American Meteorological Society - Portland Oregon Chapter Meeting
February 25, 2021

Diamond Lake SNOTEL
Burned in Thielsen Fire – 09/09/2020
Klamath Basin

Diamond Lake SNOTEL
Re-Installed – 10/21/2020
Klamath Basin

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TOPICS

- Brief History of NRCS Snow Survey and Water Supply Forecasting Program
- Snow Survey Measurements, Data Uses, and Forecasts
- Status of Water Year 2021
- New NRCS Oregon Snow Survey Web Pages with Products

NRCS Natural Resources Conservation Service

OVERVIEW

- Approximately 50-80% of western water supply comes from snowmelt run-off
- Measurement of snow water content for determination of water supply has been on-going for over 100 years
- Due to the significance of snowmelt run-off as a major contributor to streamflow, the federal government funded a program to measure western snowpack and ultimately forecast future streamflows volumes
- Snow measurements are conducted using several methods, both manual and automated
- Forecasts and numerous other products generated from snow data are used for water supply, drought identification, recreation, flood forecasting, and many other applications

NRCS Natural Resources Conservation Service

Brief History - Snow Survey Measurement and Water Supply Forecasting in the West

- Dr. James Church in Lake Tahoe Region initiated some of the first snow surveys to determine snow water content in 1906-1910
- Snow surveys were initiated with the concept that streamflow could be forecast using snow data (mainly water content) as a primary input.
- Cooperative snow survey programs were established in:
  - California 1917
  - Nevada, Wyoming 1919
  - Washington 1920
  - Montana 1922
  - Utah 1923
  - Oregon 1928
- These programs were administered by cooperators, such as State Engineers, Irrigation Districts, Power and Utility Companies, Universities

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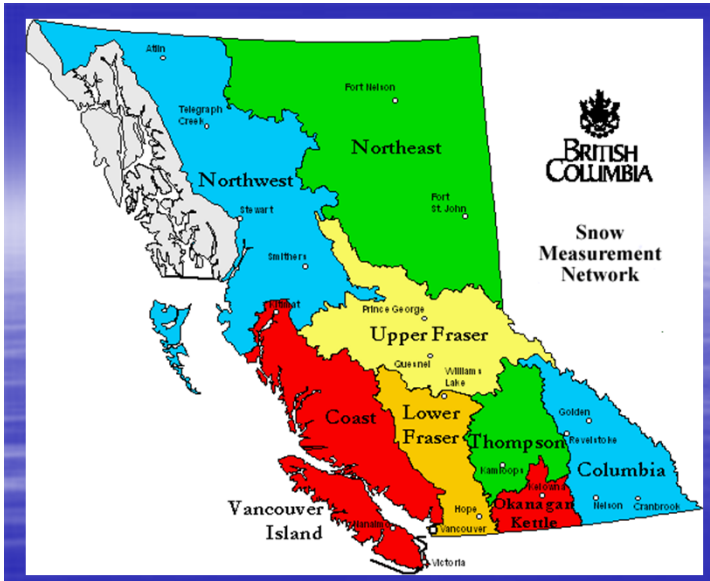
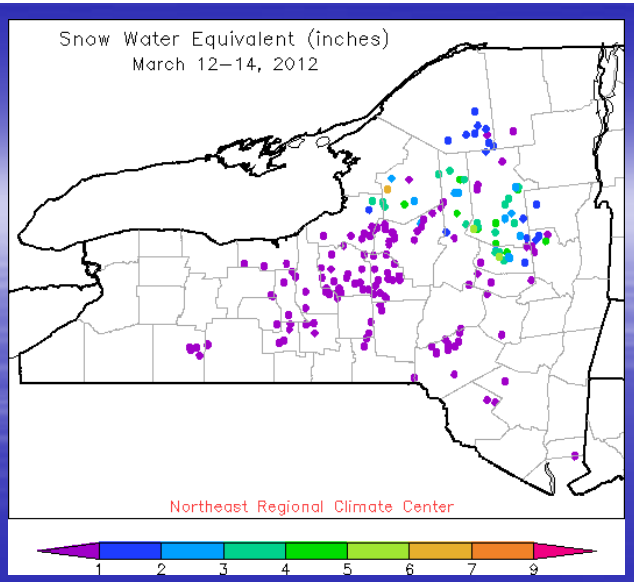
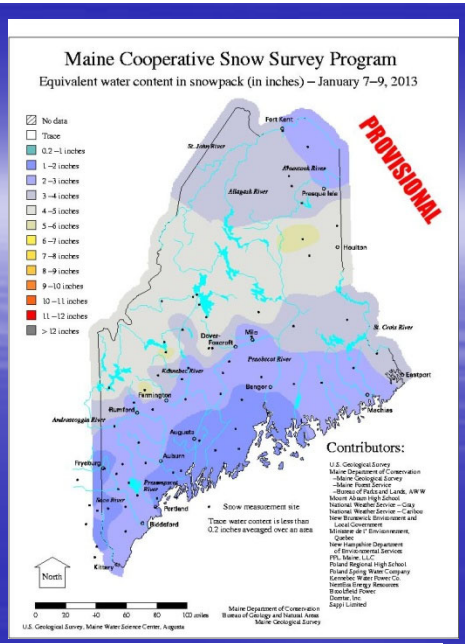
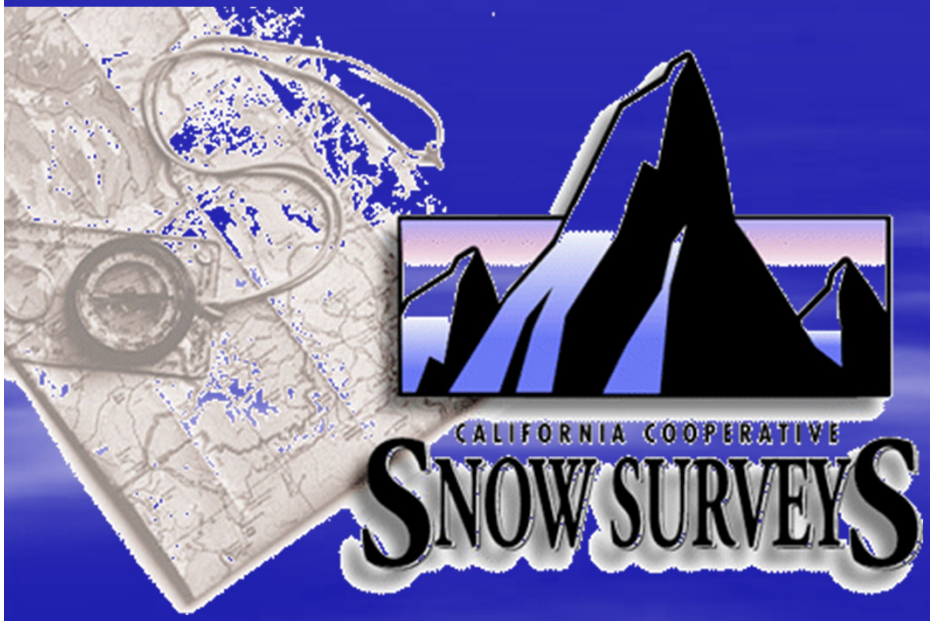
Brief History - Snow Survey Measurement and Water Supply Forecasting in the West
(continued)

