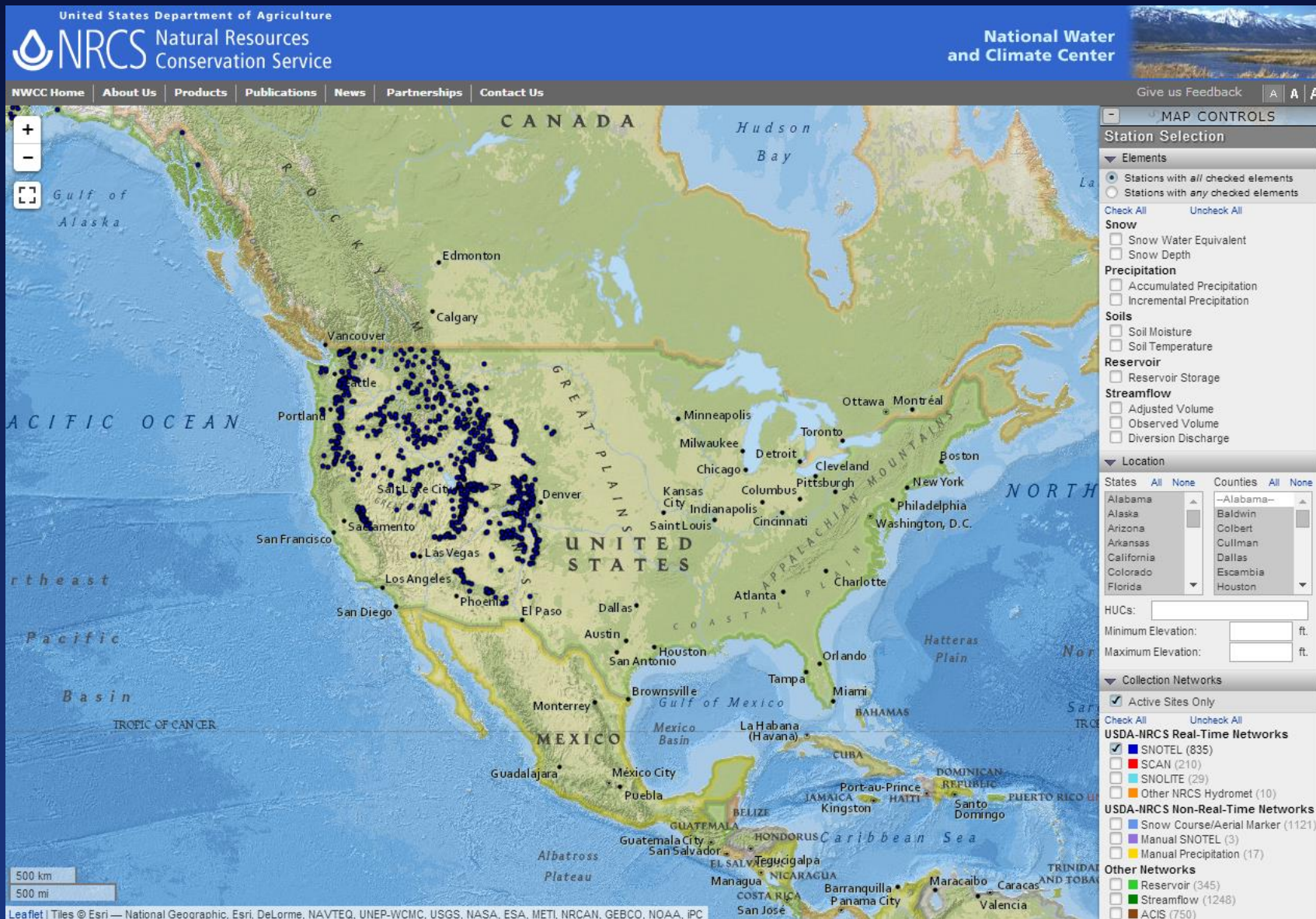
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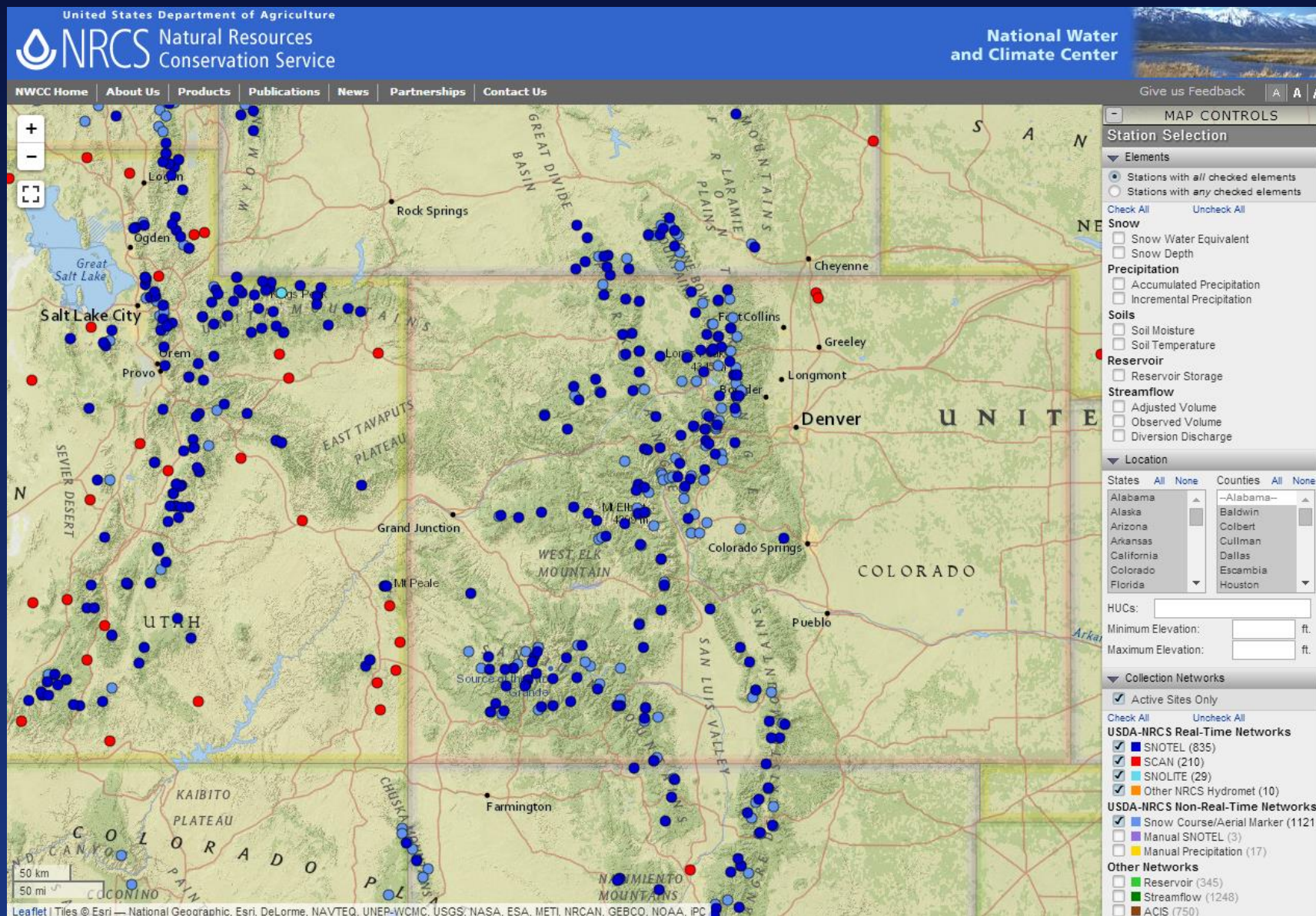
United States Department of Agriculture Natural Resources Conservation Service



