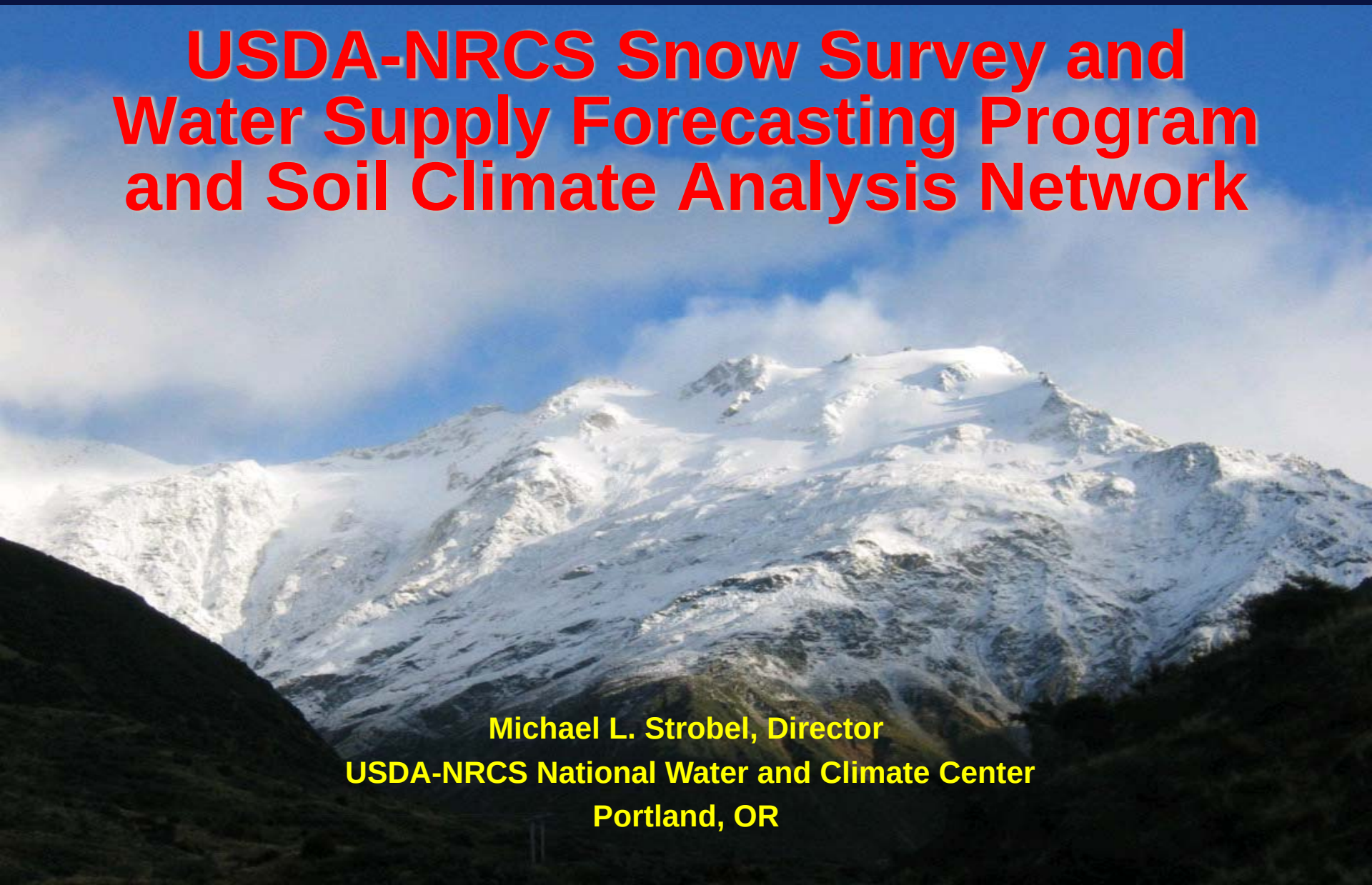
United States Department of Agriculture
Natural Resources Conservation Service

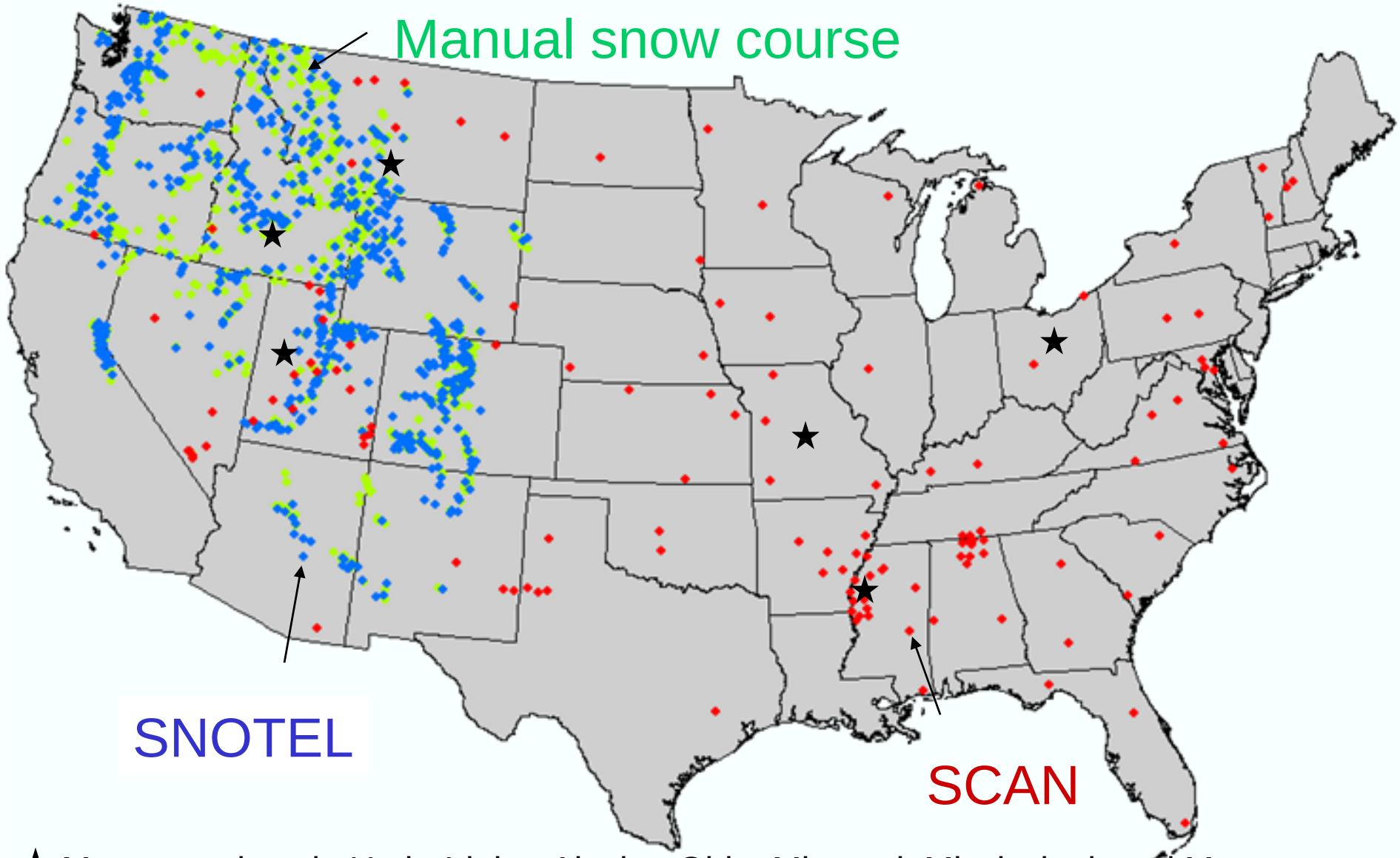
USDA-NRCS Snow Survey and Water Supply Forecasting Program and Soil Climate Analysis Network



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

United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS



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

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

SSWSF Program Users and Cooperators

Agriculture

Drought and Flood Risk Reduction

Wildlife management

Recreation

Municipal Water Management,
Reservoir Management,
Power Generation

Snow Survey and Water Supply Forecasting Program

Customers utilizing program data and forecasts:

- *Sovereign Nations*
  - Canada, Mexico, Native American Nations
  - Technology exchange with China, Mongolia, Antarctica, Europe
- *Federal Departments & Agencies*
  - Agriculture, Interior, Commerce, Defense, Energy, Bureau of Indian Affairs, Environmental Protection Agency, Bonneville Power Administration, Federal Water Masters
- *State and Local Agencies*
  - State and Interstate Organizations involved in: Drought Planning, Water Resources, Emergency Preparedness, Planning & Zoning, Forestry, Lands, Recreation and Tourism

Snow Survey and Water Supply Forecasting Program

Customers (continued):

- *Non-Governmental Entities*
  - Soil and Water Conservation Districts, University Researchers, Natural Resource Management Businesses, Private Citizens, Agricultural and Forestry Industry Cooperators
  - Water Utilities, Irrigation Districts, Limited Resource Farmers, Construction Contractors, Consulting Meteorologists, Hydrologists and Engineers
  - Educators and Schools, Energy and Power Generation Companies, Landscape Architects, Media, Recreational Interests and Transportation Companies.

United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS

Today

1906

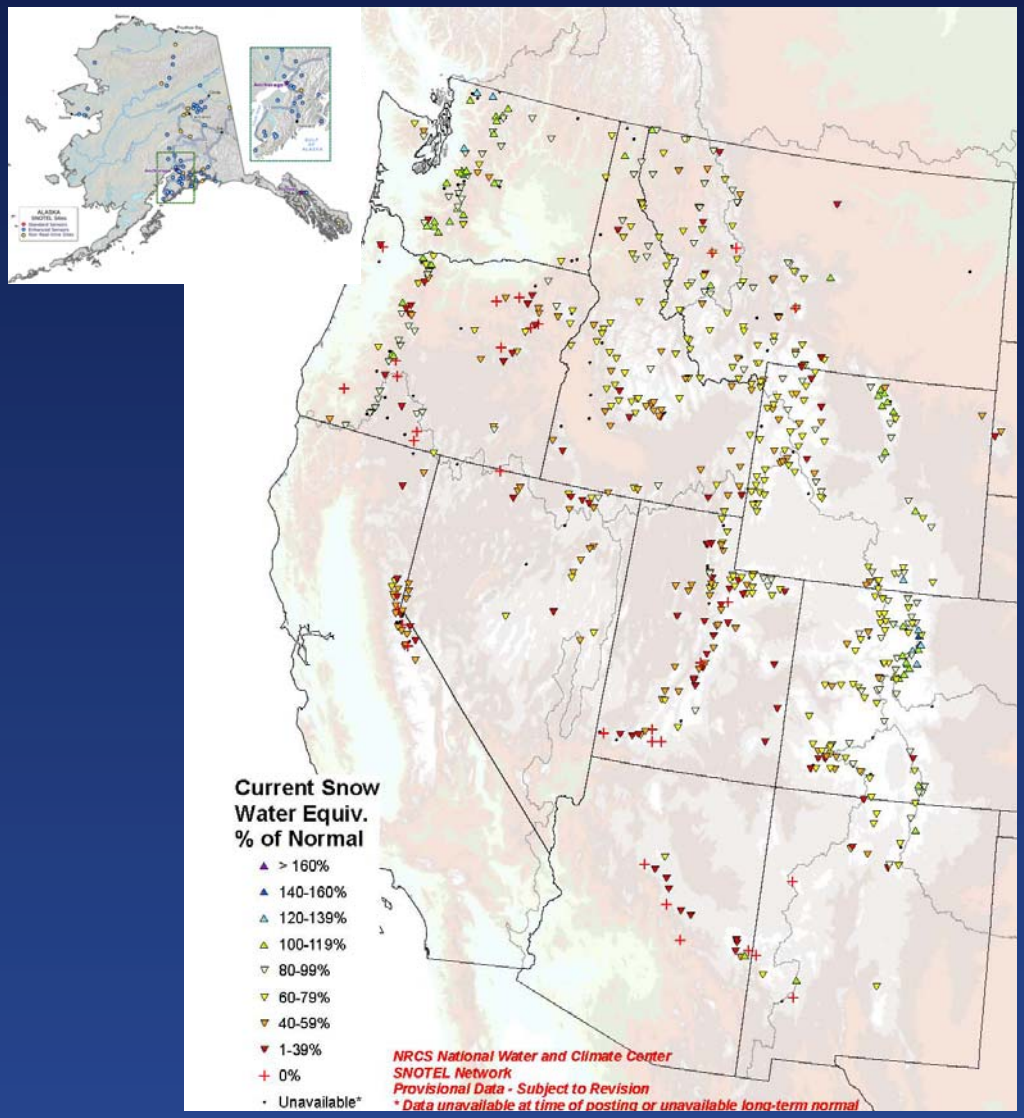
Manual Snow Surveys

Metal tube inserted into snow and weighed to measure water content.