- In 1935 cooperatives were brought under federal coordination after the 1934 drought. Among the agencies considered to administer the new program were the Weather Bureau (then a part of USDA) and the Forest Service.
- The program was merged into the Bureau Of Agricultural Engineering (USBAE). In 1939 USBAE was transferred to Soil Conservation Service, (SCS) Research Division.
- In 1953, the SCS Research Division was transferred to Agricultural Research Service (ARS), however the Snow Survey program remained an SCS program.
- In 1994, SCS became the Natural Resources Conservation Service (NRCS), snow surveys remains a program within the agency

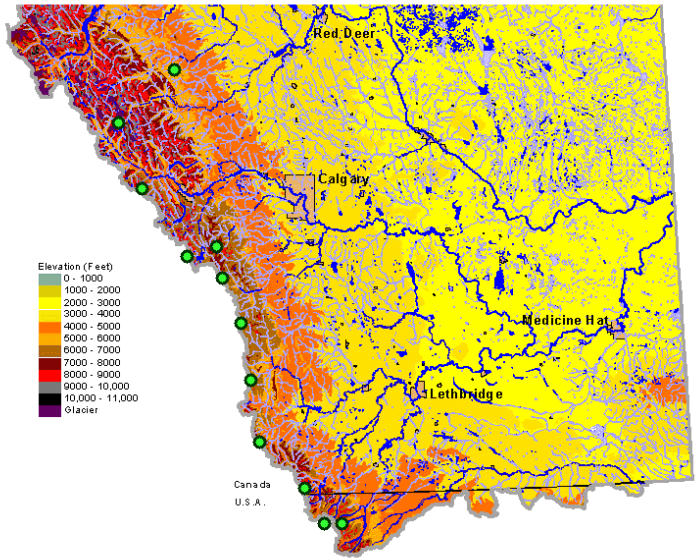








South Saskatchewan River Basin
Oldman River Sub Basin
Snow Data



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COMMON TERMINOLGY

SWE = Snow Water Equivalent, the depth of water in inches if snow was melted to liquid

Water Year Precipitation = Amount of precipitation (liquid and frozen) accumulated from October 1 through date of reference. Current Water Year 2021 is the period – October 1, 2020 through September 30, 2021.