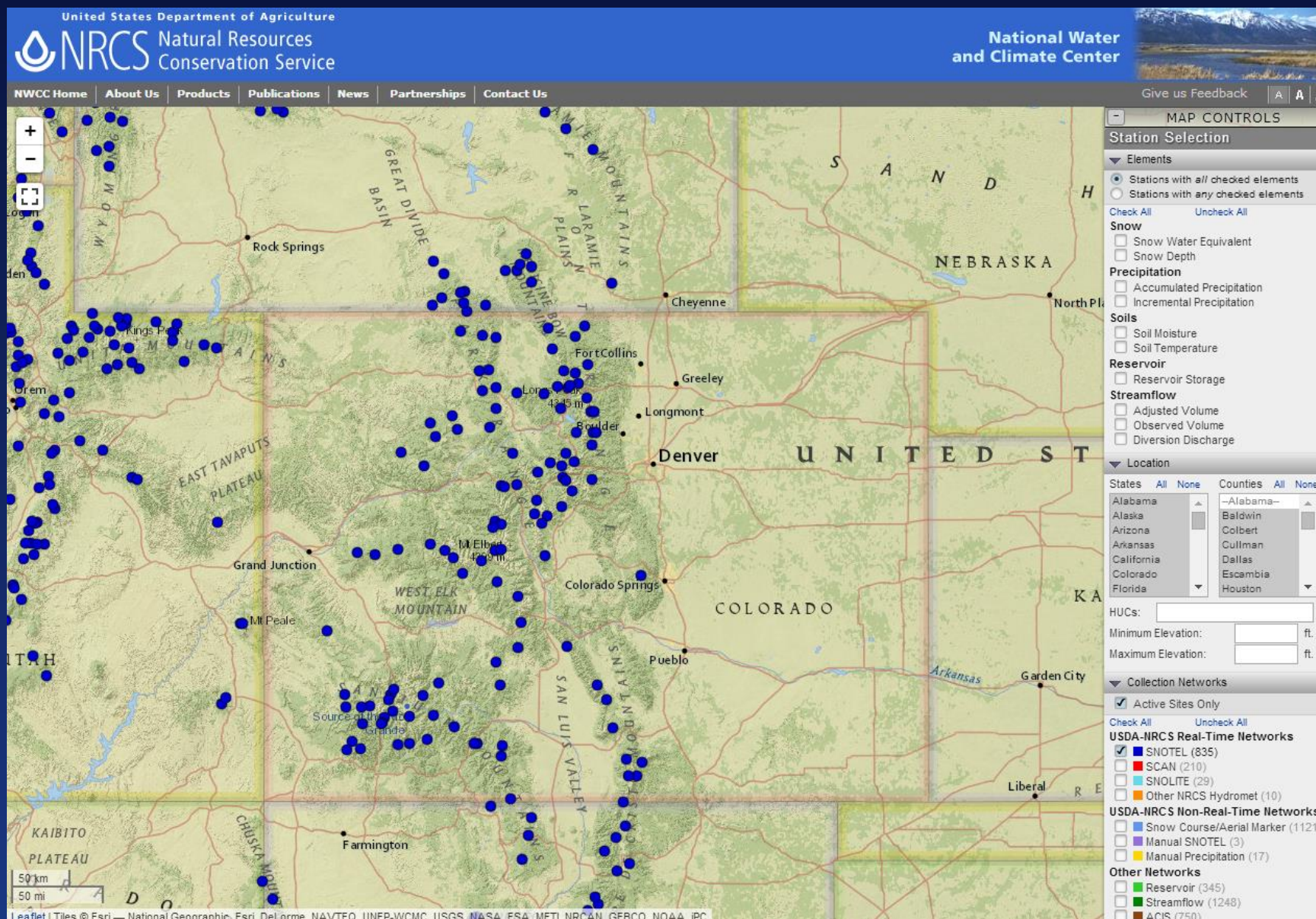
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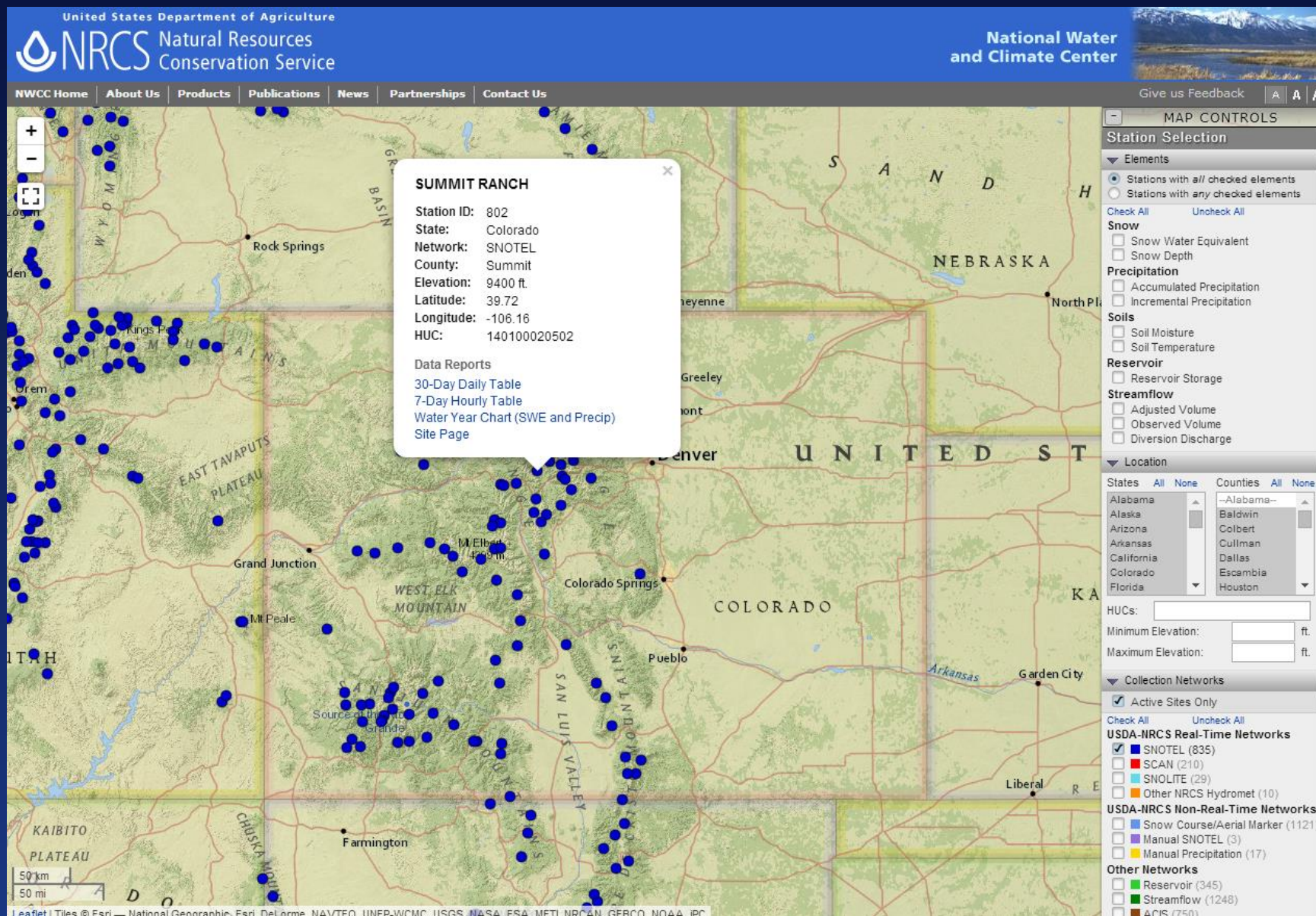
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- Reservoirs
- Surface Water

Climate Monitoring

- SNOTEL Data
- SCAN Data
- Snow Course Data
- Data Search
- Soil Search

Climate Interpretation

- Climate Analysis
- PRISM
- Climate Data
- General Information

- Snow Survey Programs by State

- Find a Service Center

- States and Regions

- National Centers

SNOTEL Site: Summit Ranch
State: Colorado
Site Number: 802
County: Summit
Latitude: 39 deg; 43 min N
Longitude: 106 deg; 9 min W
Elevation: 9400 feet
Reporting since: 1980-06-14

[Questions about this site.](#)

[View Daily Sensor Descriptions](#)

[View Hourly Sensor Descriptions](#)

[View Sensor History](#)



Site notes:

- Data is provisional and subject to revision.
- [More site notes.](#)
- Site photo not available - typical SNOTEL site is shown.
- 2014-August-07 National Water and Climate Center
- To Obtain the Daily Normals for the Period 1981-2010:
 - [Daily Snow Water Equivalent Medians](#)
 - [Daily Accumulated Precipitation Averages](#)

Site Reports:

Report Type	Daily	Current Water Year*	Historical	Hourly
Standard Sensors† (Most Current Data)	Last 7 Days	Daily Readings	Daily (Csv Delimited)	Last 7 Days
Precipitation, Accumulated	Last 7 Days	Daily Table	Daily Table	Last 7 Days
Snow Depth	Last 7 Days	Daily Readings		Last 7 Days
Snow Water Equivalent	Last 7 Days	Daily Table • Daily Graph	Daily • Monthly	Last 7 Days
Temperature	Last 7 Days	Max • Min • Avg	Max • Min • Avg	Last 7 Days
Soil Moisture/Temperature				Select # of Days ▾

Element Reports:

☐ Check to view temperatures in degrees Fahrenheit. Default is degrees Celcius.

Select Report Content	Select Time Series	Select Format	View Current	View Historic
Standard SNOTEL (1980-06-14) All Sensors (no chart) Soil Moisture & Temperature (2003-07-15) Soil Moisture (2003-07-15) Soil & Air Temperature (2003-07-15) Accumulated Precipitation (1980-06-14) Accumulated Precipitation & Snow (1980-06-14) ===Individual elements=== Air Temperature (1979-10-01) Precipitation Accumulation (1979-10-01)	Daily ▴ Hourly ▴ 12 AM 3 AM 6 AM 9 AM 12 PM 3 PM 6 PM 9 PM ▾	table ▴ csv chart ▾	Last 30 days ▴ Last 7 days Last 24 hours Water Year Calendar Year ▾	1980 ▴ 1981 1982 1983 1984 1985 1986 1987 1988 1989 ▾ Calendar Year ▴ Water Year January February March April May June July August ▾ All days ▴ 01 02 03 04 05 06 07 08 09 ▾

☐ Check here to view reports in new window.

[Back to: \[Colorado Page\]](#) - [\[SNOTEL Main Page\]](#)



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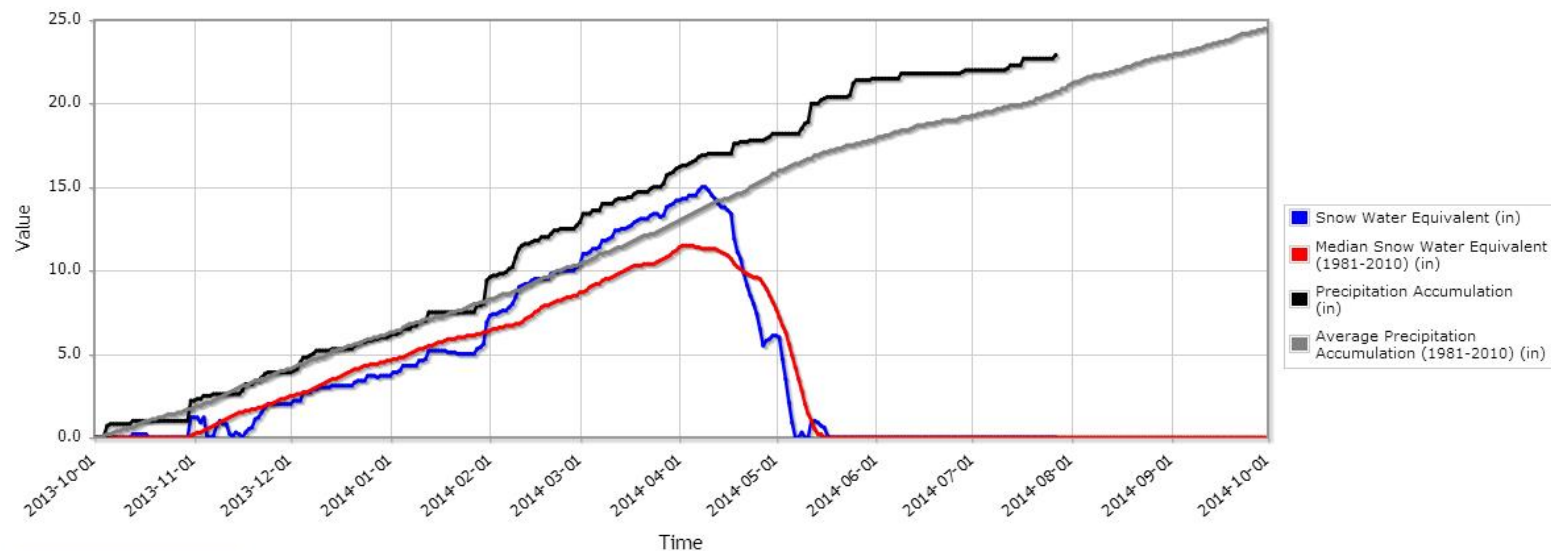
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View Report