+300,000 snow course measurements to date

NRCS SNOTEL Network

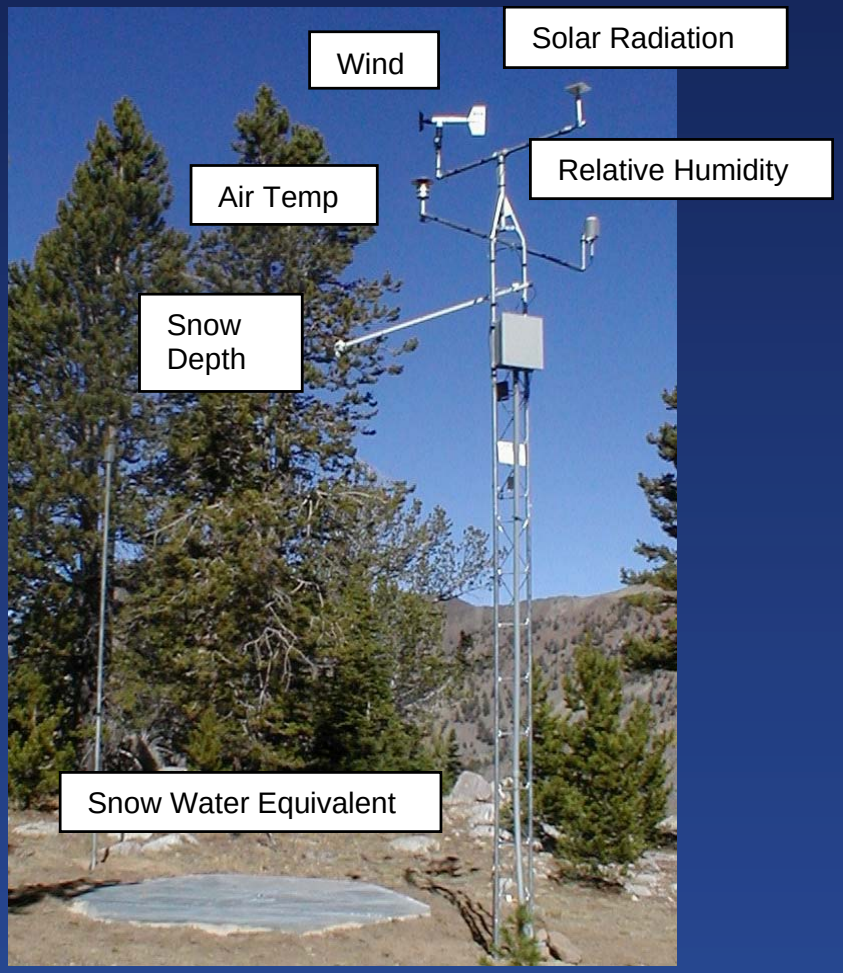
- SNOTEL network
  - 13 Western States
  - 790 sites
  - 16 million observations/year
  - Data transmitted in near real time every hour for most stations
- 950 manual snow courses