Streamflow Forecast = Issued on the first of each month (from January through June). Refers to the volume of water (Thousands of Acre Feet) forecast to pass by a real-time stream gaging station. NRCS statistical volume forecasts apply probability statistics (10%, 30%, 50%, 70%, 90%, etc.).

Snow Pillow = Large bladder filled with organic antifreeze solution and water to measure the SWE in snowpack. Snow pillows measure the weight of the water in the snowpack and a calibrated pressure transducer translates the output to inches of water.

SNOTEL Site = Automated Hydro-meteorological site: SNOwpack TELemetry

NRCS Natural Resources Conservation Service

NRCS Oregon and Washington Staffing

Scott Oviatt, NRCS Oregon Snow Survey Supervisory Hydrologist

Lauren Austin, NRCS Oregon Hydrologist

Allen Buckman, NRCS Oregon Field Hydrologist

Dan Fries, NRCS Oregon Hydrologic Technician

Scott Pattee, NRCS Washington Water Supply Specialist

Nick Steele, NRCS Oregon Hydrologist

Matt Warbritton, NRCS Oregon Hydrologist

Zoe Wellschlager, NRCS Oregon Field Hydrologist

VACANT, NRCS Oregon Hydrologist

NRCS Natural Resources Conservation Service

NRCS Oregon Snow Staff Responsibilities

Staff of 8 Hydrologists and Hydrologic Technicians responsible for:

- ✓ Snow course data quality control and archival
- ✓ Snow course site maintenance (snow-free season)

- ✓ SNOTEL data quality control, review and archival
- ✓ SNOTEL site maintenance (snow-free season)
- ✓ SNOTEL site emergency repair/equipment removal (Wildfire, wildlife)

- ✓ Snow data analysis, interpretation, for water supply determinations and forecasting
- ✓ Snow and water supply data dissemination to partners/public
- ✓ Develop and release state water supply outlook reports
- ✓ Handle media contacts and issue state news releases
- ✓ Work with partners, state, federal, and local entities in assessing/mitigating drought and flood conditions

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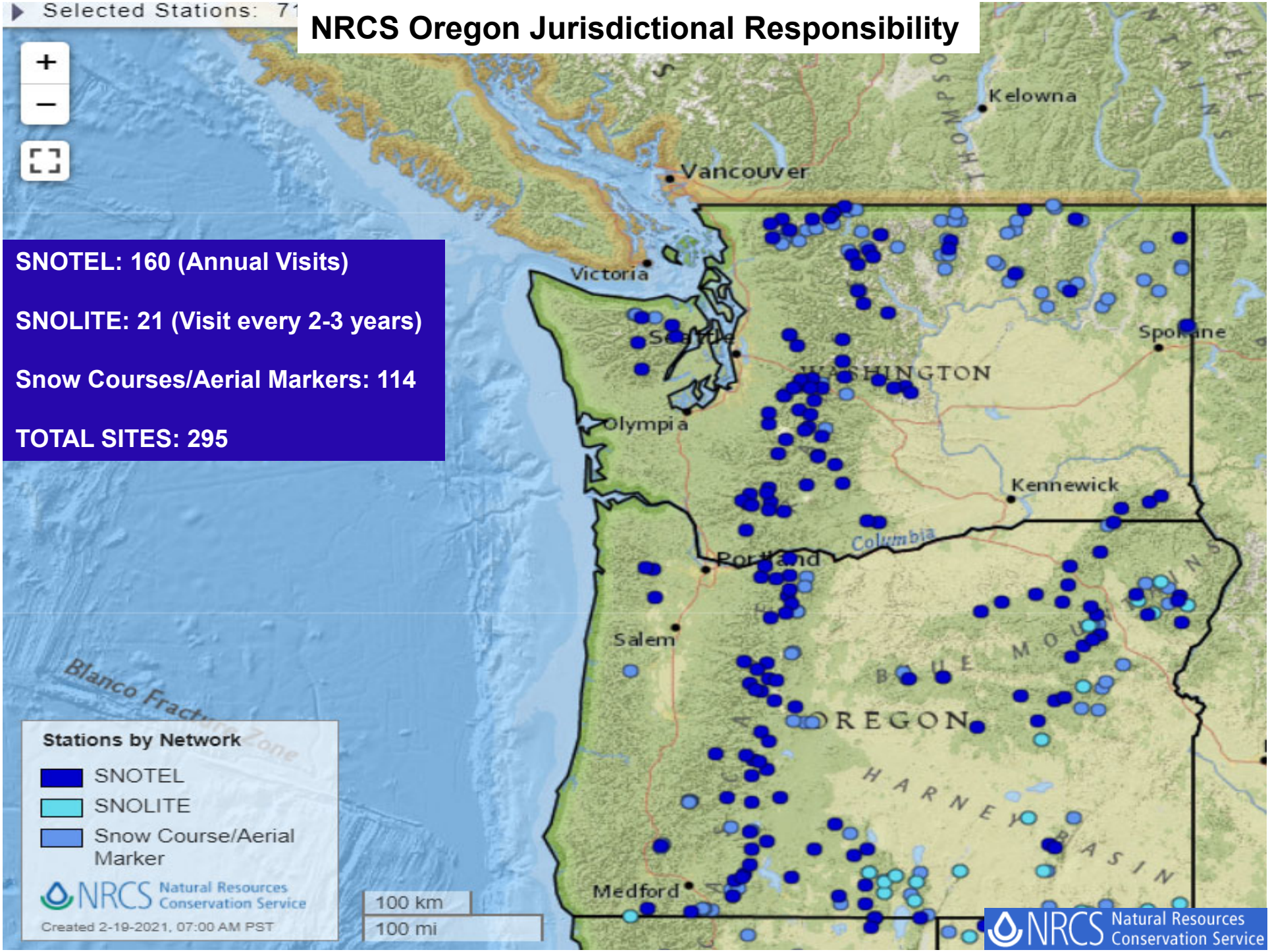
NRCS Oregon Jurisdictional Responsibility