Output Format ▾ Layout ▾ Units ▾ Time Period ▾ Fit Chart To Screen ☒

Summit Ranch (802) Colorado SNOTEL Site - 9400 ft

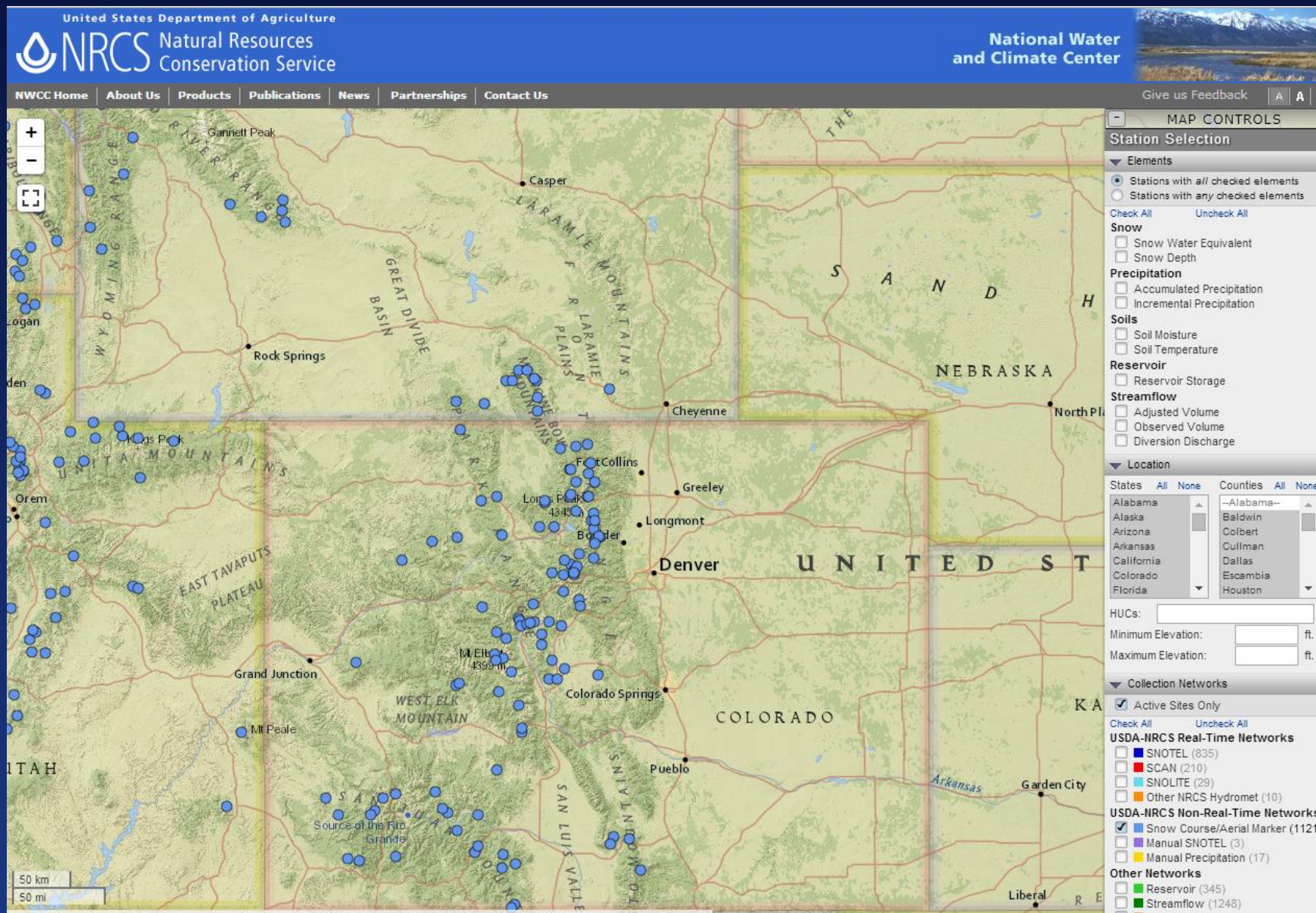
[Chart Help](#)



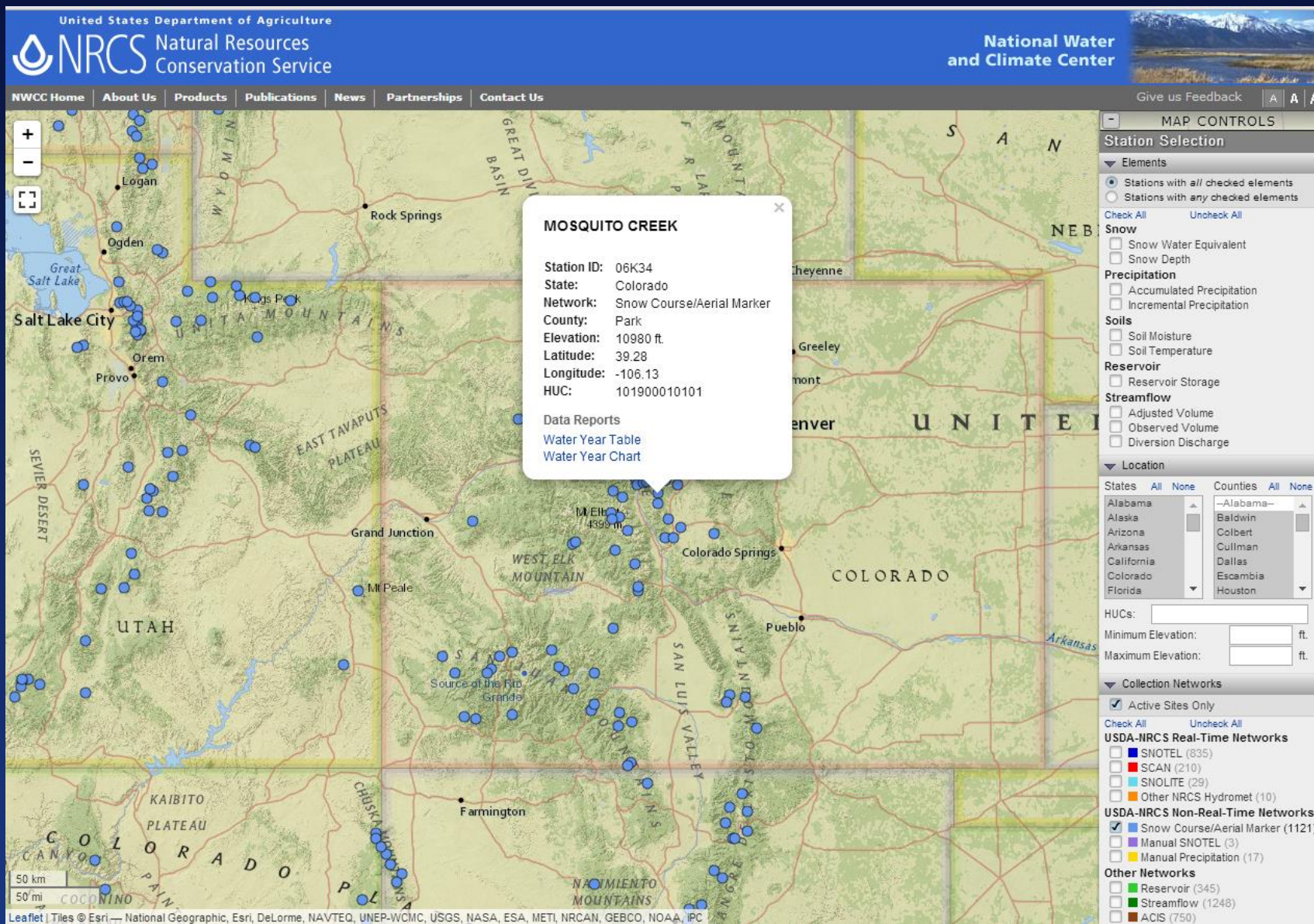
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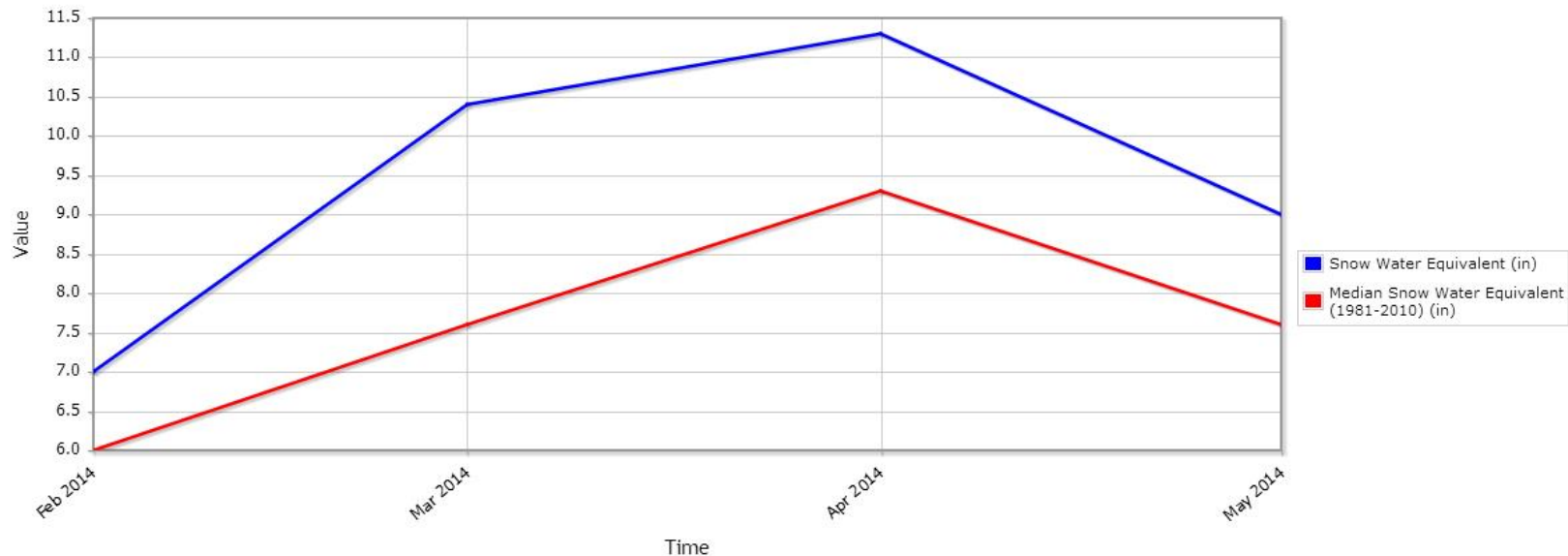
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Mosquito Creek (06K34) Colorado SNOW COURSE/AERIAL MARKER Site - 10980 ft