http://www.wcc.nrcs.usda.gov/snow/

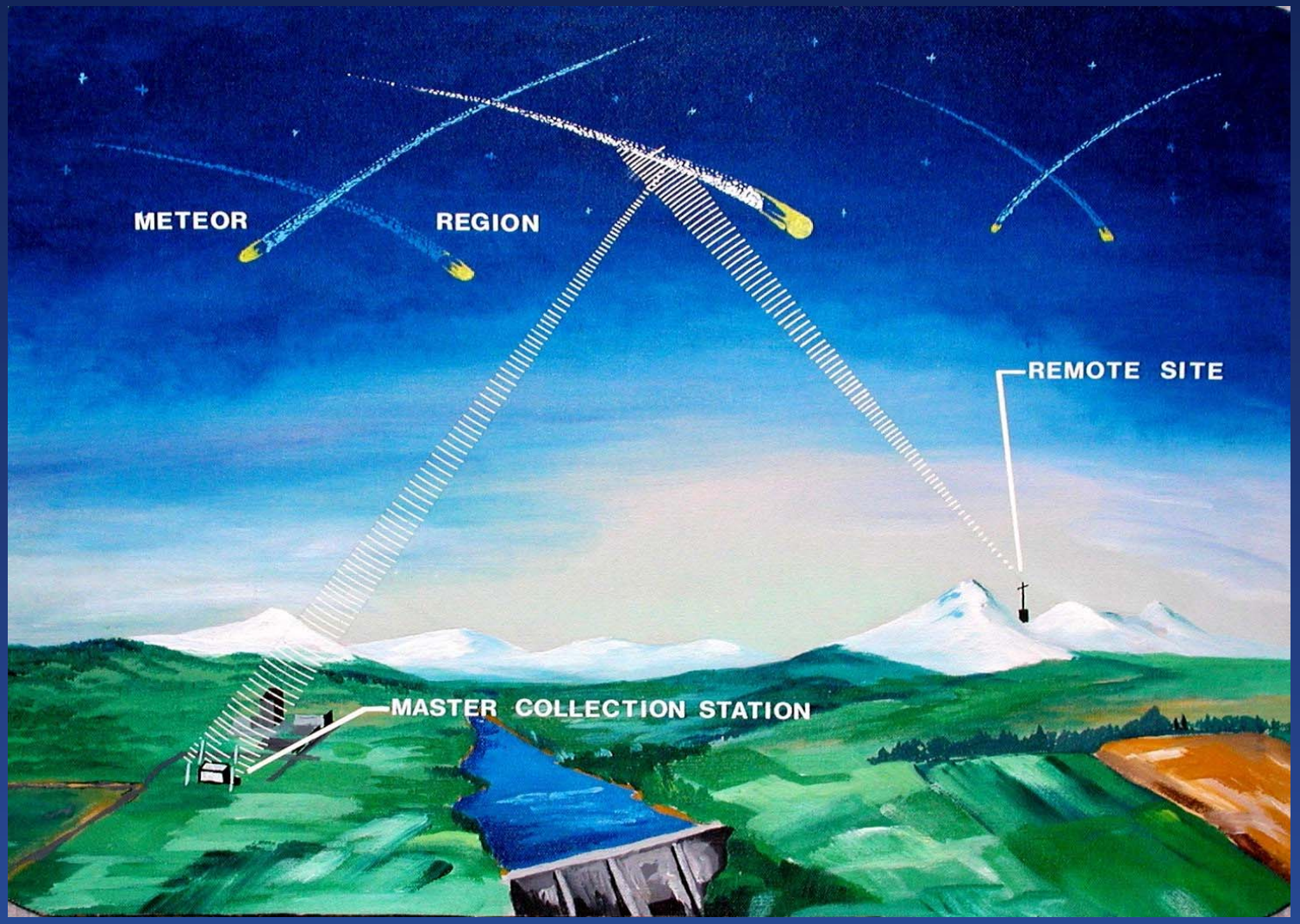
SNOTEL Site - Augmented Data Array

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

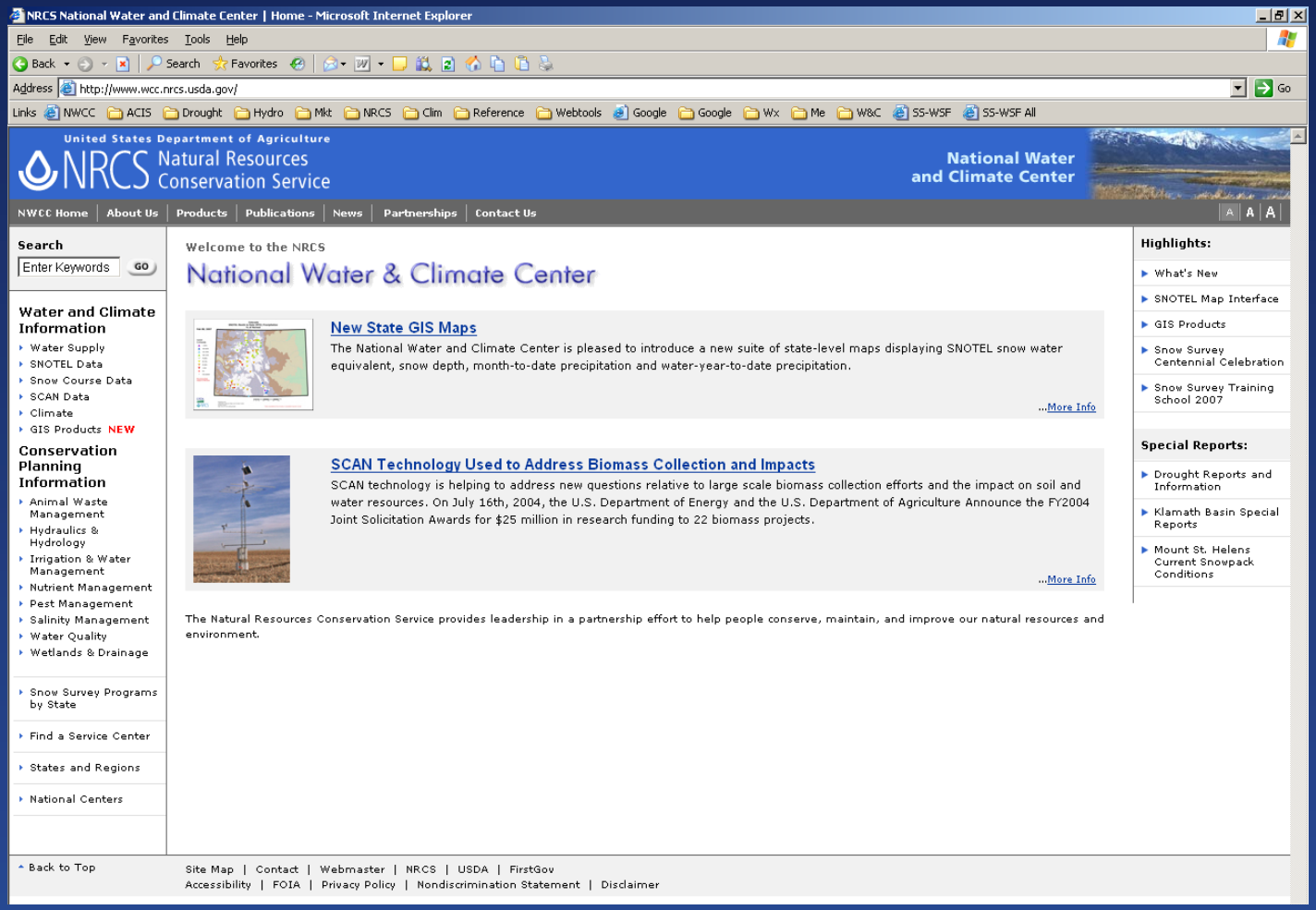


Winter SNOTEL Site

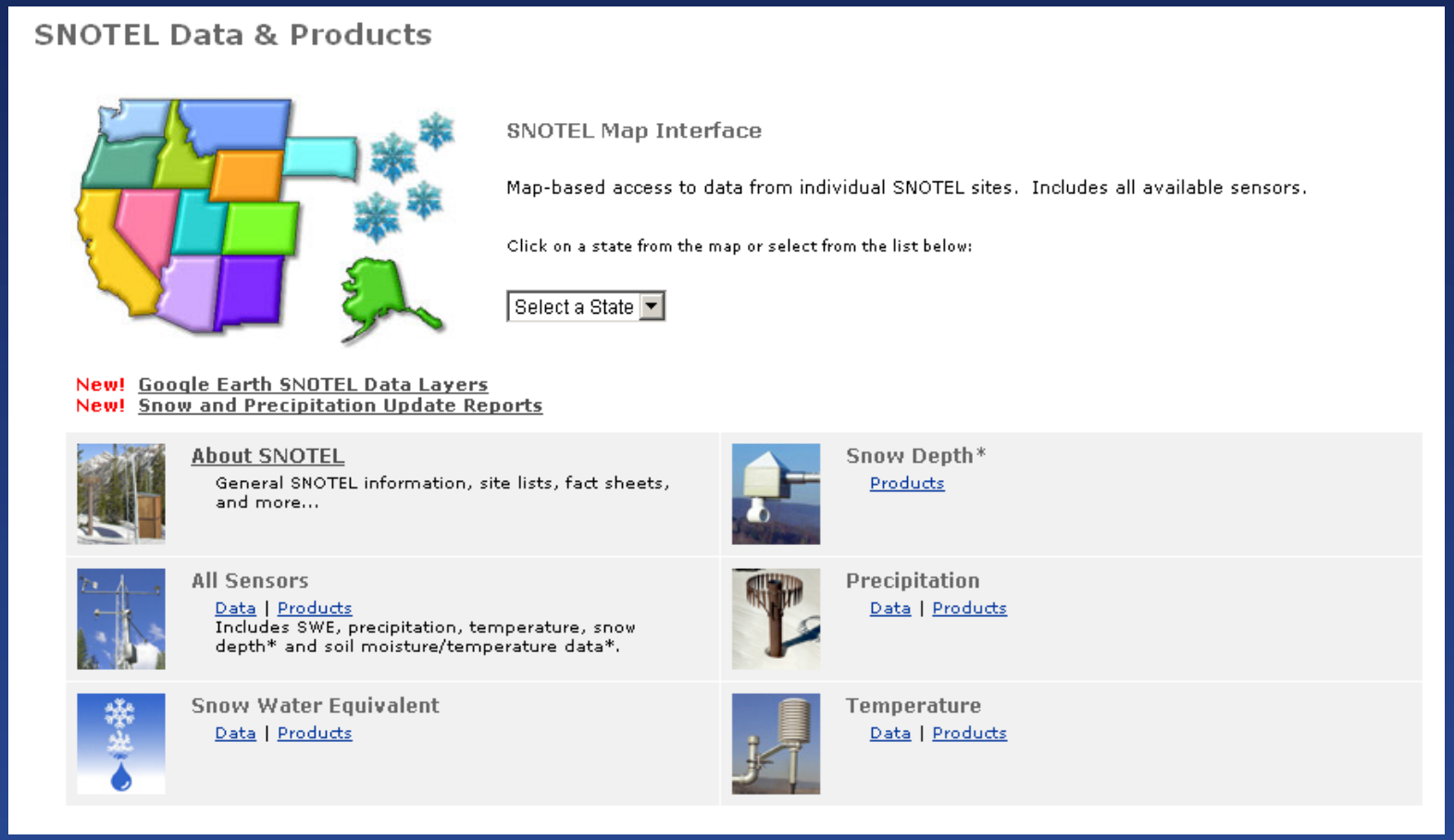
Meteor Burst Technology



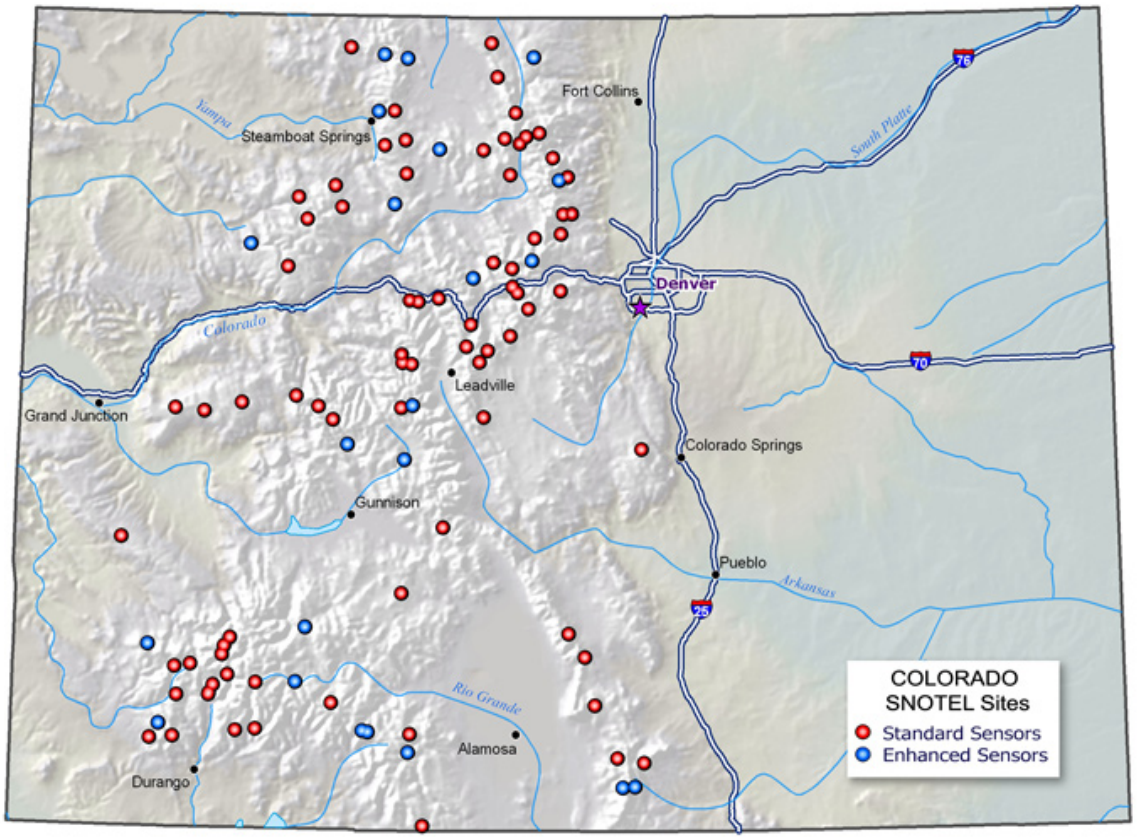
NWCC Webpage



NWCC Webpage - SNOTEL



Colorado SNOTEL Sites



NWCC Webpage Interface

Site Information and Reports for MT ROSE SKI AREA

MT ROSE SKI AREA
Site Number: 652
Station ID: 19k07s

State: Nevada
Latitude: 39.315733
Longitude: -119.894733
Elevation: 8801 feet

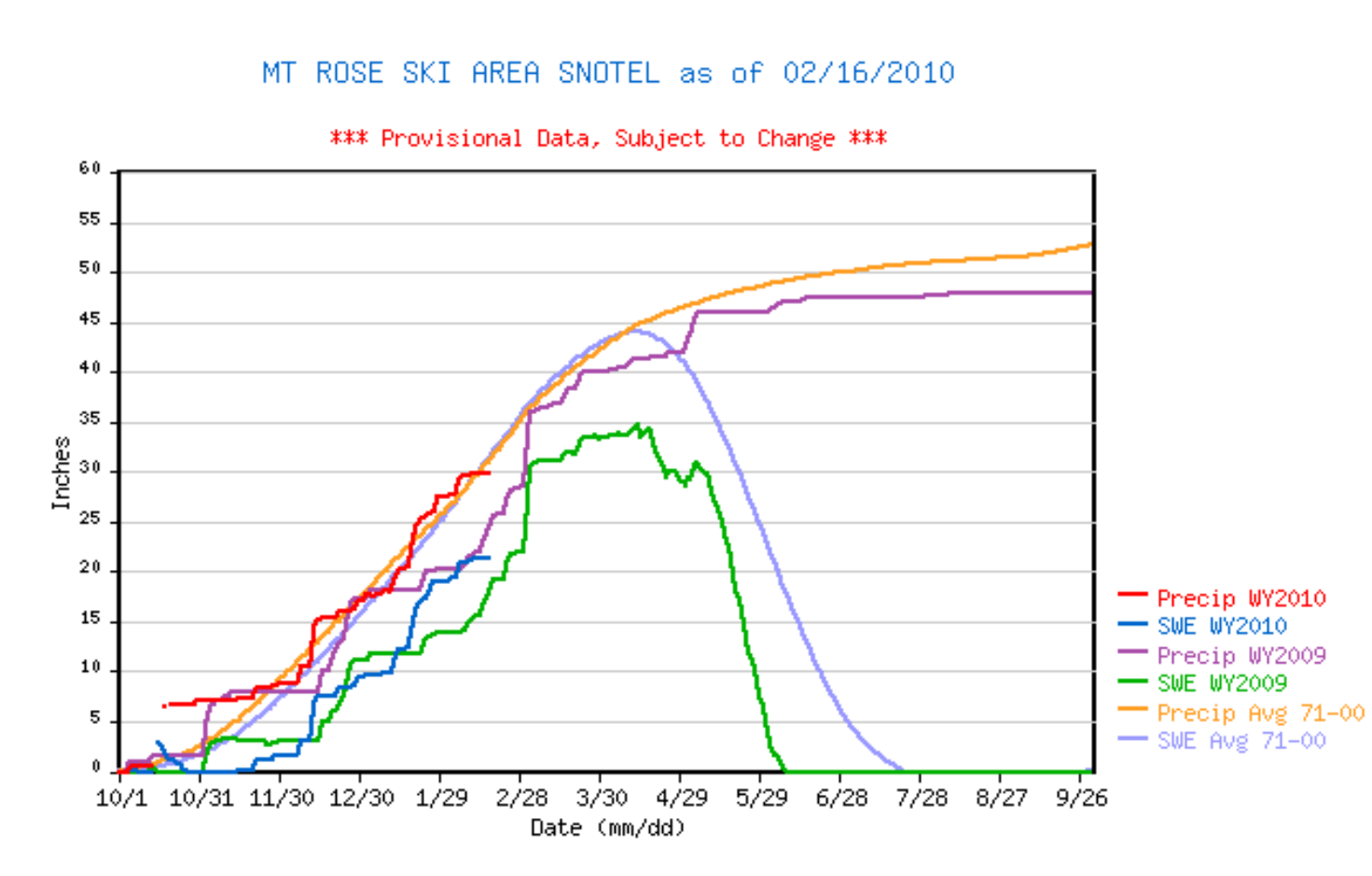
Sensor Label Descriptions
Sensor History for this Site

(Winter Photo Also Available, Select Here)

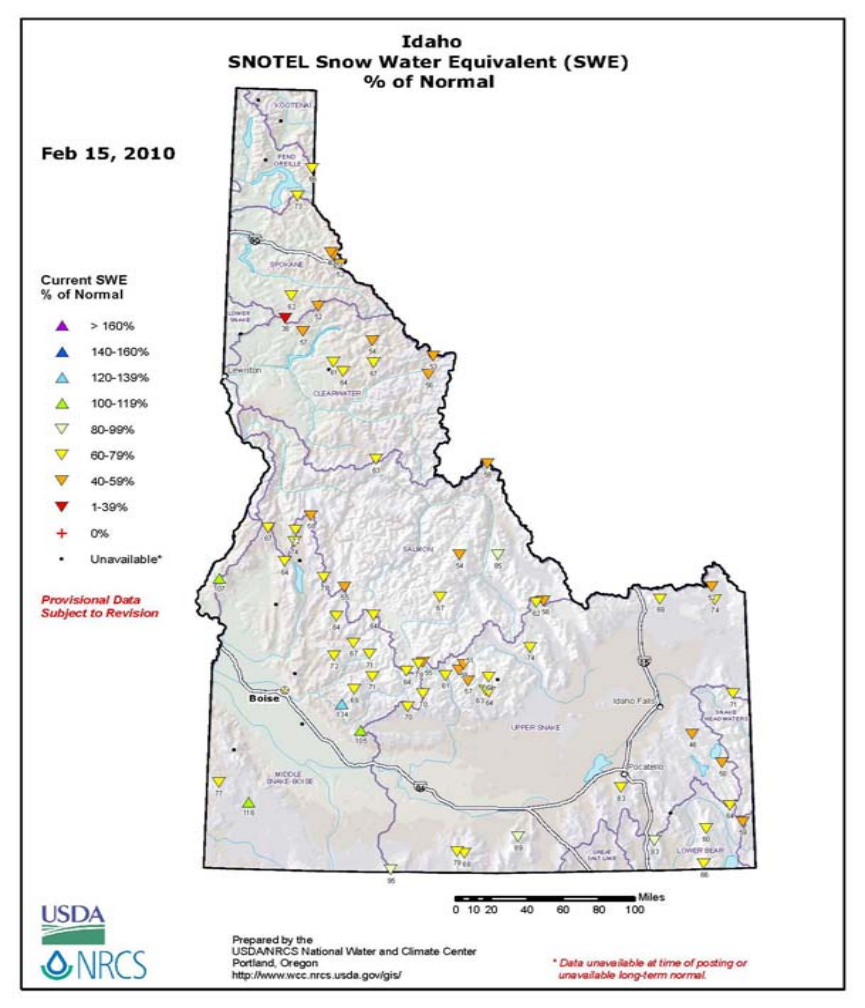
The following reports are available for this site:

Report Type	Hourly	Daily	Current Water Year*	Historical
Standard Sensors† (*Most Current Data*)	Last 7 Days	Last 7 Days	Daily Readings	Daily (Tab Formatted)
All Sensors (*TK Format*‡)	Today's Data			
Precipitation, Accumulated	Last 7 Days	Last 7 Days	Daily Table	Daily Table
Snow Depth	Last 7 Days	Last 7 Days	Daily Readings	
Snow Water Equivalent	Last 7 Days	Last 7 Days	Daily Table • Daily Graph	Daily • Monthly
Temperature	Last 7 Days	Last 7 Days	Max • Min • Avg	Max • Min • Avg

Mt. Rose SNOTEL Data



Daily State Map - Idaho

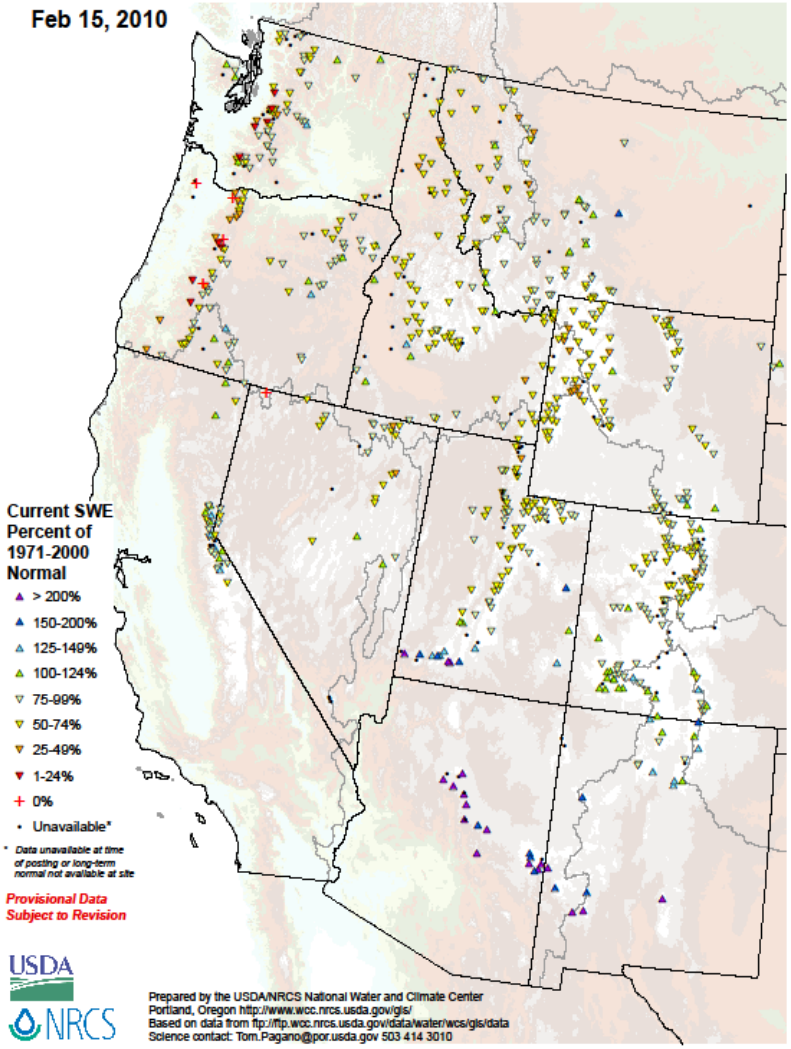


United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS

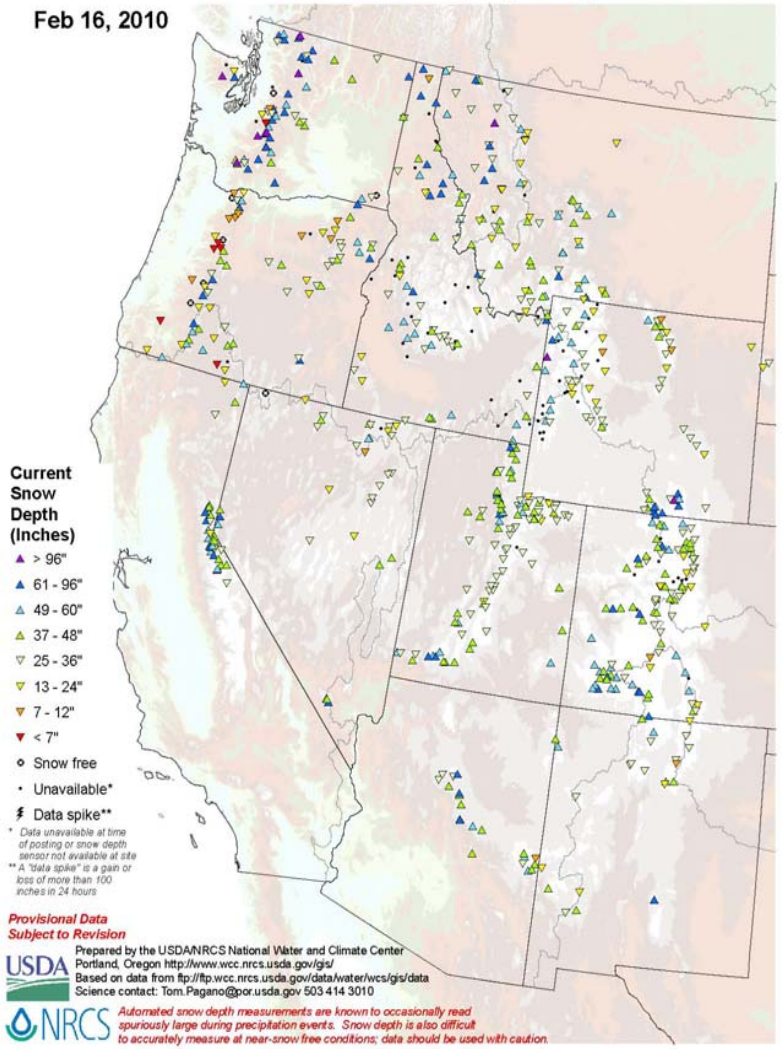
SNOTEL Current Snow Water Equivalent (SWE) Percent of Normal