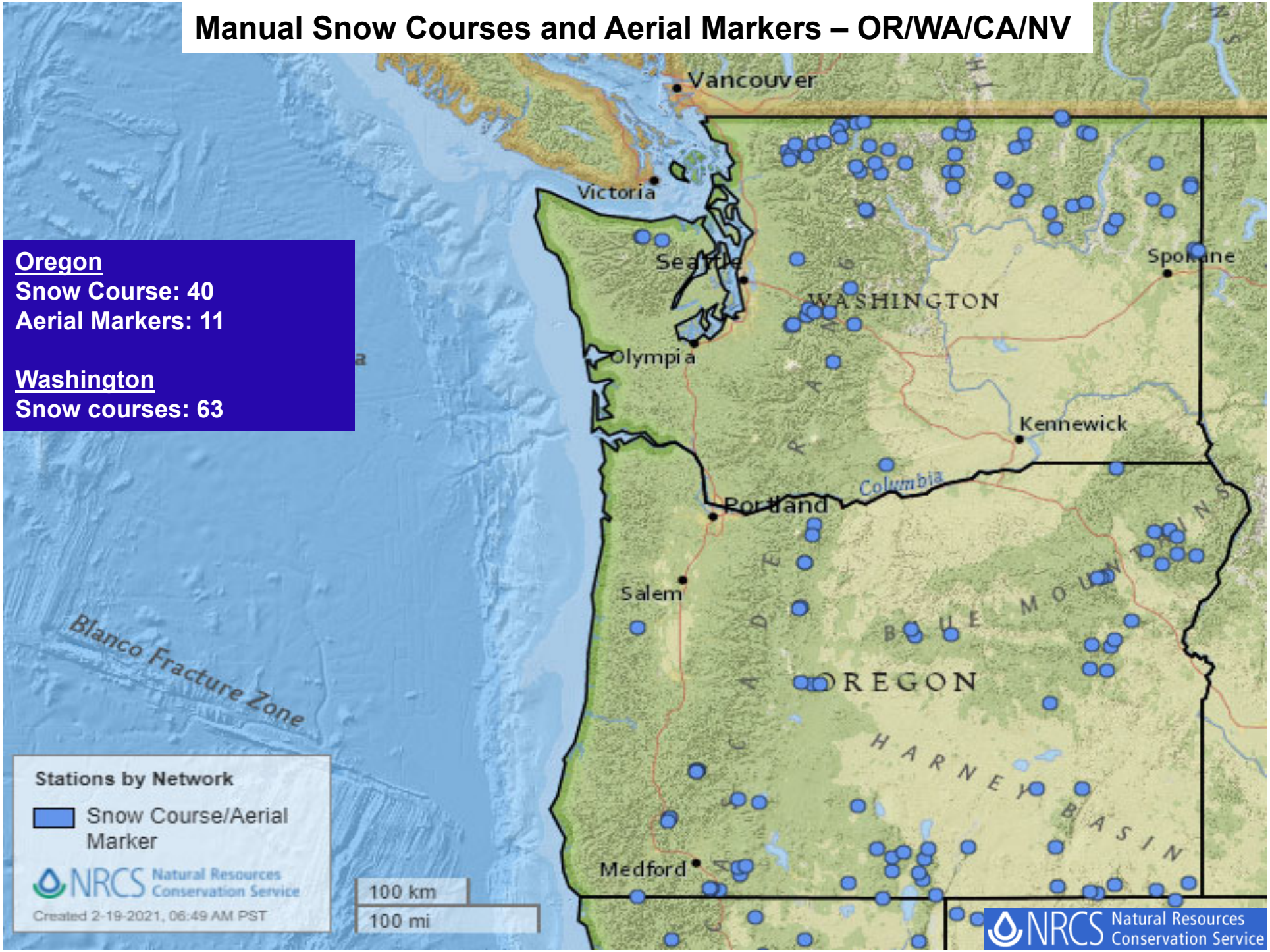


SNOW COURSES and AERIAL MARKERS:

Snow Courses: Locations (essentially transects of 5-10 points) where manual monthly snow measurements are collected during winter (Jan-May) to determine water content and depth of snowpack. Permanent locations that represent the snowpack conditions at a given elevation and geographical aspect.