Chart Help



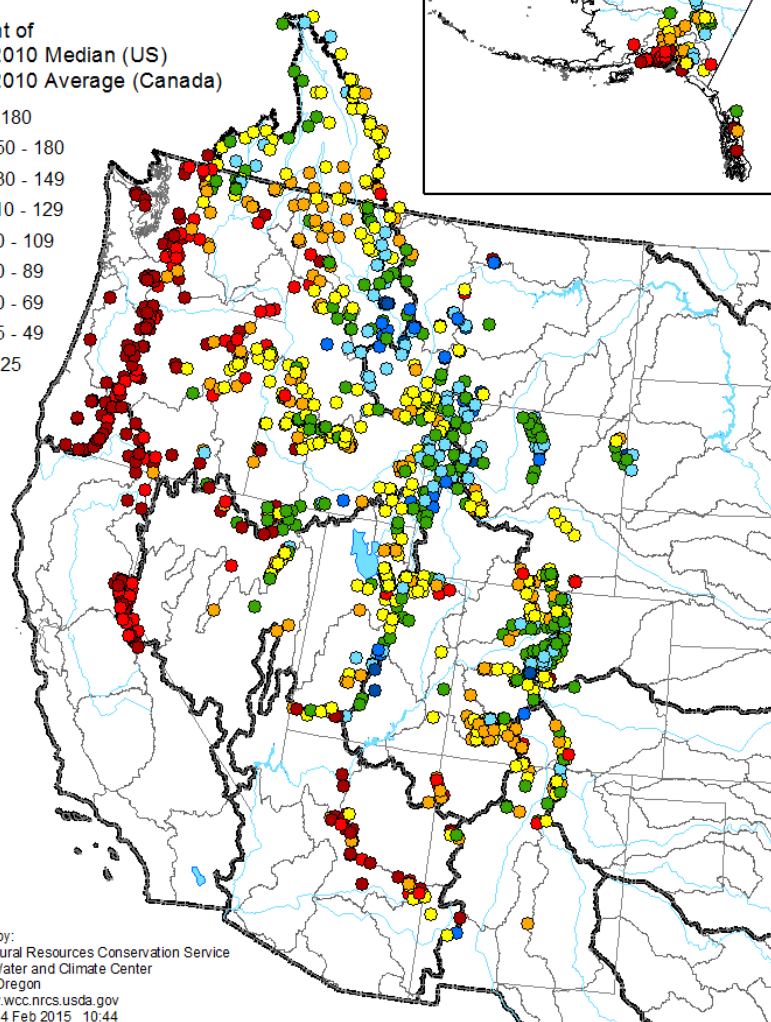
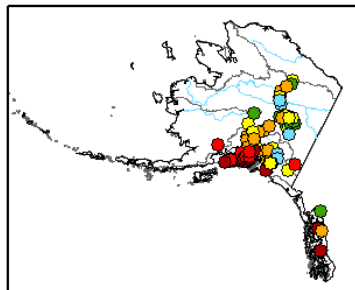
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Mountain Snowpack as of February 1, 2015

Percent of
1981-2010 Median (US)
1981-2010 Average (Canada)

- > 180
- 150 - 180
- 130 - 149
- 110 - 129
- 90 - 109
- 70 - 89
- 50 - 69
- 25 - 49
- < 25



Prepared by:
USDA Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>
Created: 4 Feb 2015 10:44

Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Feb 10, 2015

Current Snow Water
Equivalent (SWE)
Basin-wide Percent
of 1981-2010 Median

- unavailable *
- <50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- ≥ 150%

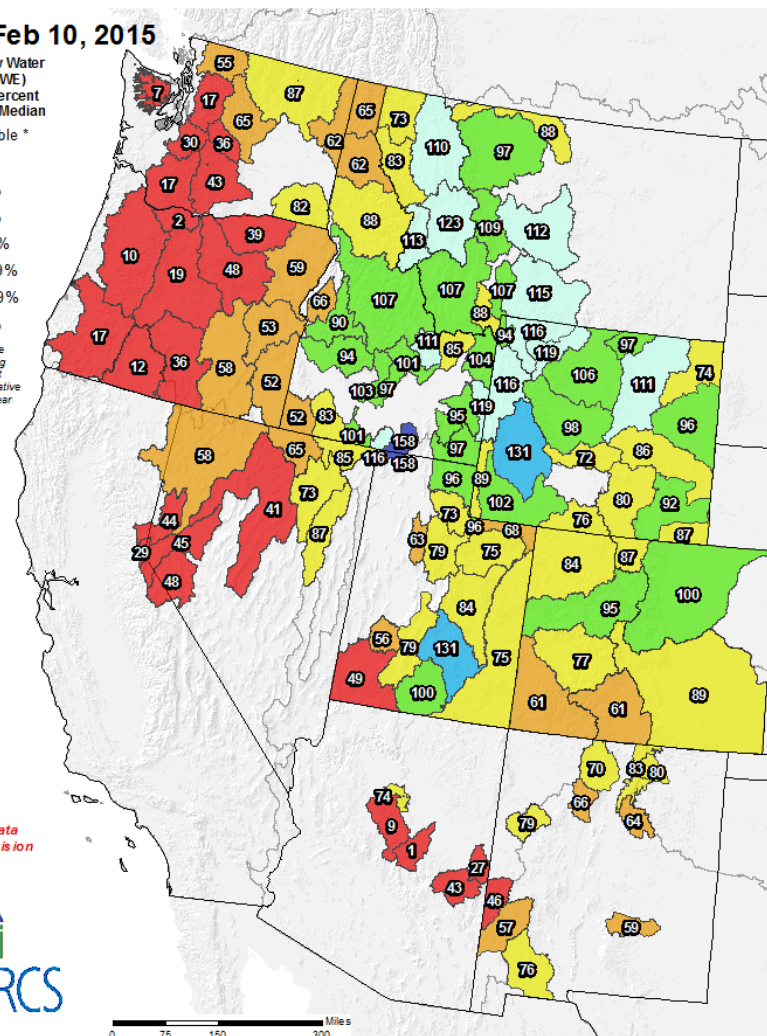
* Data unavailable
at time of posting
or measurement
is not representative
at this time of year

Provisional data
subject to revision



The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

Prepared by:
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Portland, Oregon
<http://www.wcc.nrcs.usda.gov>



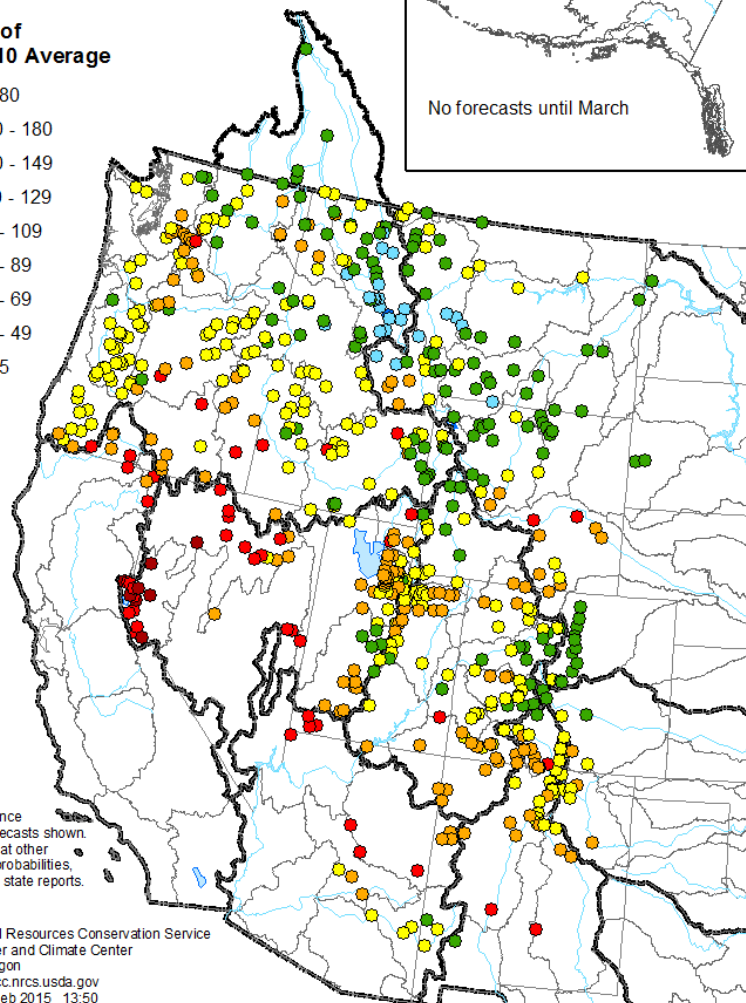
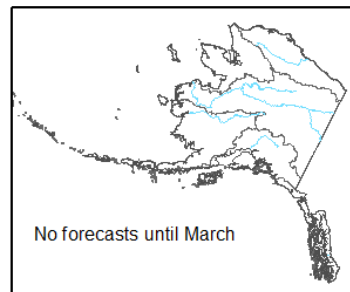
Spring and Summer Streamflow Forecasts as of February 1, 2015