Feb 15, 2010

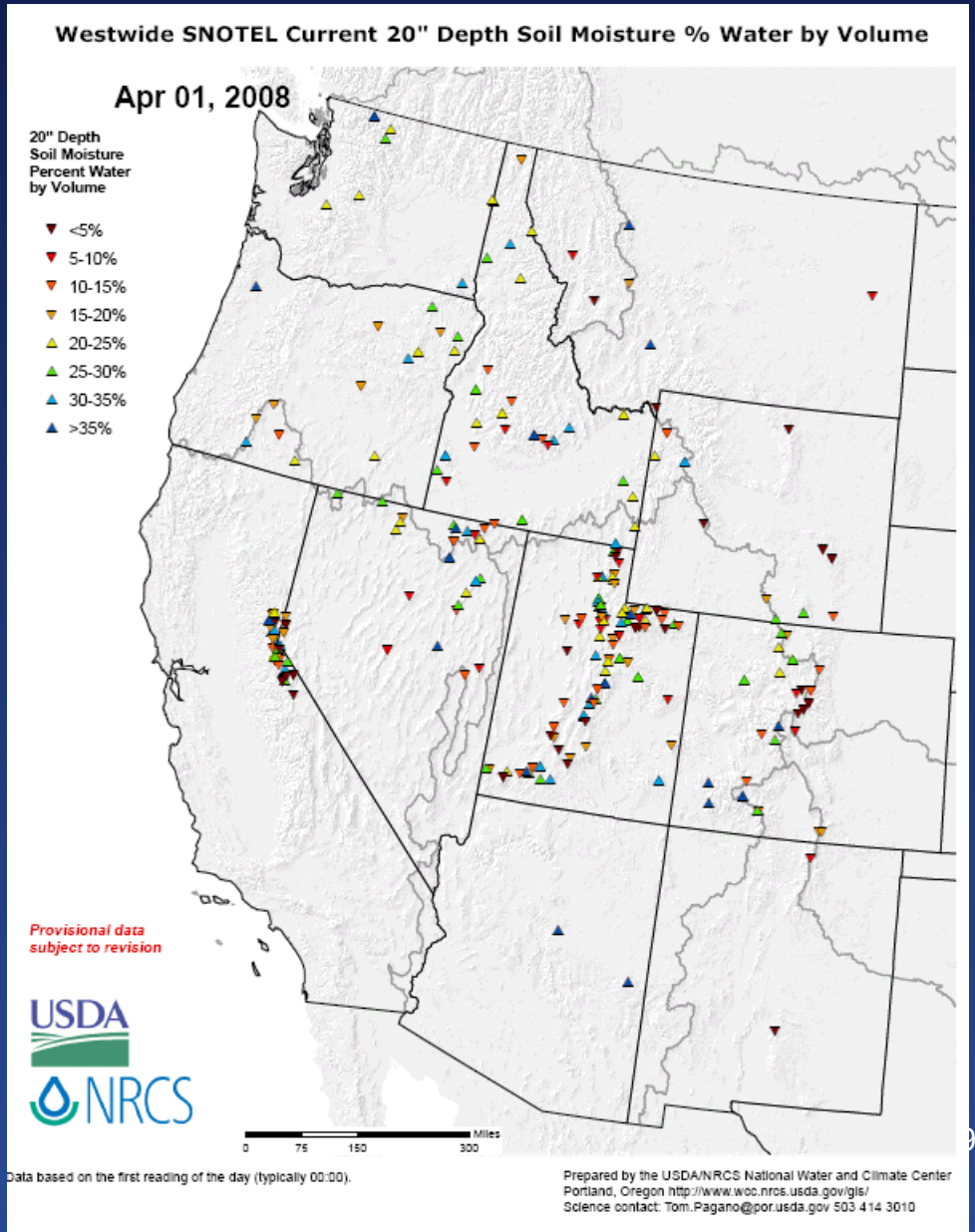


SNOTEL Current Snow Depth (Inches)

Feb 16, 2010



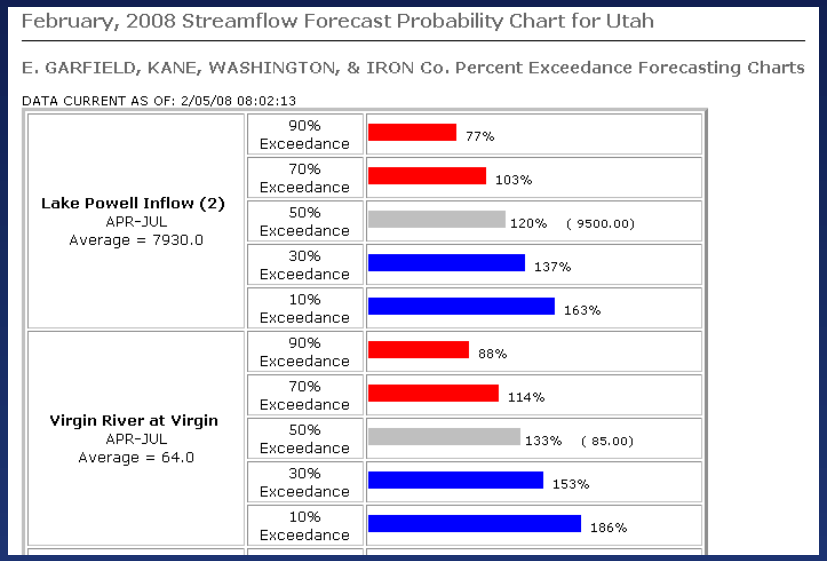
Expansion of soil moisture to SNOTEL network (data starts 2003)



Water Supply Forecasts

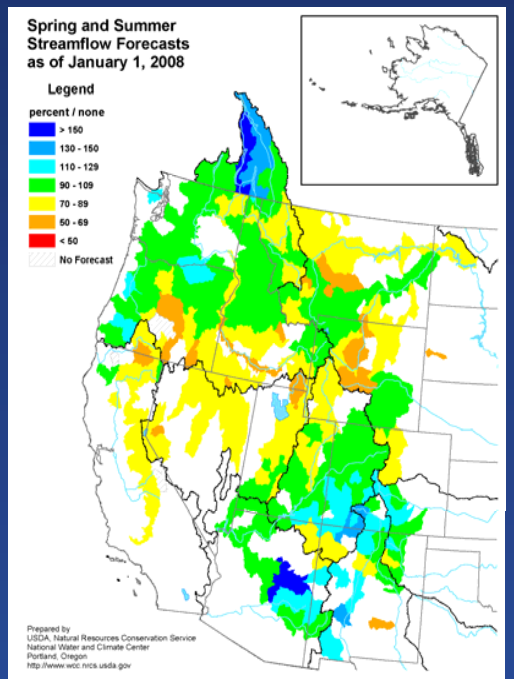
- Water Year 2009
  - 740 locations forecast Jan-Jun with NWS
  - Over 12,000 forecasts issued by States to users
  - Over 2M visits to WSF pages
- www.wcc.nrcs.usda.gov/wsf

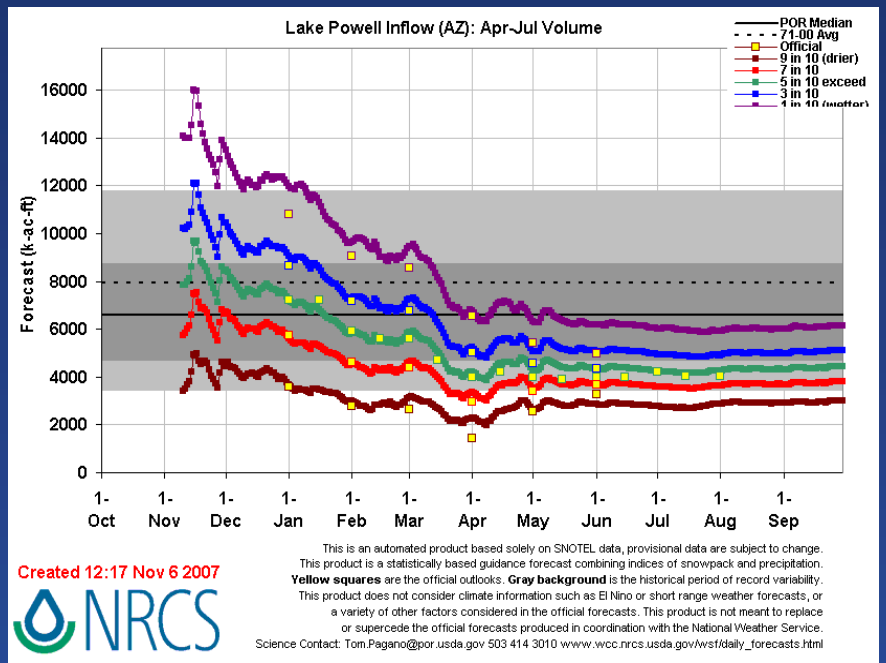
United States Department of Agriculture
Natural Resources Conservation Service



RIO GRANDE BASIN
Streamflow Forecasts - April 1, 2002

Forecast Pt / Forecast Period	<=== Drier === 90% (1000AF)	70% (1000AF)	Future Conditions 50% (Most Prob) (1000AF)	(% AVG.)	=== Wetter ===> 30% (1000AF)	10% (1000AF)	30 Yr Avg (1000AF)
Rio Grande nr Del Norte							
APR-SEP	129	157	177	33	242	339	531
Platoro Reservoir Inflow							
APR-JUL	12.0	19.7	25	39	30	38	64
APR-SEP	23	27	29	41	35	43	71
Conejos River nr Mogote							
APR-SEP	57	68	75	38	95	125	200



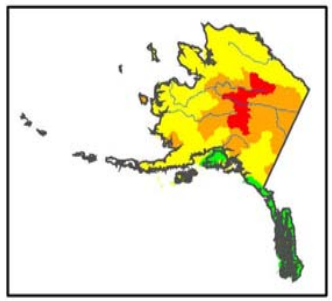


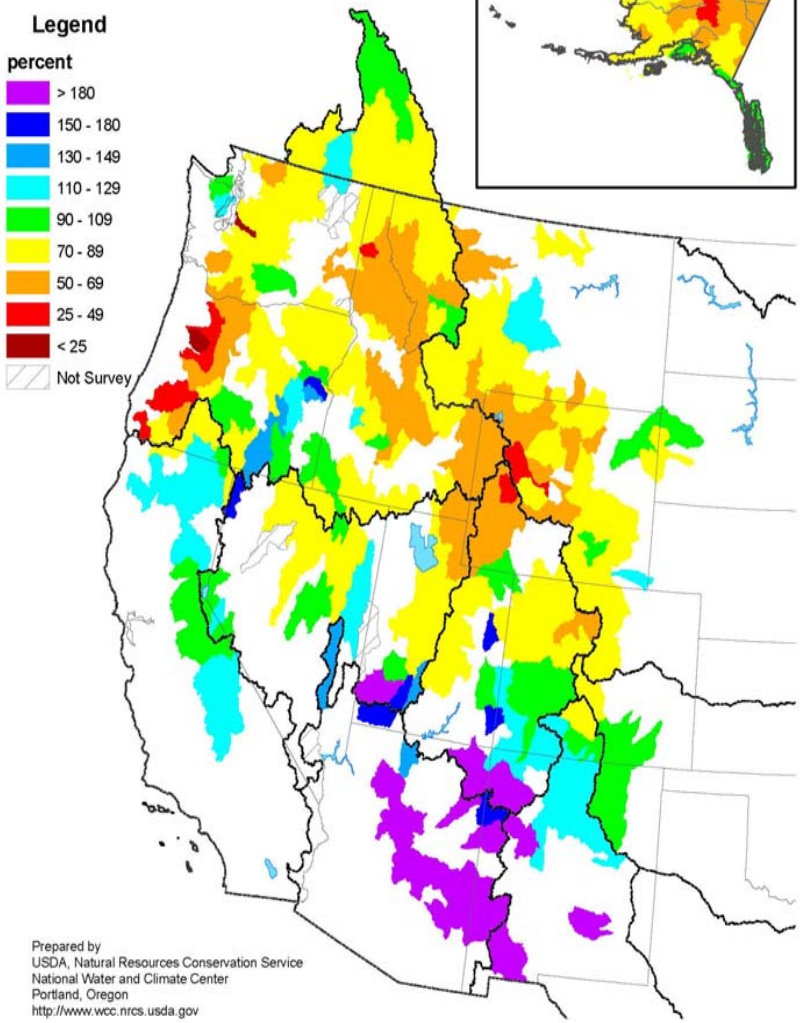
Seasonal water supply volume forecasts (available in a variety of formats) NRCS formats:

United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS

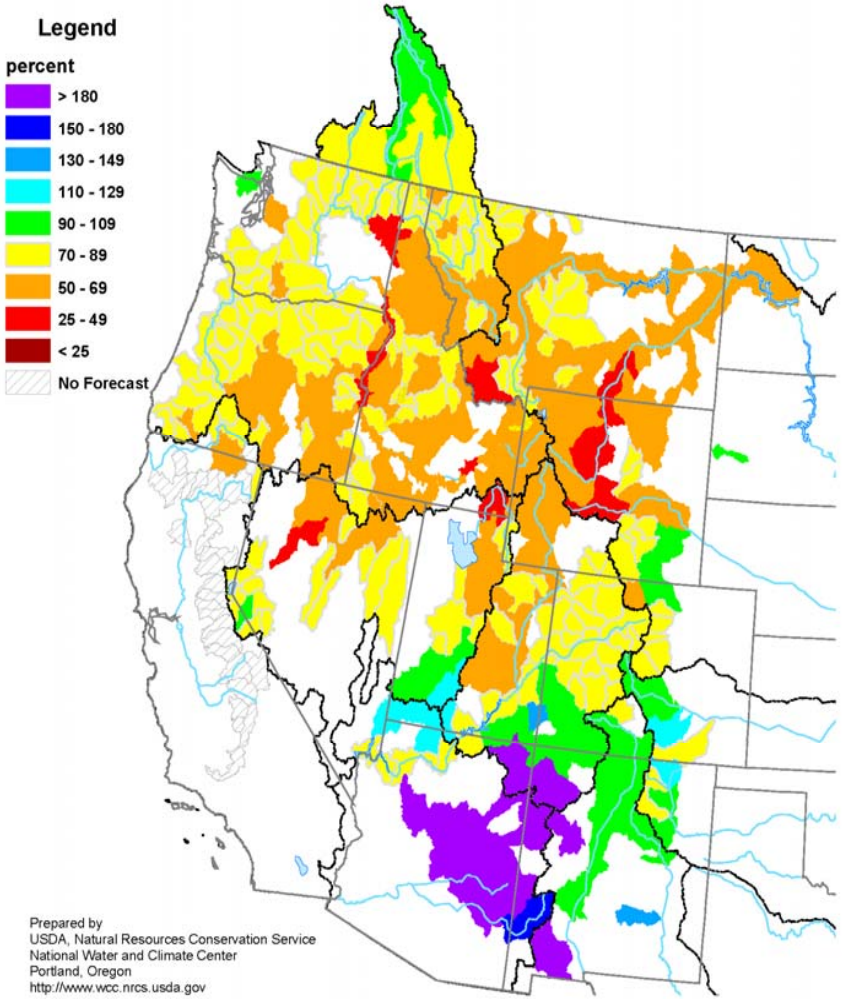
Mountain Snowpack as of February 1, 2010





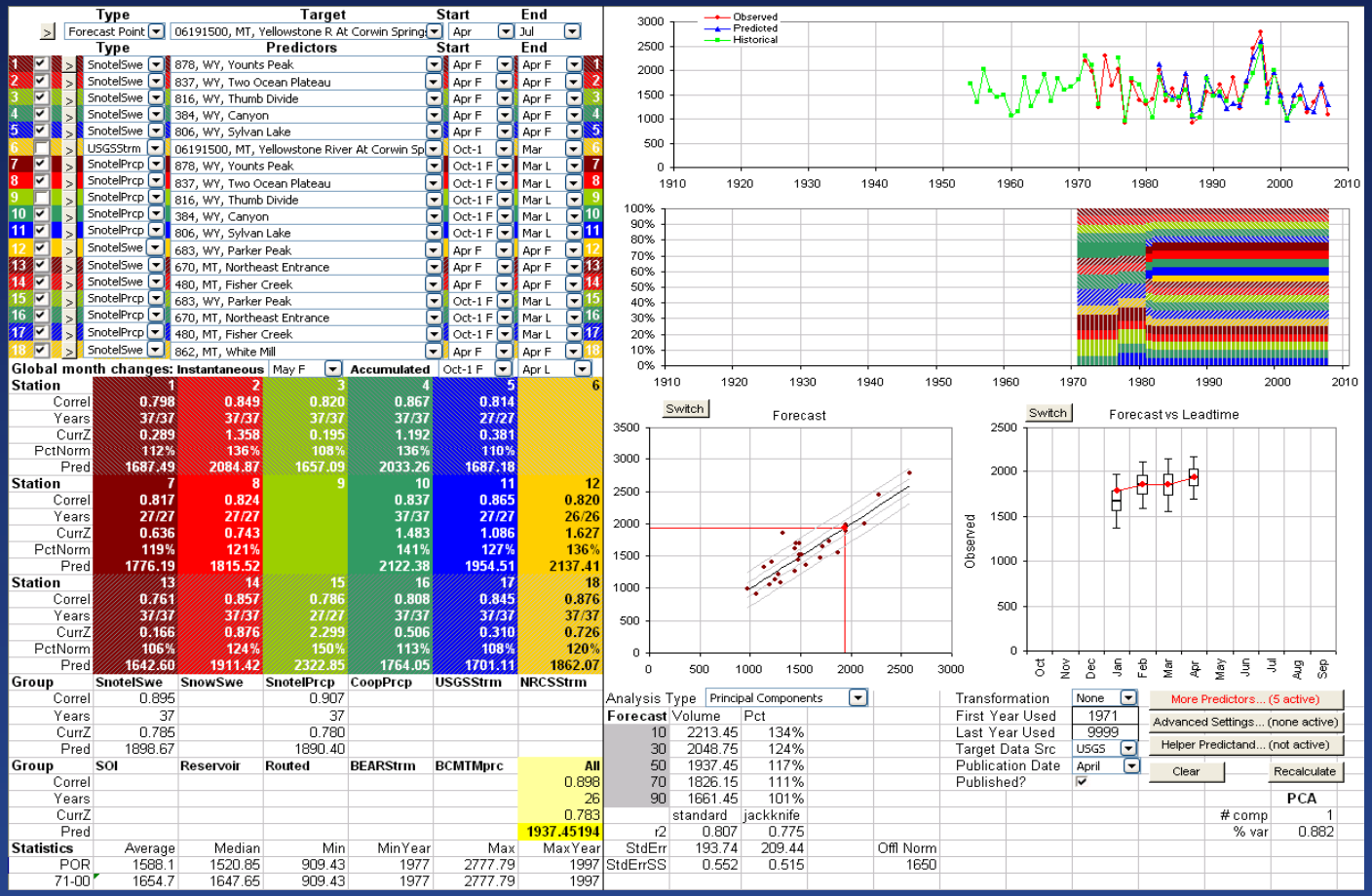
Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

Spring and Summer Streamflow Forecasts as of February 1, 2010



Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

New WSF Process - VIPER



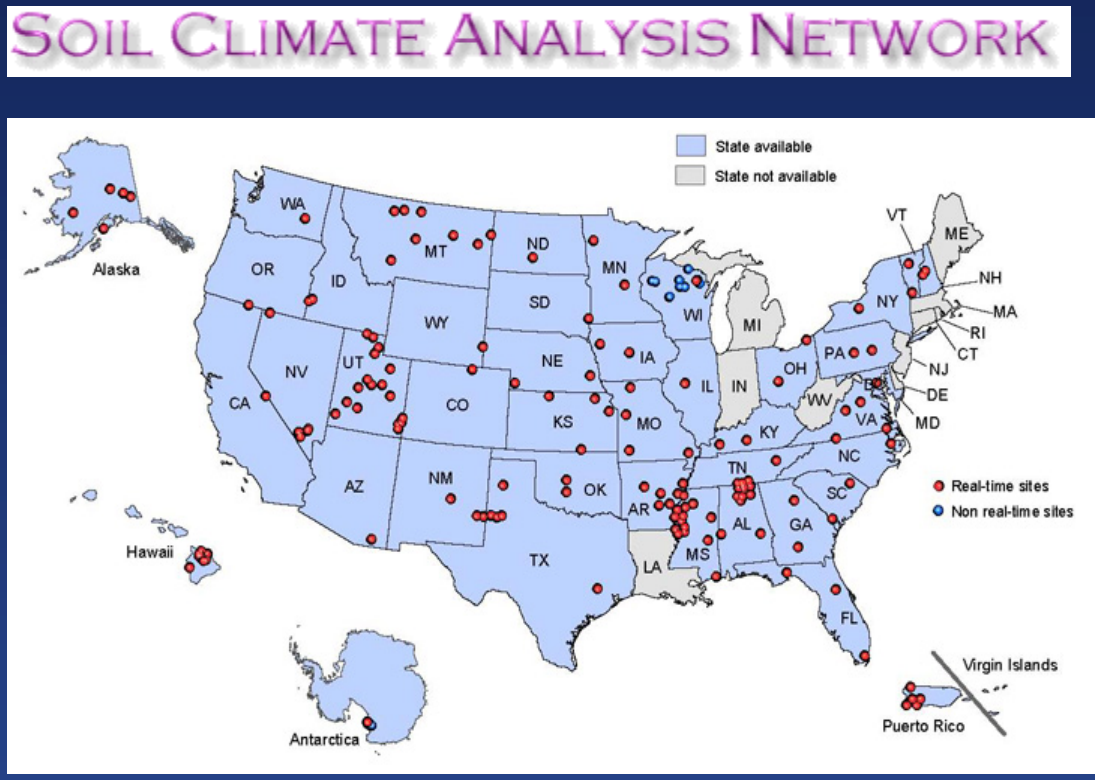
"Visual Interactive Prediction and Estimation Routines"

VIPER features

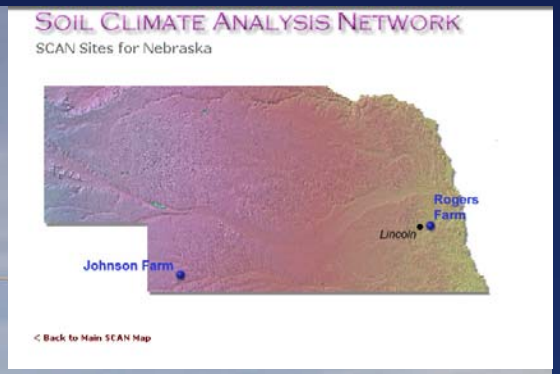
- Predictor search routines
- Predictor time optimization
- Report generation
- Exporting to GIS
- Saving and managing forecast equations/models
- Automated data acquisition from web
- Data management and editing
- Forecast coordination and management
- Downstream relational forecasts
- Configuration management

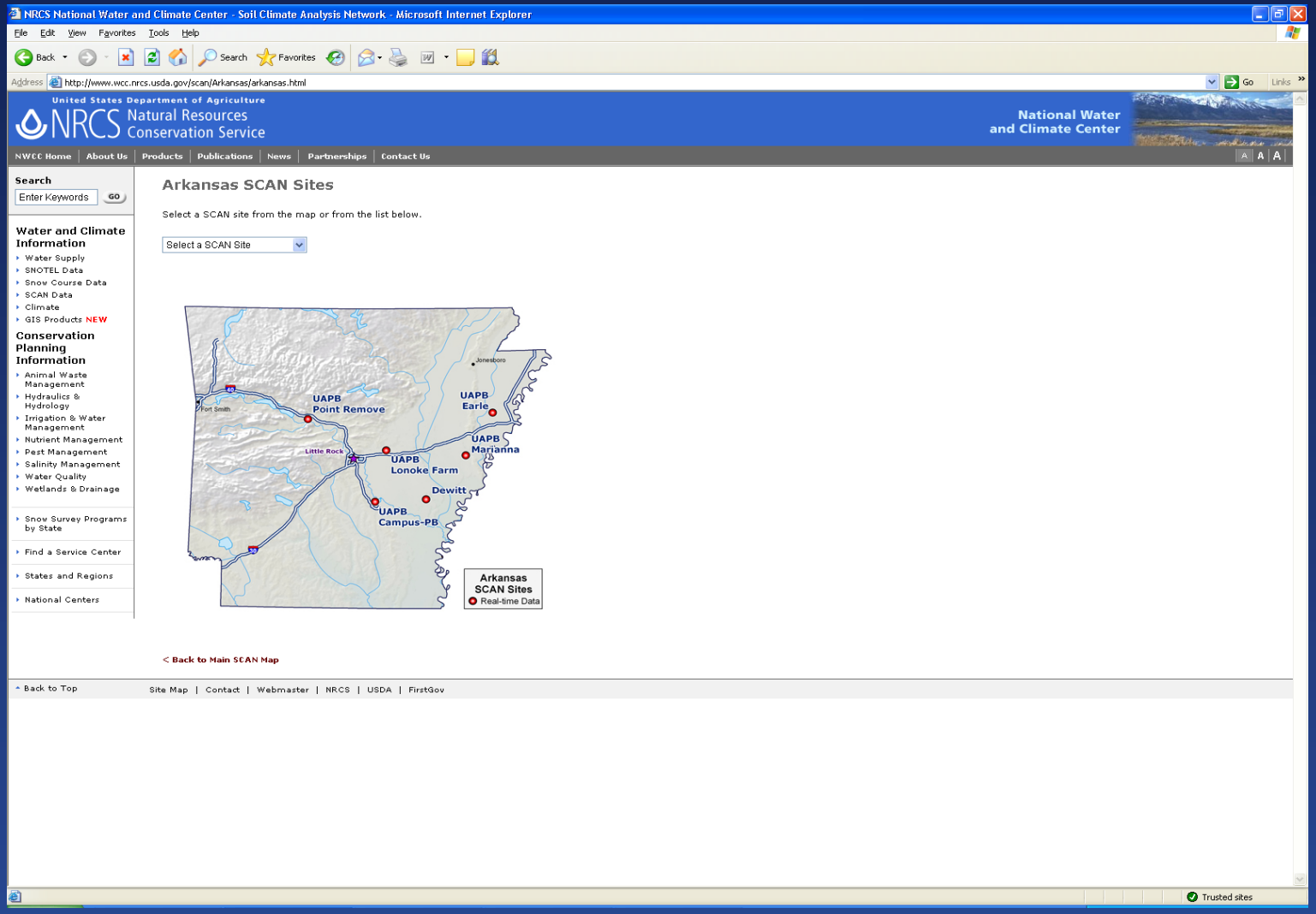
Soil Climate Analysis Network

- **SCAN** (Soil Climate Analysis Network)
  - 151 sites in 40 States
  - Soil-climate monitoring
  - Uses meteor burst telemetry
  - Critical for drought monitoring
- www.wcc.nrcs.usda.gov/scan/