Aerial markers: Used to measure the depth of snow. The markers are located in remote locations that are difficult to reach by over-snow travel. Consisting of a single point marked by a vertical support with crossbars that are observed or photographed by aircraft flyover.

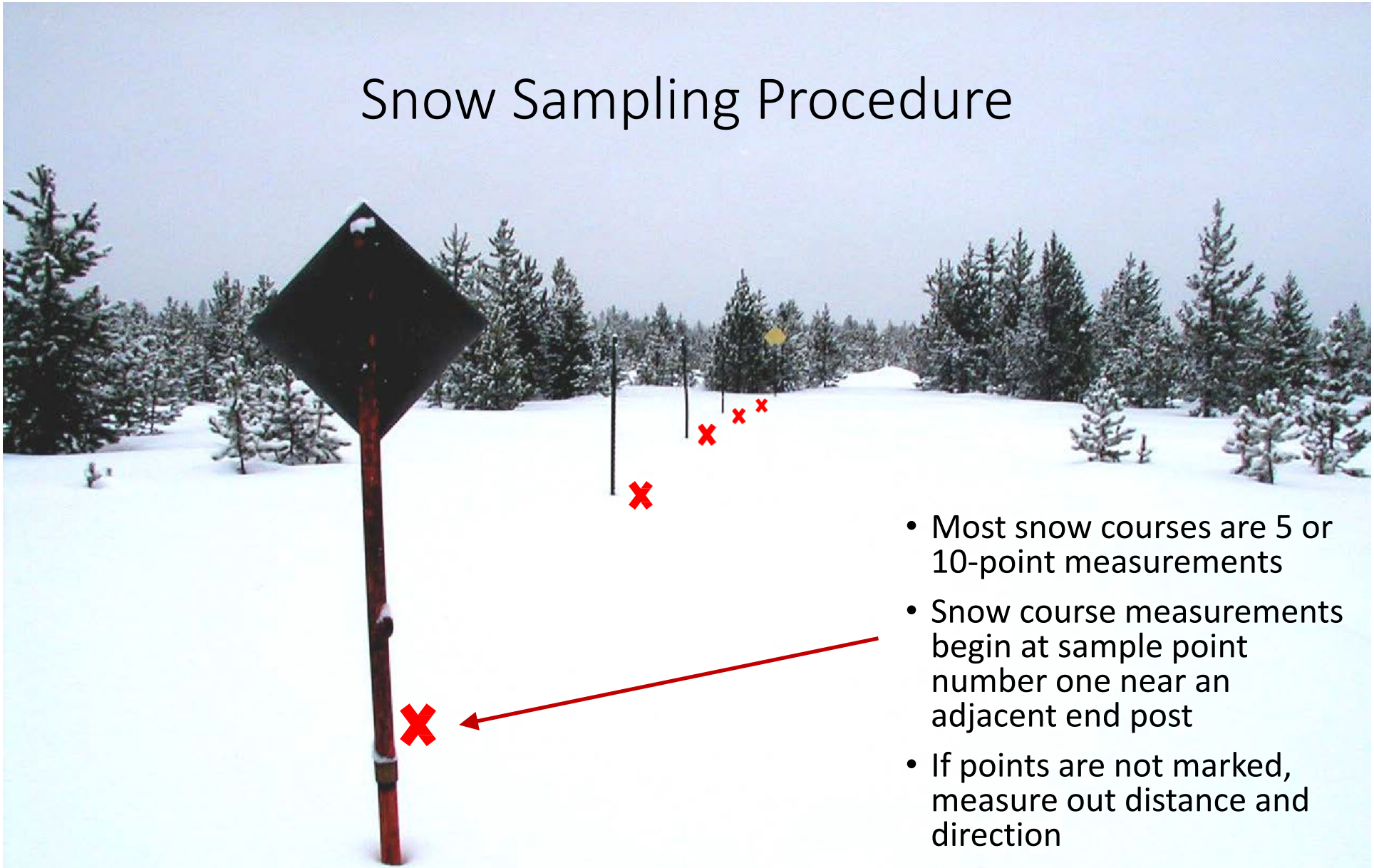
Manual Snow Courses and Aerial Markers – OR/WA/CA/NV