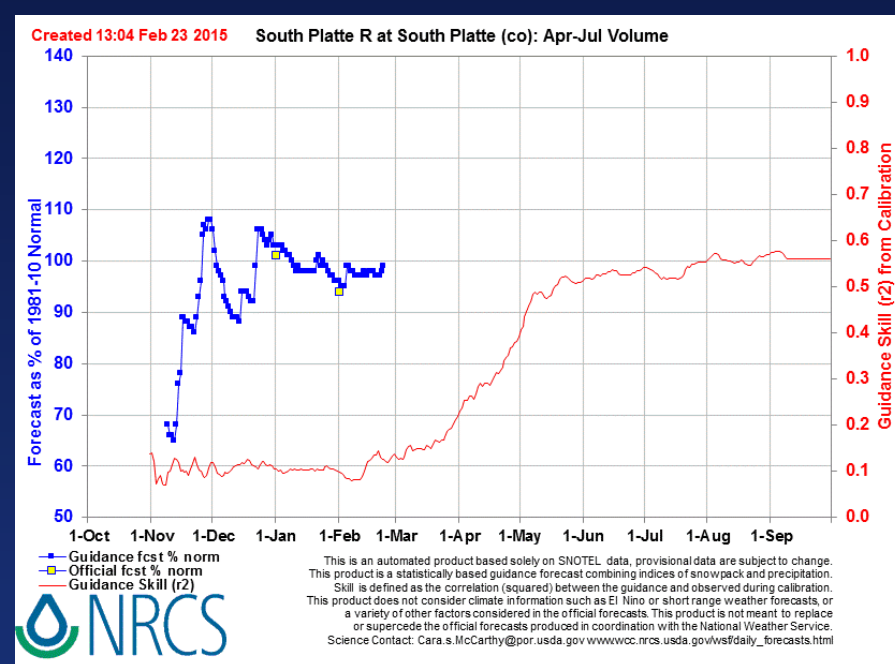
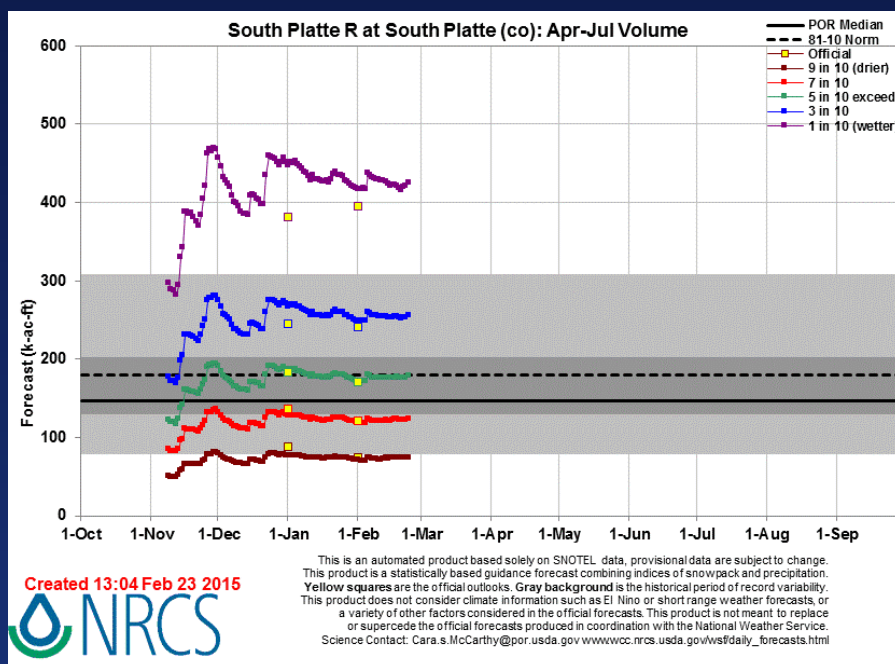
Percent of
1981-2010 Average

- > 180
- 150 - 180
- 130 - 149
- 110 - 129
- 90 - 109
- 70 - 89
- 50 - 69
- 25 - 49
- < 25

50% exceedance
probability forecasts shown.
For forecasts at other
exceedance probabilities,
see individual state reports.

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Created: 6 Feb 2015 13:50

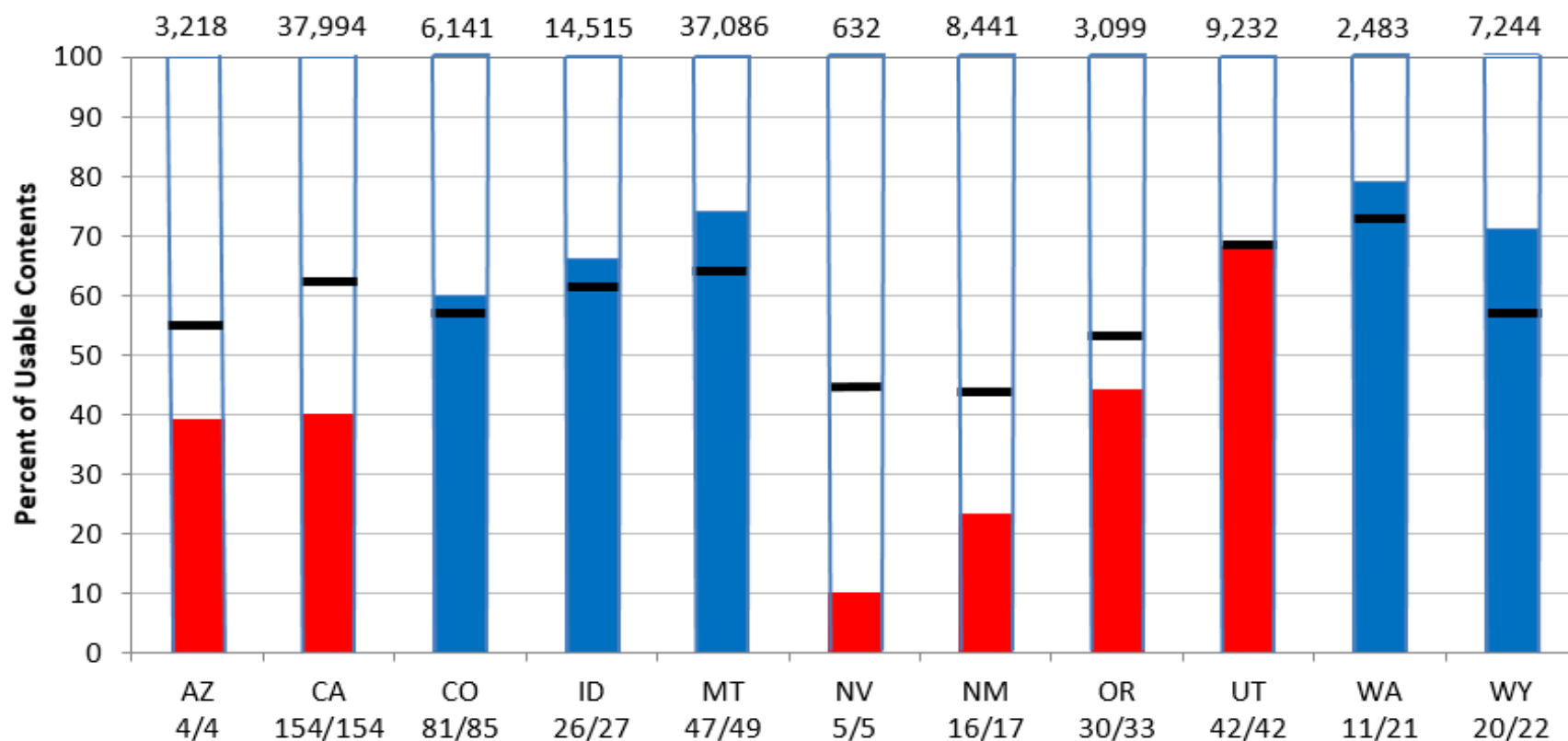




Reservoir Storage as of February 1, 2015

■ Below Average ■ Above Average ■ Average

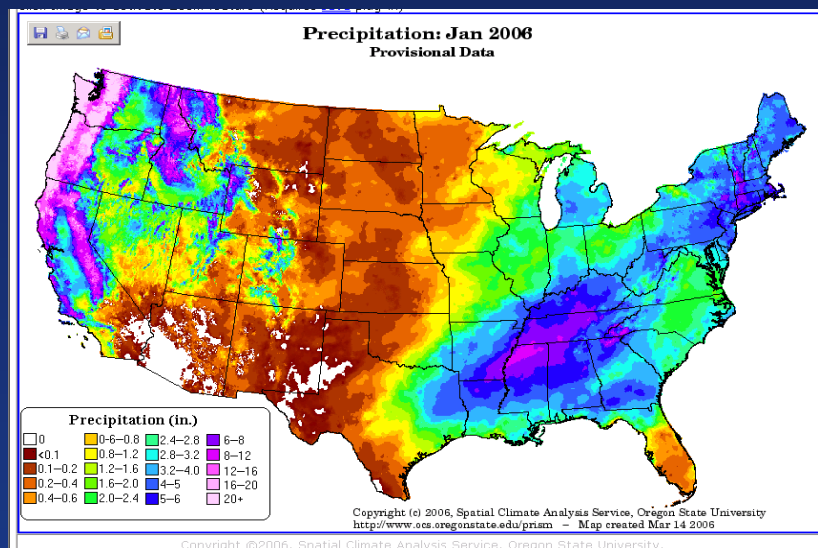
Capacity of Reservoirs Reported (1000 Acre-Feet)