Johnson Farm, Nebraska SCAN Site




NRCS National Water and Climate Center - Soil Climate Analysis Network - Microsoft Internet Explorer
http://www.wcc.nrcs.usda.gov/scan/Arkansas/arkansas.html
United States Department of Agriculture
NRCS Natural Resources Conservation Service
National Water and Climate Center
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Water Supply
SNOTEL Data
Snow Course Data
SCAN Data
Climate
GIS Products NEW
Conservation Planning Information
Animal Waste Management
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Irrigation & Water Management
Nutrient Management
Pest Management
Salinity Management
Water Quality
Wetlands & Drainage
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Arkansas SCAN Sites
Select a SCAN site from the map or from the list below.
Select a SCAN Site
Jonesboro
Fort Smith
Little Rock
UAPB Point Remove
UAPB Earle
UAPB Marianna
UAPB Lonoke Farm
Dewitt
UAPB Campus-PB
Arkansas SCAN Sites
Real-time Data
< Back to Main SCAN Map
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Trusted sites

NWCC - SCAN Site Information - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address http://www.wcc.nrcs.usda.gov/scan/site.pl?sitenum=2085&state=ar

United States Department of Agriculture
NRCS Natural Resources Conservation Service

National Water and Climate Center

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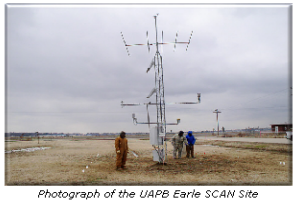
SCAN Site Information for UAPB Earle in Arkansas

UAPB Earle

Site Number: 2085
Crittenden County

Latitude: 35° 17' N
Longitude: 90° 27' W
Elevation: 213 feet
Period of Record: 2/7/2004 to Present

- Soils Pedon Information
  (Information unavailable, soil currently being analyzed)
- Sensor History
- Sensor Label Descriptions



Photograph of the UAPB Earle SCAN Site

Data Reports: - *Provisional Data - Subject to Revision*

- Soil Moisture/Temperature reports for this site in table format:

Last 1 Day | Generate Report

- TK Formatted - Select HERE to get Todays Data - or choose from a range of days below

Daily Reports for the Current Month of June
Select the Day or Day(s) by Selecting Below:
(use Shift-Click or CTRL-Click to select a *range* of days)

1 2 3 4 5 | Submit Query

Daily Reports for the Previous Month of May
Select the Day or Day(s) by Selecting Below:
(use Shift-Click or CTRL-Click to select a *range* of days)

1 2 3 4 5 | Submit Query

- TK Formatted Historical Files for this Site (FTP Server)

< Back to: [Arkansas Page] - [SCAN Main Page]