Oregon
Snow Course: 40
Aerial Markers: 11

Washington
Snow courses: 63

Snow Sampling Procedure



- Most snow courses are 5 or 10-point measurements
- Snow course measurements begin at sample point number one near an adjacent end post
- If points are not marked, measure out distance and direction

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Snow Tube Types: Federal Sampler

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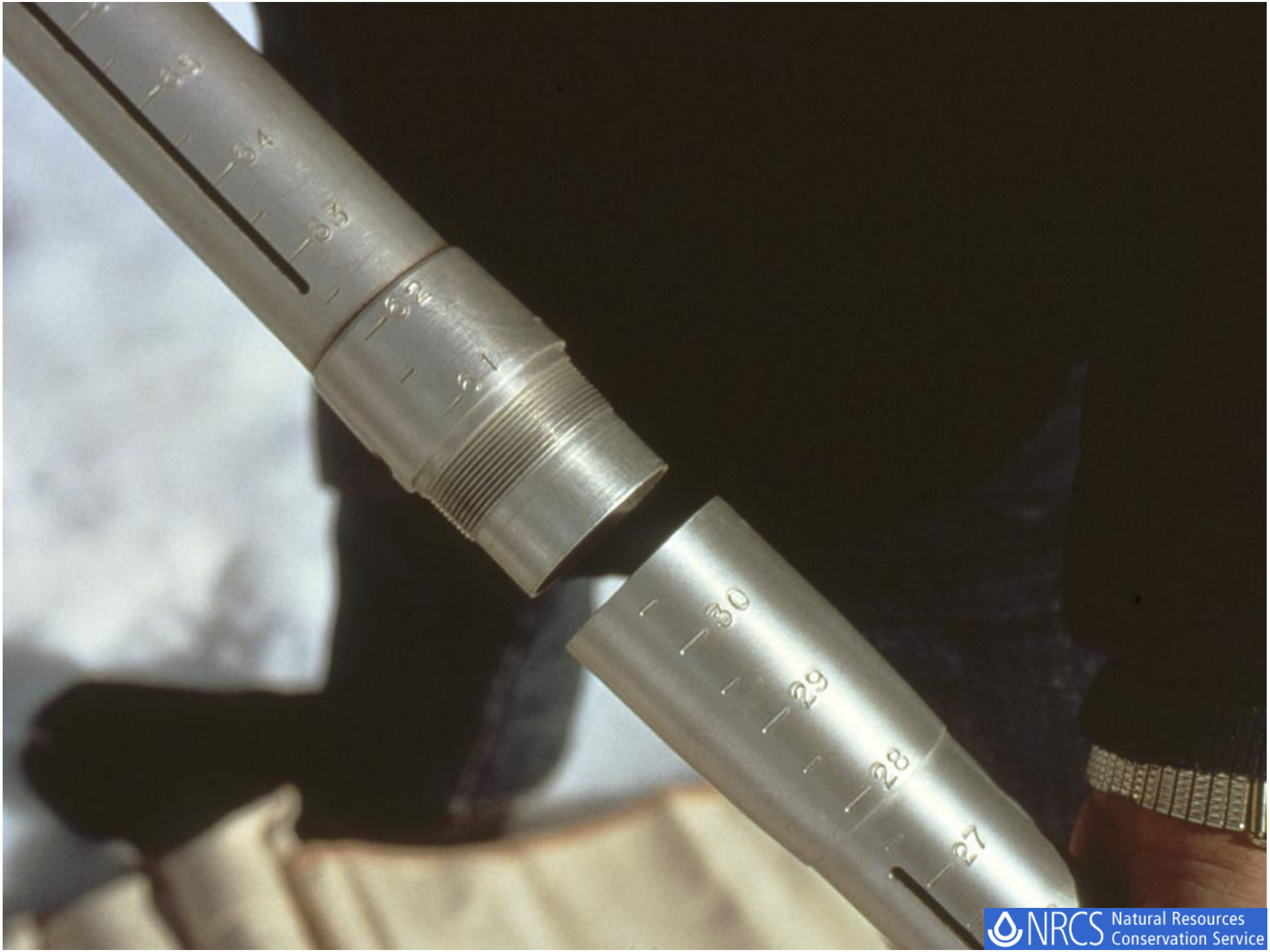
30
29
28
27
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FEDERAL-STATE
COOPERATIVE
SNOW SURVEYS
SNOW COURSE
MARKER
SOIL CONSERVATI
SERVICE
USDA
NRCS Natural Resources
Conservation Service