Climate Maps

- Maps of snowpack, precipitation, temperature
- NRCS Geospatial Warehouse
- Oregon State University

<http://www.ocs.orst.edu/prism/>



IT Services

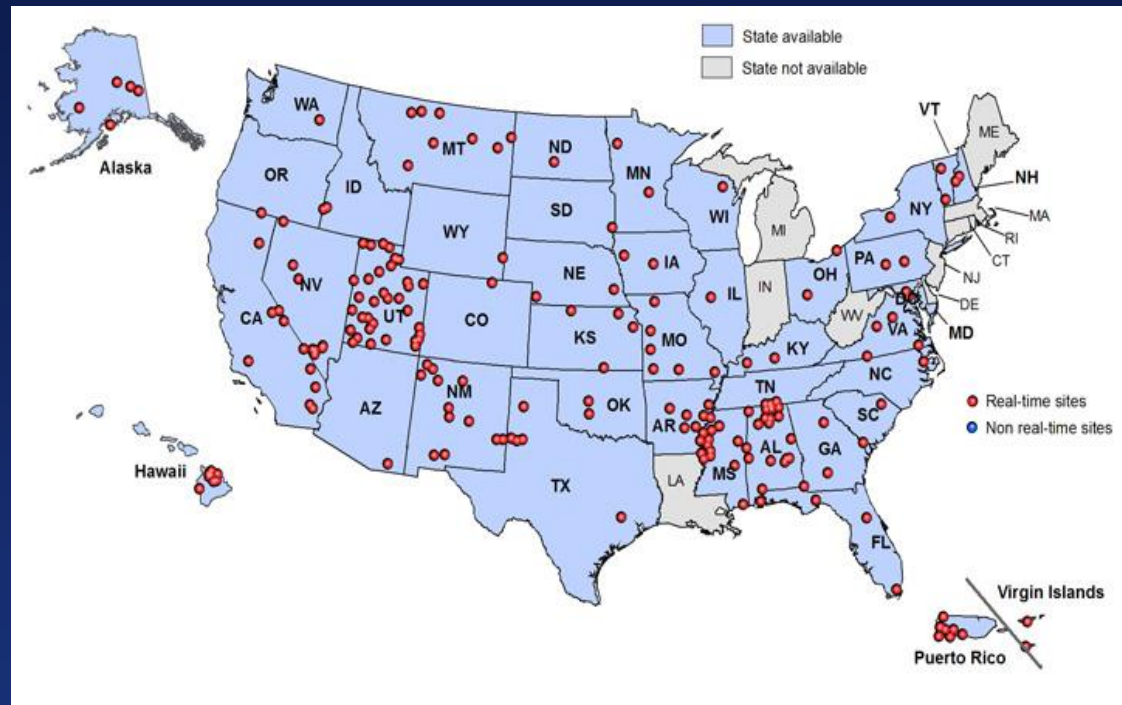
- 24/7 data delivery
- Data management, data quality
- Web services
- Failover/hosting/IRB
- Report generator
- Critical users

Soil Climate Analysis Network

- **SCAN** (Soil Climate Analysis Network)
 - 221 sites in 40 States and US Territories
 - Soil-climate monitoring
 - Uses meteor burst telemetry
 - Critical for drought monitoring

- www.wcc.nrcs.usda.gov/scan/

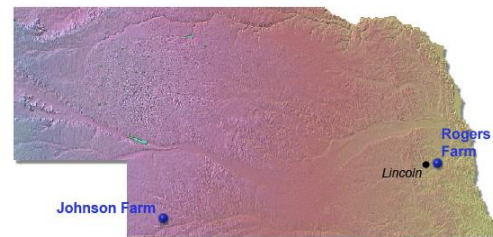
SOIL CLIMATE ANALYSIS NETWORK



Johnson Farm, Nebraska SCAN Site

SOIL CLIMATE ANALYSIS NETWORK

SCAN Sites for Nebraska



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NRCS National Water and Climate Center - Soil Climate Analysis Network - Microsoft Internet Explorer

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Arkansas SCAN Sites

Select a SCAN site from the map or from the list below.

Select a SCAN Site

Arkansas SCAN Sites
● Real-time Data

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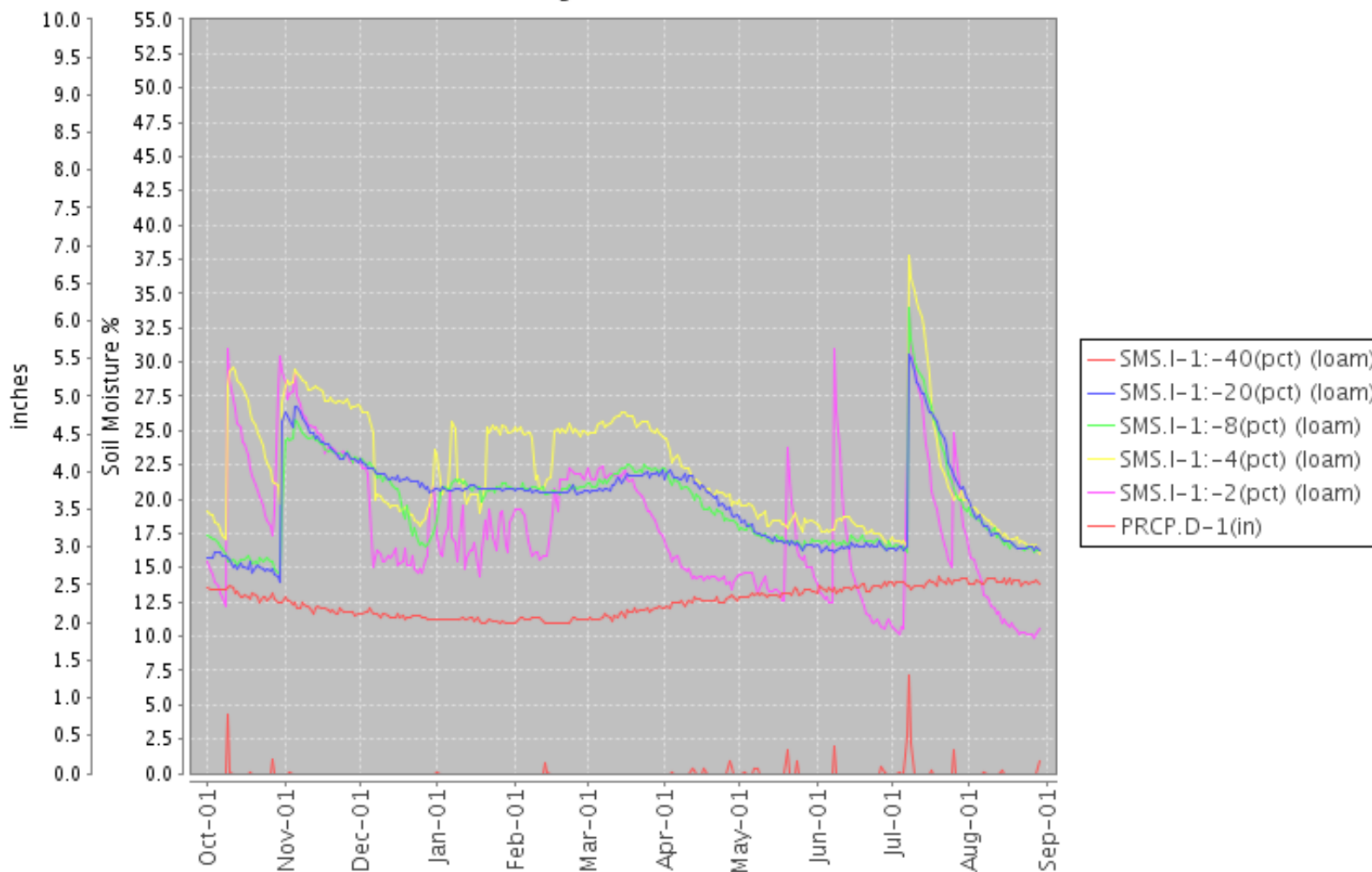
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Trusted sites

40

SCAN Data Plot

Station (2017) WATERYEAR=2012 (Daily) NRCS National Water and Climate Center - Provisional Data - subject to revision Wed Aug 29 14:15:29 PDT 2012



Colorado
SCAN
Site
NUNN

Climate

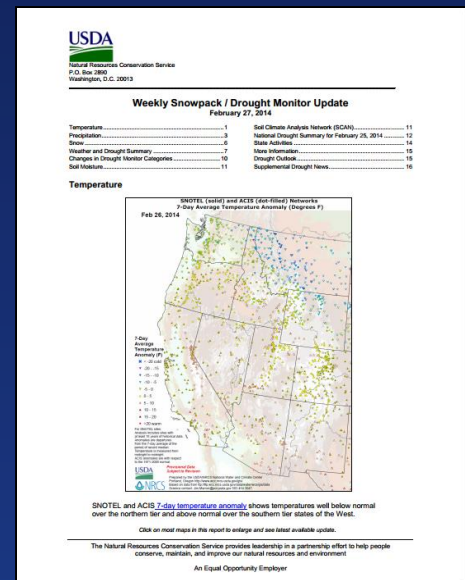
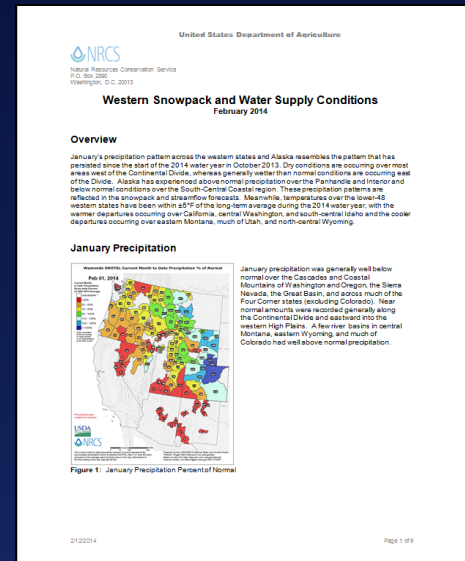
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- National Climate Assessment
- Climate Science Centers
- Expertise to NHQ (data requests, testimonies, Climate Change Team)