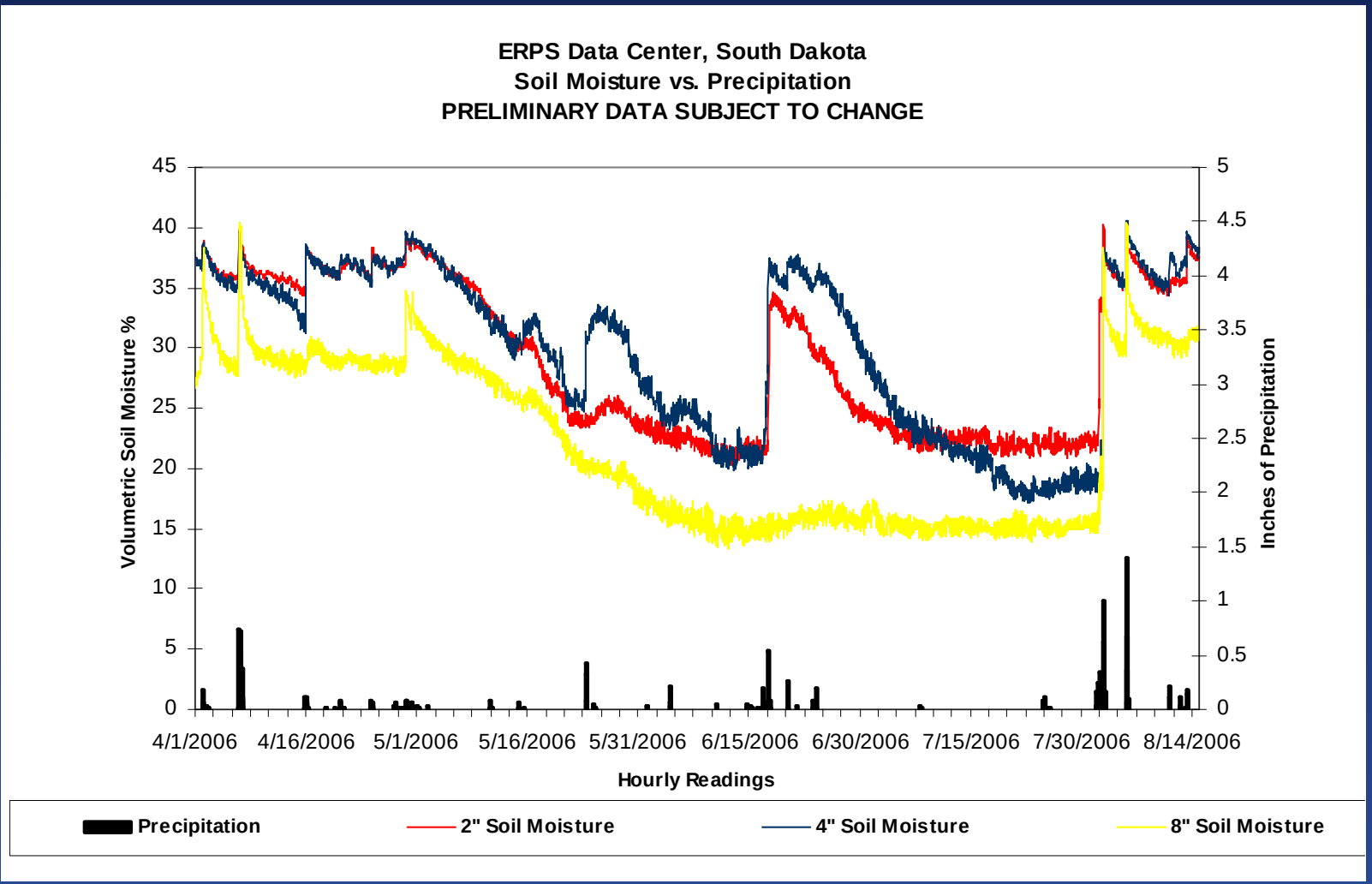
^ Back to Top

Site Map | Contact | Webmaster | NRCS | USDA | FirstGov

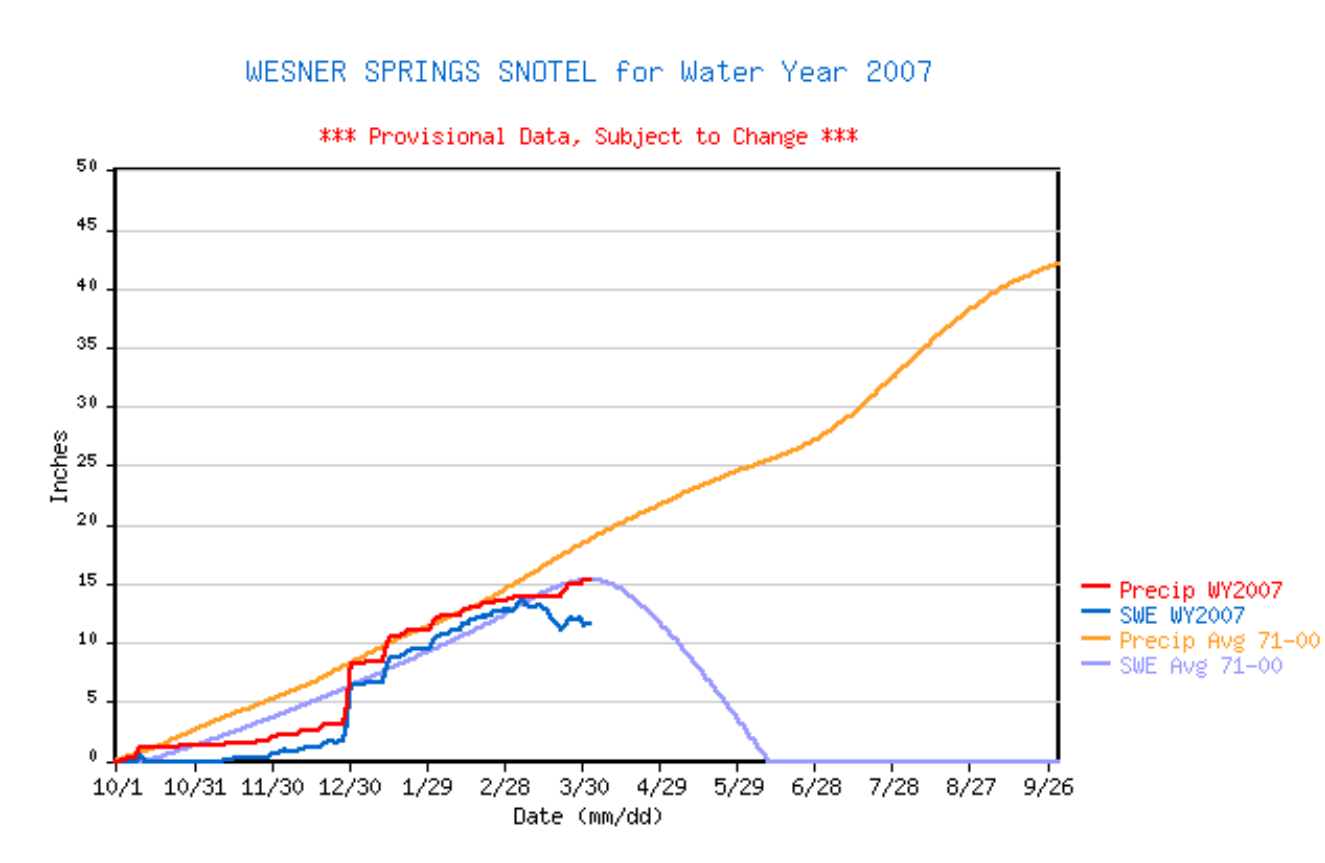
Done

Trusted sites

SCAN Data Plot

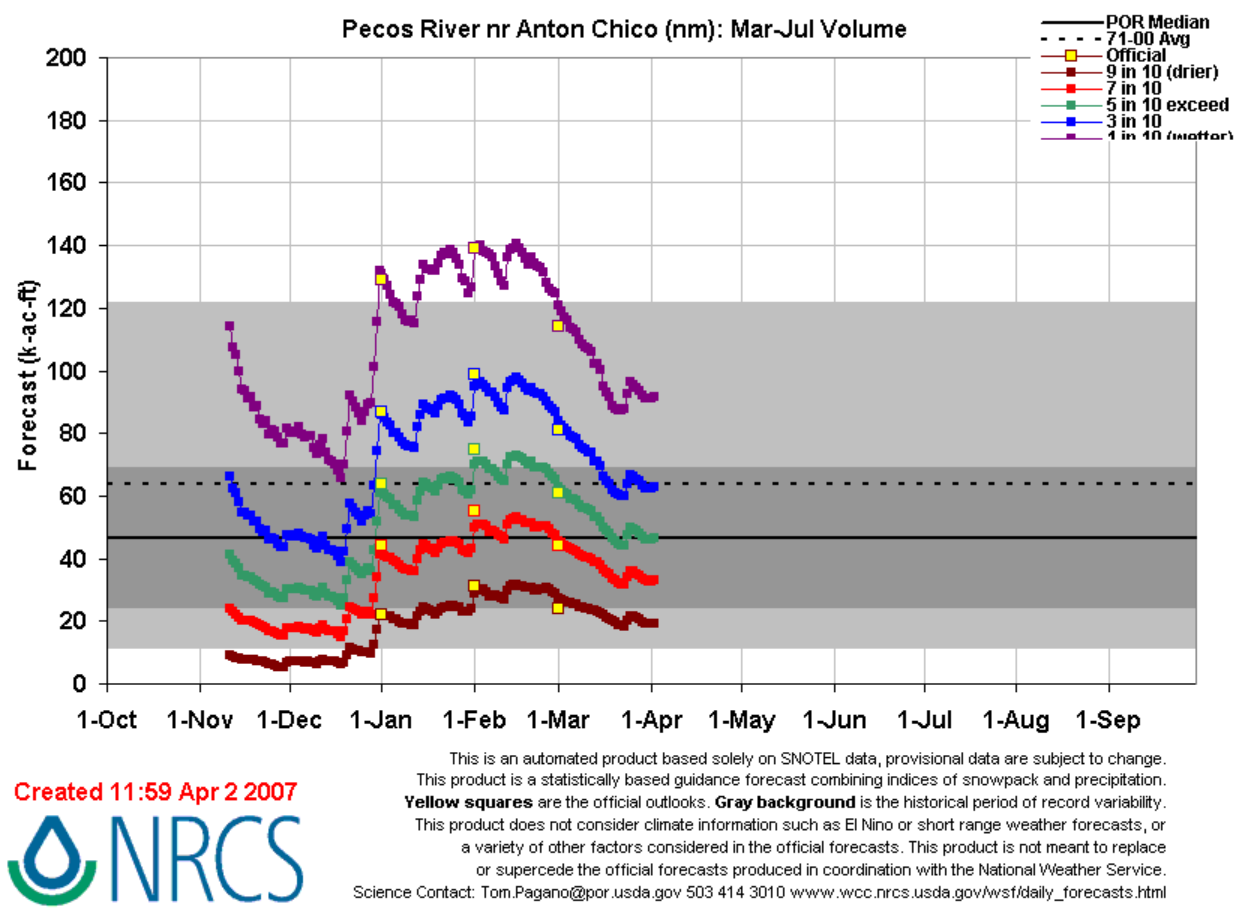


Other Tools – Water Supply Forecasting



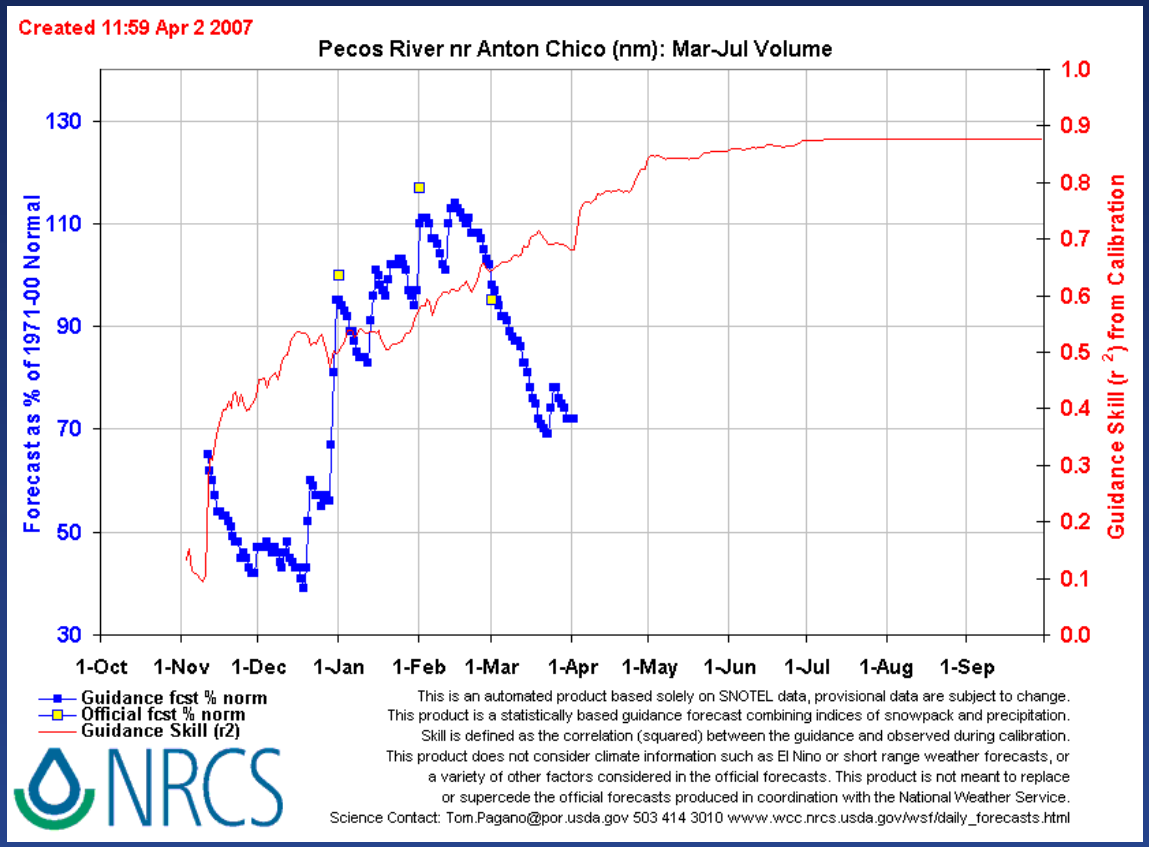
Rapid changes in snowpack affect water supply forecasts

Daily WSF Guidance



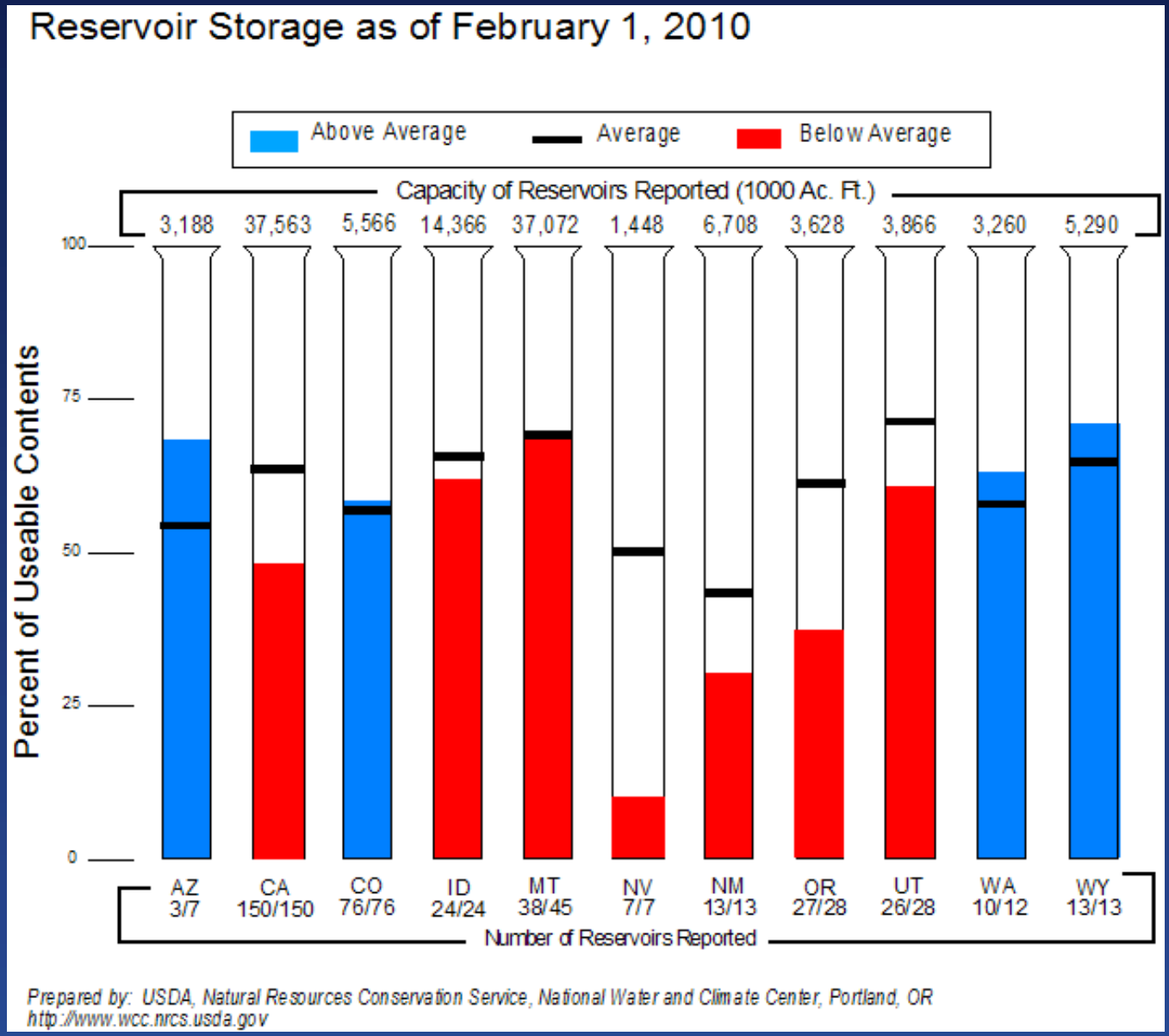
Daily Water Supply Guidance Forecasts use daily SNOTEL data

Daily WSF – Volume & Skill

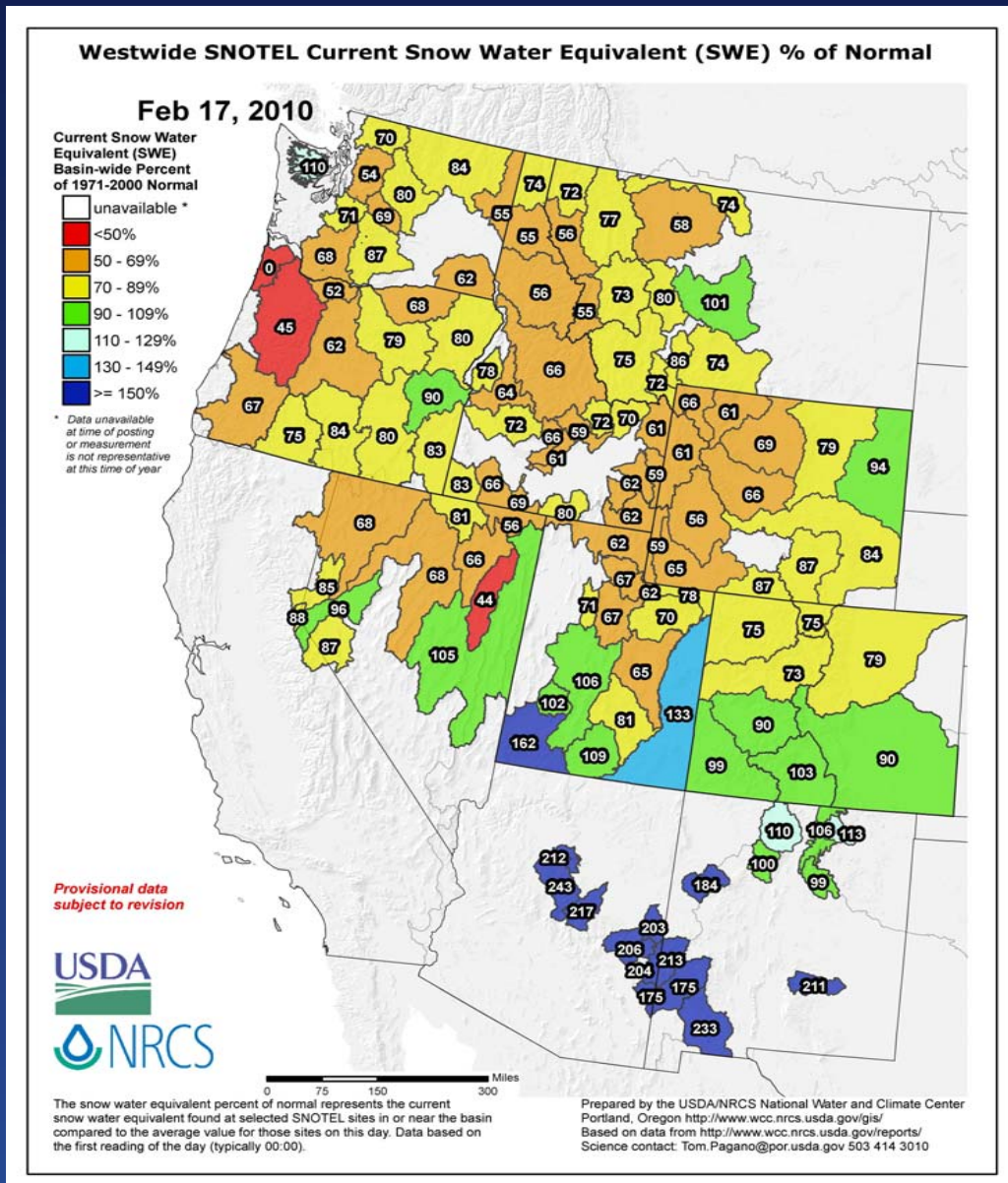


Daily Water Supply Guidance Forecasts use daily SNOTEL data

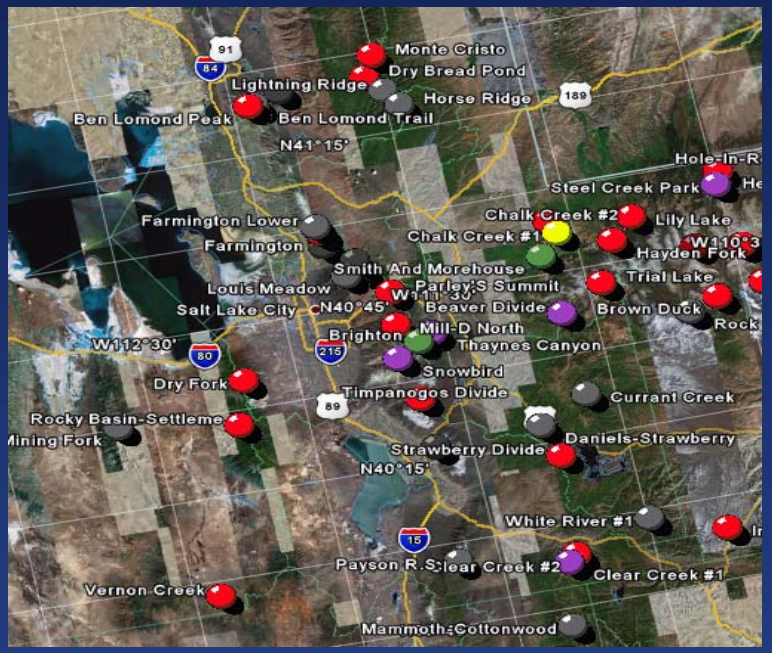
Reservoir Storage as of February 1, 2010