FEDERAL-STATE
COOPERATIVE
SNOW SURVEYS
SNOW COURSE
MARKER
SOIL CONSERVATION
SERVICE
USDA
NRCS Natural Resources
Conservation Service


FEDERAL-STATE
COOPERATIVE
SNOW SURVEYS
SNOW COURSE
MARKER
SOIL CONSERVATION
SERVICE
NRCS Natural Resources
Conservation Service

Silver Burn Snow Course (Winter)
S. Cascades, Jackson County, Oregon
Elevation 3680’

NRCS Natural Resources Conservation Service

Succor Creek Aerial Marker (Snow Free)
Owyhee Basin – Idaho Border
Elevation 6310’

NRCS Natural Resources Conservation Service

Succor Creek Aerial Marker (Winter)
Owyhee Basin – Idaho Border
Elevation 6310’

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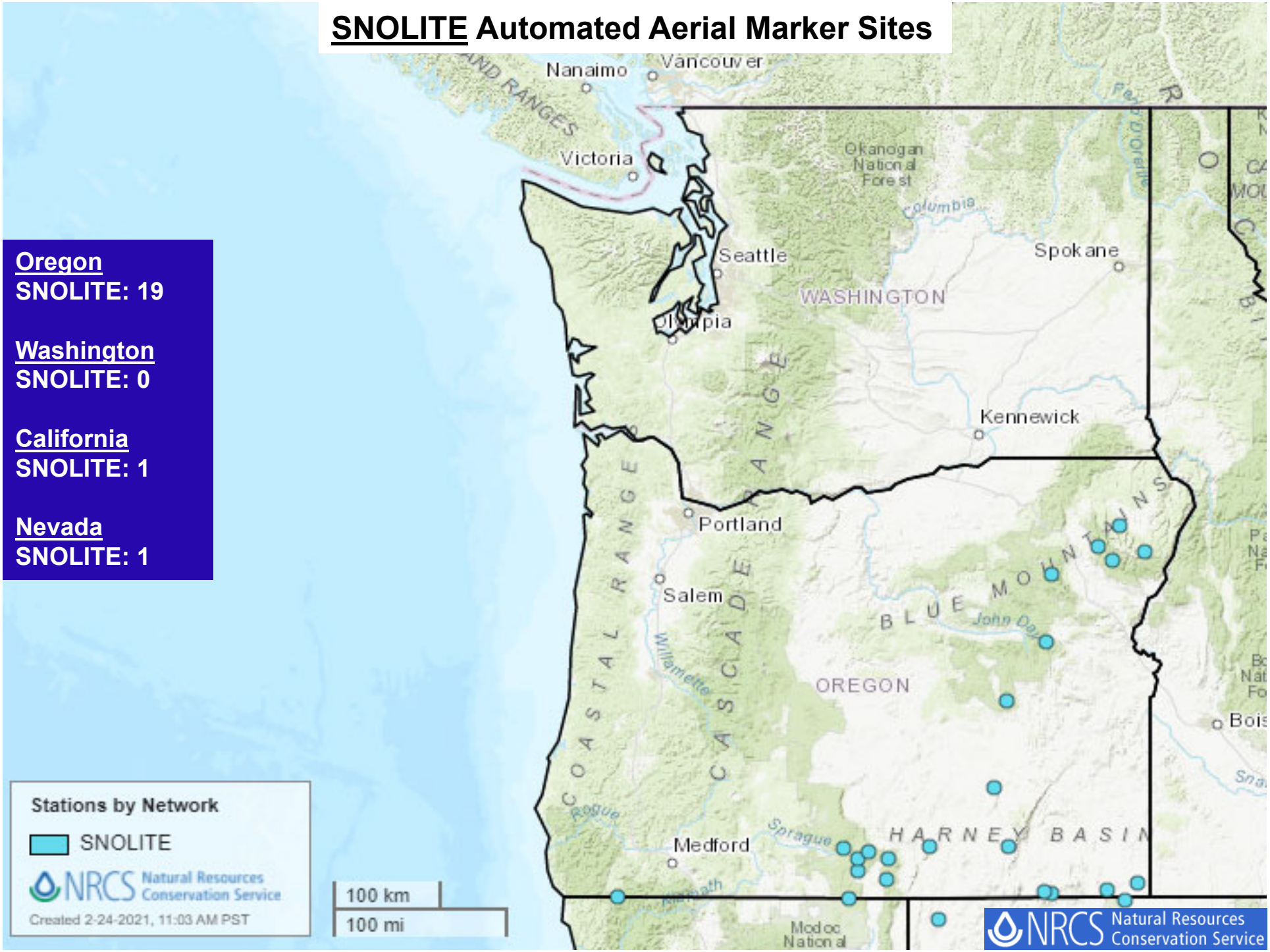
SNOLITE Automated Aerial Marker Sites