Drought

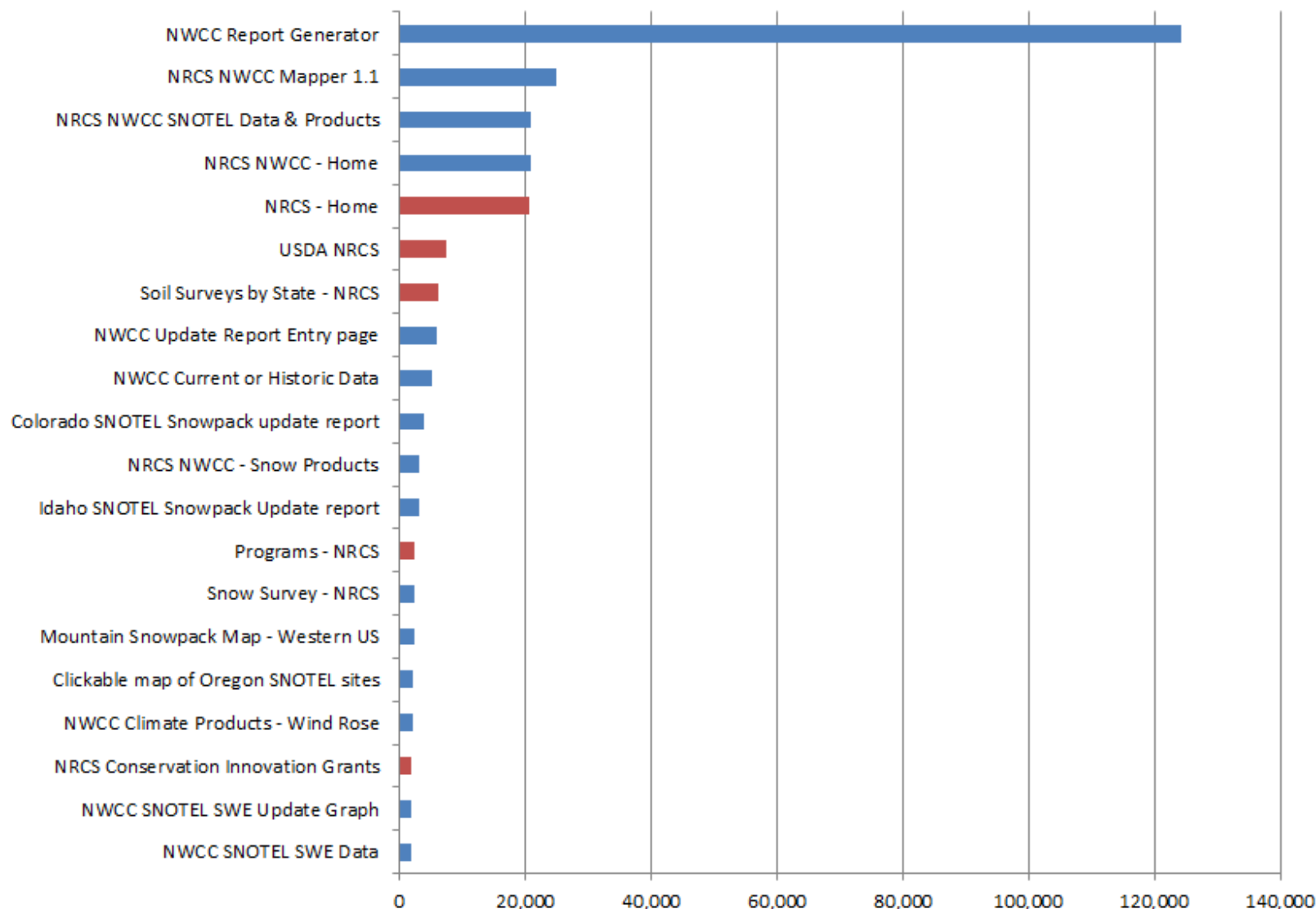
- NIDIS workshops
- NIDIS Soil Moisture Monitoring workgroup
- Development of a National Soil Moisture Network