Prepared by: USDA, Natural Resources Conservation Service, National Water and Climate Center, Portland, OR
http://www.wcc.nrcs.usda.gov


Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal
Feb 17, 2010
Current Snow Water Equivalent (SWE) Basin-wide Percent of 1971-2000 Normal
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
USDA
NRCS
0 75 150 300 Miles
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 the USDA/NRCS National Water and Climate Center
Portland, Oregon http://www.wcc.nrcs.usda.gov/gis/
Based on data from http://www.wcc.nrcs.usda.gov/reports/
Science contact: Tom.Pagano@por.usda.gov 503 414 3010

Google Earth Viewers

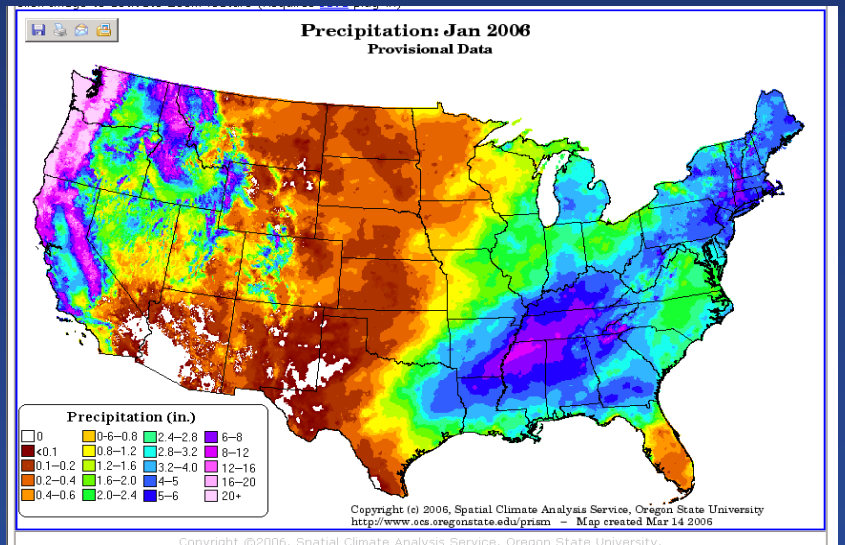


- Google Earth
  - SNOTEL
    http://www.wcc.nrcs.usda.gov/snotel/earth/index.html
  - Water Supply Forecasts
    http://www.wcc.nrcs.usda.gov/wsf/earth/index.html

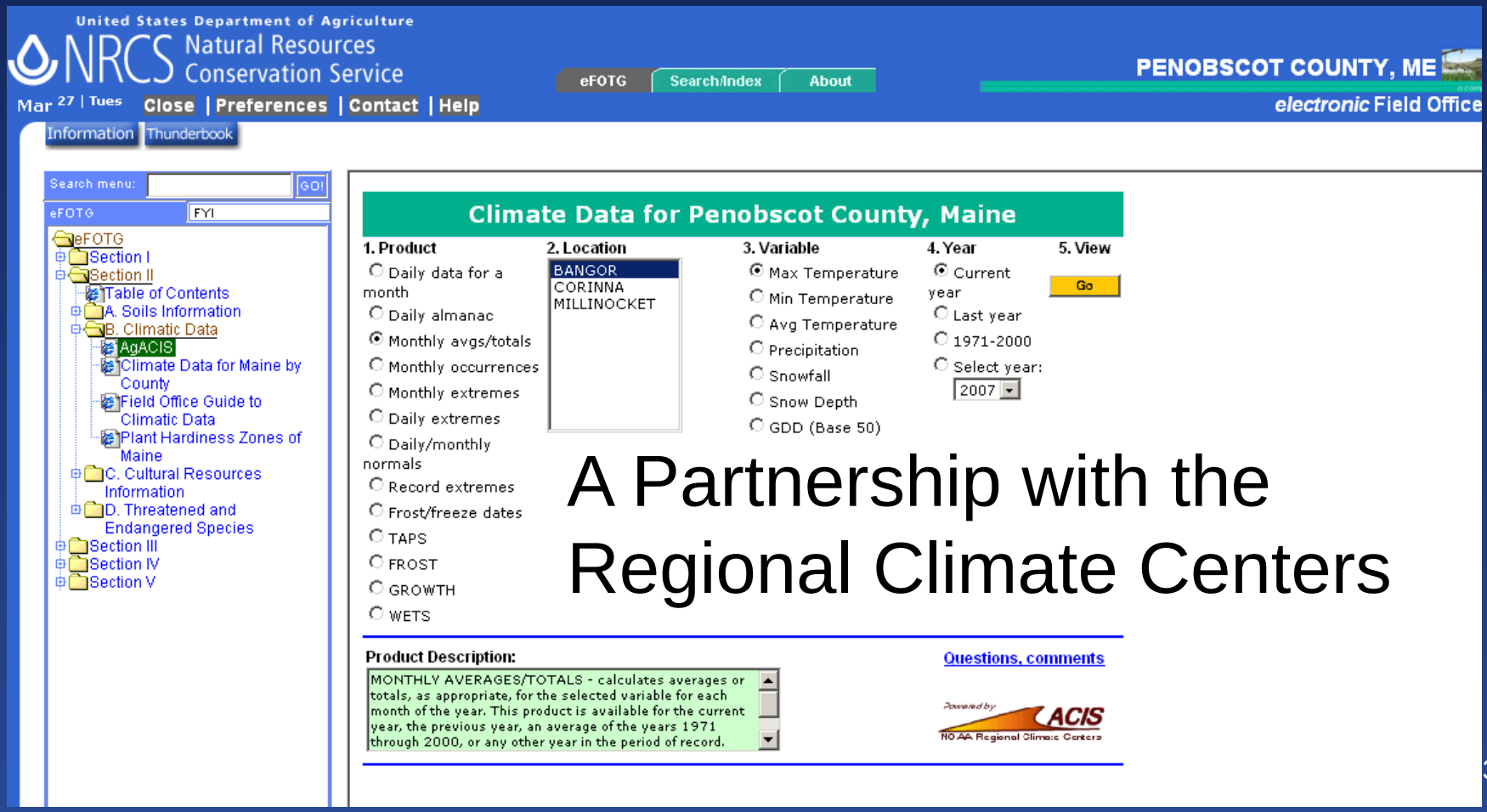
Climate Maps

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

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



AgACIS - Agricultural Applied Climate Information System



A Partnership with the Regional Climate Centers

AgACIS Products

BANGOR INTL AP (170355)
Observed Daily Data
Month: Mar 2007

Day	Max Temp	Min Temp	Avg Temp	GDD B50	GDD B40	Total Prcpn	New Snow	Snow Depth
1	34	9	21.5	0	0	0.00	0.0	7
2	34	18	26.0	0	0	0.74	6.6	8
3	44	13	28.5	0	0	T	T	13
4	39	26	32.5	0	0	T	T	11
5	32	18	25.0	0	0	0.03	0.5	10
6	18	-6	6.0	0	0	0.00	0.0	10
7	14	-6	4.0	0	0	0.00	0.0	10
8	8	-11	-1.5	0	0	T	T	10
9	29	-11	9.0	0	0	0.00	0.0	10
10	40	19	29.5	0	0	0.11	0.0	9
11	47	30	38.5	0	0	0.31	0.0	6
12	46	29	37.5	0	0	0.00	0.0	2
13	49	25	37.0	0	0	0.00	0.0	2
14	48	38	43.0	0	3	0.13	0.0	0
15	46	27	36.5	0	0	0.24	0.0	0
16	27	16	21.5	0	0	0.34	2.8	3
17	47	19	33.0	0	0	2.52	1.0	4
18	29	24	26.5	0	0	T	T	3
19	33	20	26.5	0	0	T	T	2
20	38	19	28.5	0	0	0.10	0.7	3
21	34	10	22.0	0	0	0.00	0.0	2
22	48	28	38.0	0	0	T	0.0	0
23	53	27	40.0	0	0	0.00	0.0	0
24	45	26	35.5	0	0	T	T	T
25	49	25	37.0	0	0	0.00	0.0	0
26	44	24	34.0	0	0	0.01	0.0	0
27	M	M	M	M	M	M	M	M
28	M	M	M	M	M	M	M	M
29	M	M	M	M	M	M	M	M
30	M	M	M	M	M	M	M	M
31	M	M	M	M	M	M	M	M
Smry	37.5	17.5	27.5	0	3	4.53	11.6	4.8

Product generated by ACIS - NOAA Regional Climate Centers.

BANGOR INTL AP (170355)
Monthly Totals/Averages
Precipitation (inches)
Years: 1971-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	3.17	2.51	3.45	3.37	3.47	3.44	3.24	3.15	3.59	3.32	3.71	3.46	39.40

Product generated by ACIS - NOAA Regional Climate Centers.

CORINNA (171628)
Daily Climate Normals
Maximum Temperature (degrees F)
1971-2000

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	27	26	33	45	59	71	77	80	74	63	50	37
2	27	27	34	45	60	71	78	80	73	63	50	36
3	26	27	34	46	60	72	78	80	73	62	49	36
4	26	27	35	46	61	72	78	80	73	62	49	35
5	26	27	35	47	61	72	78	79	72	62	48	35
6	26	27	35	47	62	72	78	79	72	61	48	34
7	26	27	36	48	62	72	78	79	72	61	48	34
8	26	28	36	48	63	73	79	79	71	60	47	34
9	26	28	36	48	63	73	79	79	71	60	47	33
10	26	28	37	49	64	73	79	79	71	60	46	33
11	26	28	37	49	64	73	79	79	70	59	46	32
12	26	28	37	50	65	73	79	79	70	59	45	32
13	25	29	38	50	65	74	79	79	70	58	45	32
14	25	29	38	51	65	74	79	78	69	58	44	31
15	25	29	39	51	66	74	79	78	69	58	44	31
16	25	29	39	52	66	74	79	78	69	57	44	31
17	25	30	39	52	67	75	79	78	68	57	43	30
18	25	30	40	53	67	75	80	78	68	56	43	30
19	25	30	40	53	67	75	80	77	68	56	42	30
20	25	31	40	54	68	75	80	77	67	56	42	30
21	25	31	41	54	68	75	80	77	67	55	41	29
22	25	31	41	54	68	76	80	77	66	55	41	29
23	25	31	42	55	69	76	80	76	66	54	40	29
24	26	32	42	56	69	76	80	76	66	54	40	28
25	26	32	42	56	69	76	80	76	65	53	39	28
26	26	32	43	57	70	76	80	76	65	53	39	28
27	26	33	43	57	70	77	80	75	65	52	38	28
28	26	33	44	58	70	77	80	75	64	52	38	28
29	26	33	44	58	70	77	80	75	64	52	38	27
30	26	-	44	59	71	77	80	74	63	51	37	27
31	26	-	45	-	71	-	80	74	-	51	-	27
Month	25.7	29.3	39.0	51.6	65.8	74.2	79.2	77.6	68.7	57.1	43.7	31.1

Sum/average of daily normals might not match monthly normal due to rounding.

Product generated by ACIS - NOAA Regional Climate Centers.

AgACIS Features

- Fully integrated with NRCS e-Field Office Technical Guide
- Historical and real-time data
- Updated in real-time
- Seamless Internet interface to model development
- Opportunity to leverage climate expertise
- Basis for integrating many other climate networks

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

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Energy and Water Programs within the United States Department of Agriculture

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The United States Department of Agriculture (USDA) is one of the nation's oldest Federal departments. It employs more than 100,000 people whose work touches the lives of every American in various ways every day. It is one of the most complex departments in the Federal Government, with more than 300 programs that spend more than $75 billion each year to help lead and manage a variety of food, agriculture, natural resources, and related programs. The USDA goals and objectives, and the implementation of its programs, are sound public policy based on the best available science. USDA works with individuals, agricultural and natural resources organizations, and units of government throughout the U.S., and in many other countries throughout the world, to enhance economic opportunities for agricultural producers and rural communities, to protect the nation's food supply, to improve nutrition and health, and to protect the nation's natural resources and environment.

Energy and water programs are critical components of the USDA. Agriculture in the U.S. is both a major consumer and producer of energy, with crops, forests and livestock requiring energy use for all aspects of production in the field, transport and processing, and conversely, the use of biofuels as a growing source of energy throughout the country. Irrigation is the largest user of freshwater in the U.S. and accounts for about 65 percent of total water withdrawals, excluding water used for thermoelectric power (Schaible 2004). Irrigation is critical in the U.S. as nearly half the value of all crops sold comes from the 16 percent of harvested cropland that is irrigated (Schaible 2004). Because energy and water are so critical for agriculture, the USDA strives to meet emerging issues by supporting the development and use of new technology for increased energy production and energy conservation, and by providing water supply information along with technical and financial assistance to improve the management decisions affecting both water quantity and quality. This paper provides a brief overview of the many energy and water programs managed in the USDA.

Historic Overview

The USDA was established on May 15, 1862 when President Abraham Lincoln signed the Department of Agriculture Organic Act into law. In addition to establishing this department, 1862 also saw the Homestead Act approved; the Act opened new lands for settlement and provided 160 acres of public lands to heads of families and adults. Also important was the Morrill Land Grant College Act, which donated public lands for colleges focused on agriculture and mechanical arts. The fact that this legislation passed highlights the importance which President Lincoln and Congress placed on agriculture and its place in the American society, the economy, and the future.

Authorities and Funding

The USDA was elevated to cabinet status in 1889. USDA develops and executes policy dealing with various aspects of farming, agricultural programs and activities, and food production, distribution, and safety. In addition, the department oversees research, assistance to rural communities, conservation and protection of natural resources, and global trade.

Most funding in USDA is authorized through

Thank you

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