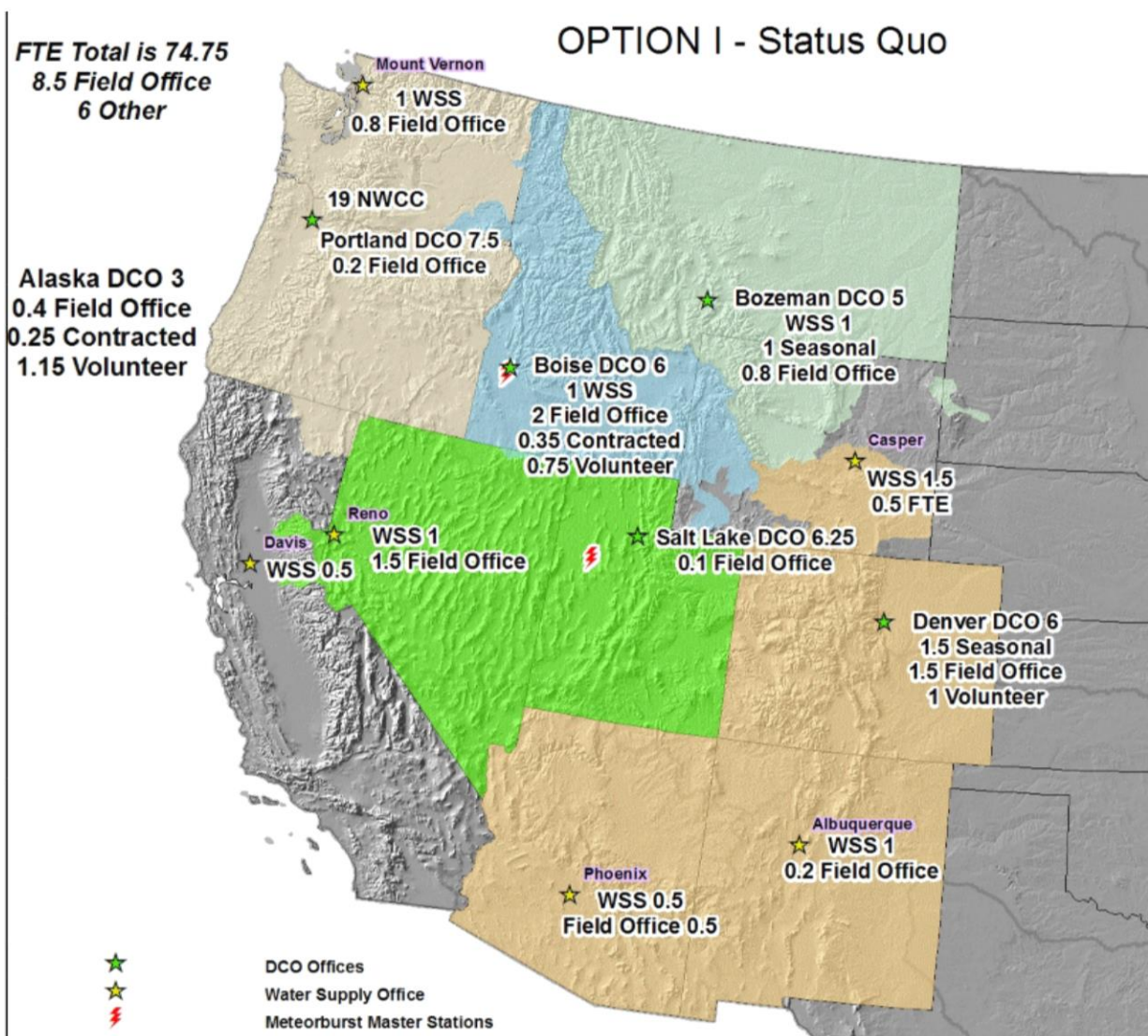
Additional Products

- Weekly Snowpack/Drought Monitor Update
- Snow News
- Wetlands Climate Tables

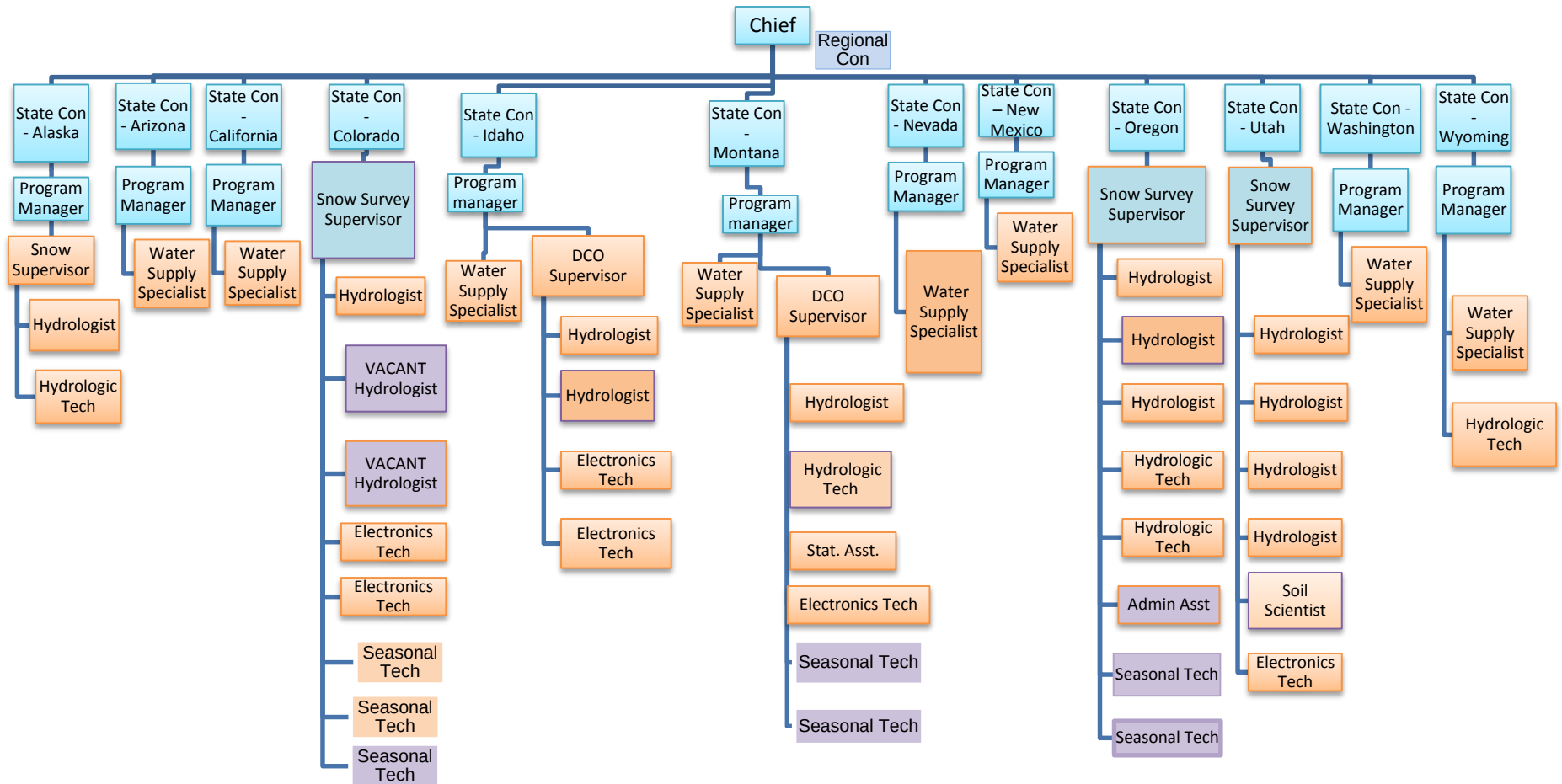


NRCS Top 20 Pageviews - February 1-9, 2015



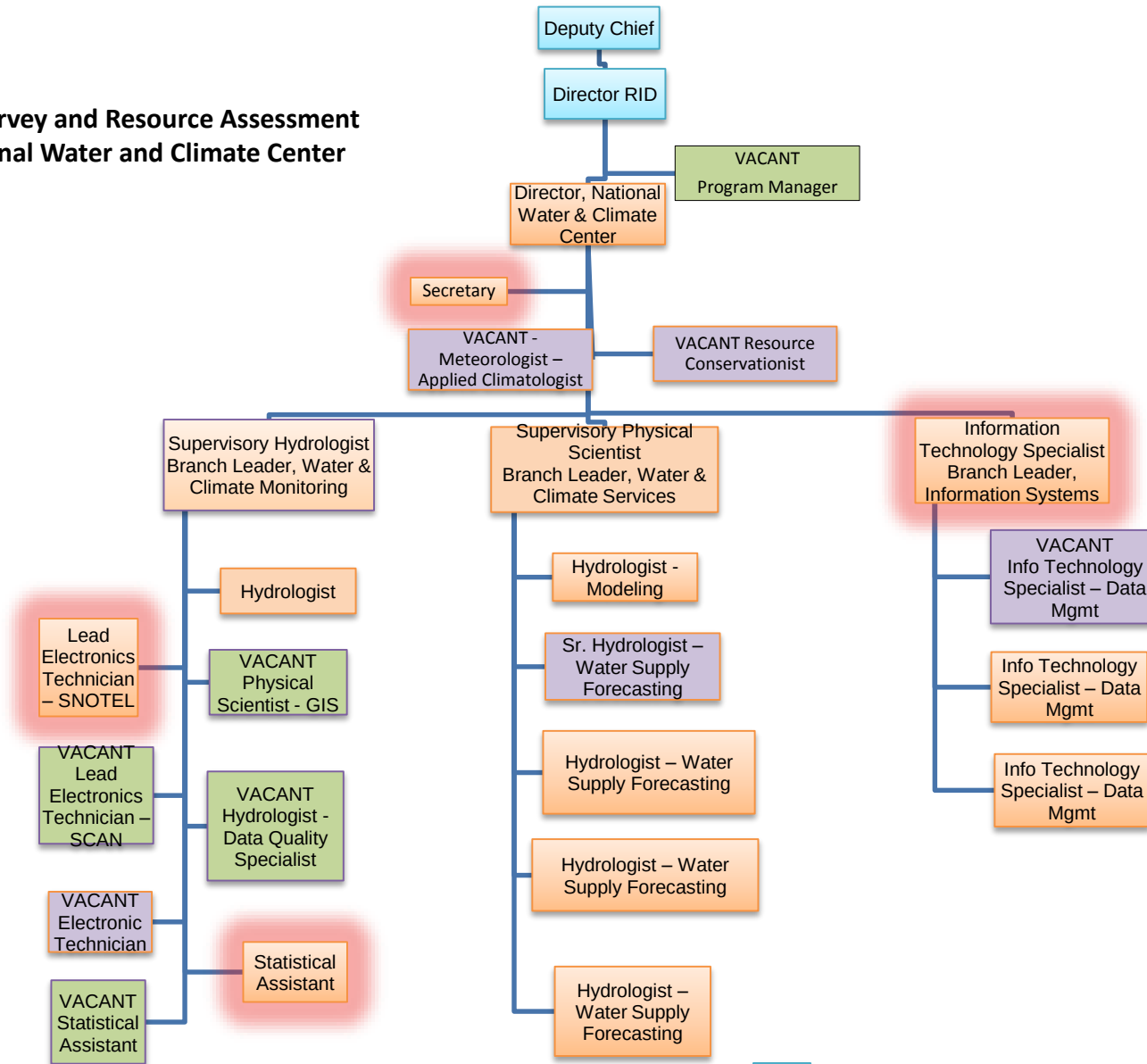


Snow Survey Program State Structure



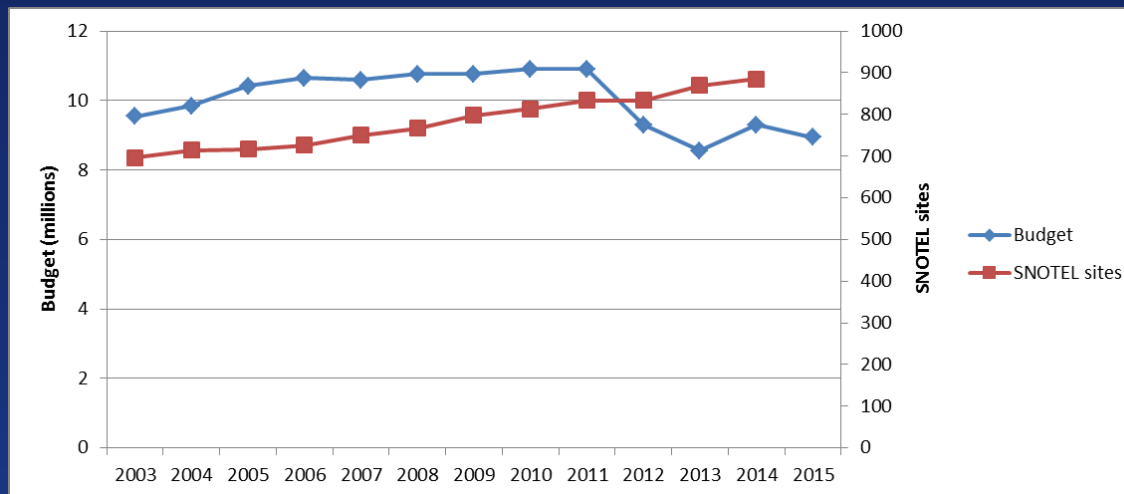
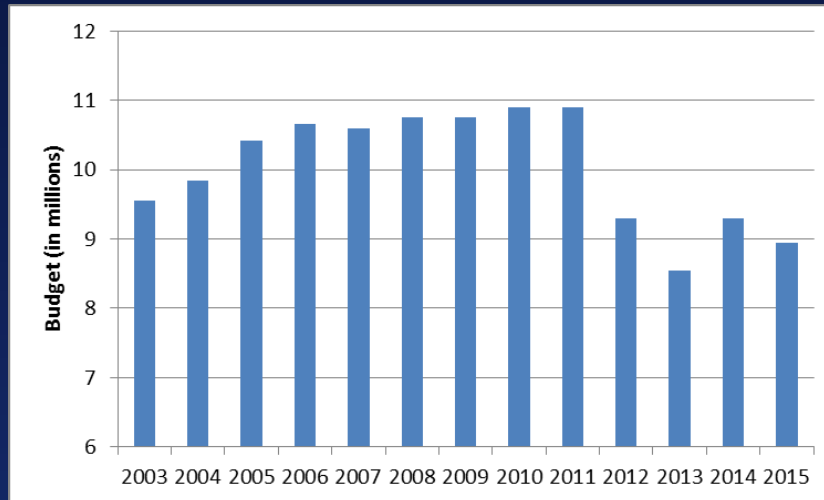
- Supervision chain-of-command above SSWSF Program
- Permanent SSWSF Program positions
- Permanent SSWSF Program positions presently vacant

Soil Survey and Resource Assessment National Water and Climate Center



- Supervision chain-of-command above SSWSF Program
- Permanent SSWSF Program positions
- Permanent SSWSF Program positions presently vacant
- Vacant and no longer funded

Snow Survey Program Budget





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Tower Training



Future Directions

- ✓ Further automating of manual snow courses to SNOTEL sites where real-time information is needed to provide water supply forecasts.
- ✓ Expansion of SCAN to provide governments, water managers, agricultural producers, businesses and researchers improved information about soil moisture conditions and potential droughts.
- ✓ Improving models and computational capacity to provide more frequent and accurate water supply forecasts and assessments of soil moisture.
- ✓ Development of simulation modeling capabilities to compliment statistical modeling efforts