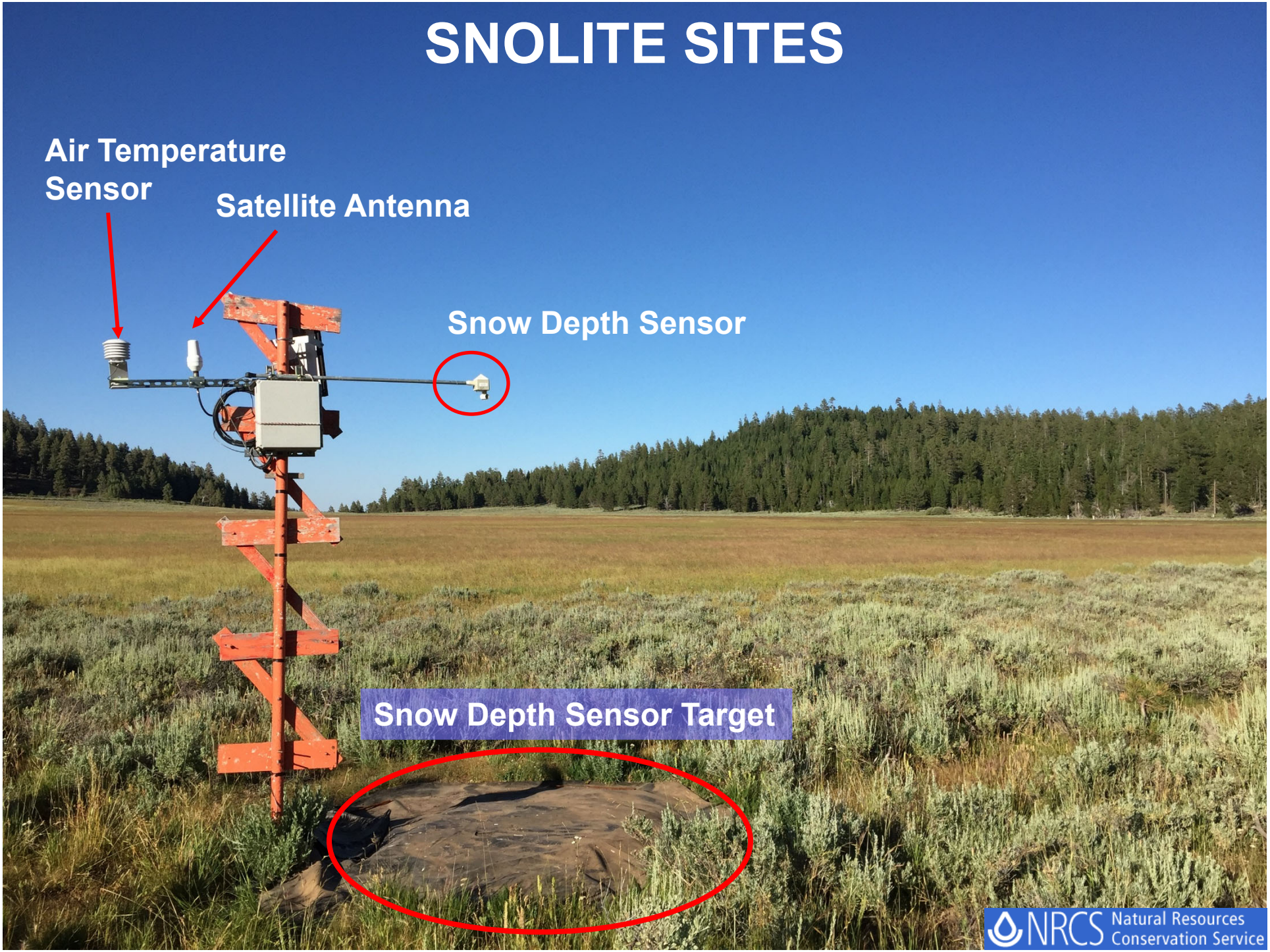
Oregon
SNOLITE: 19

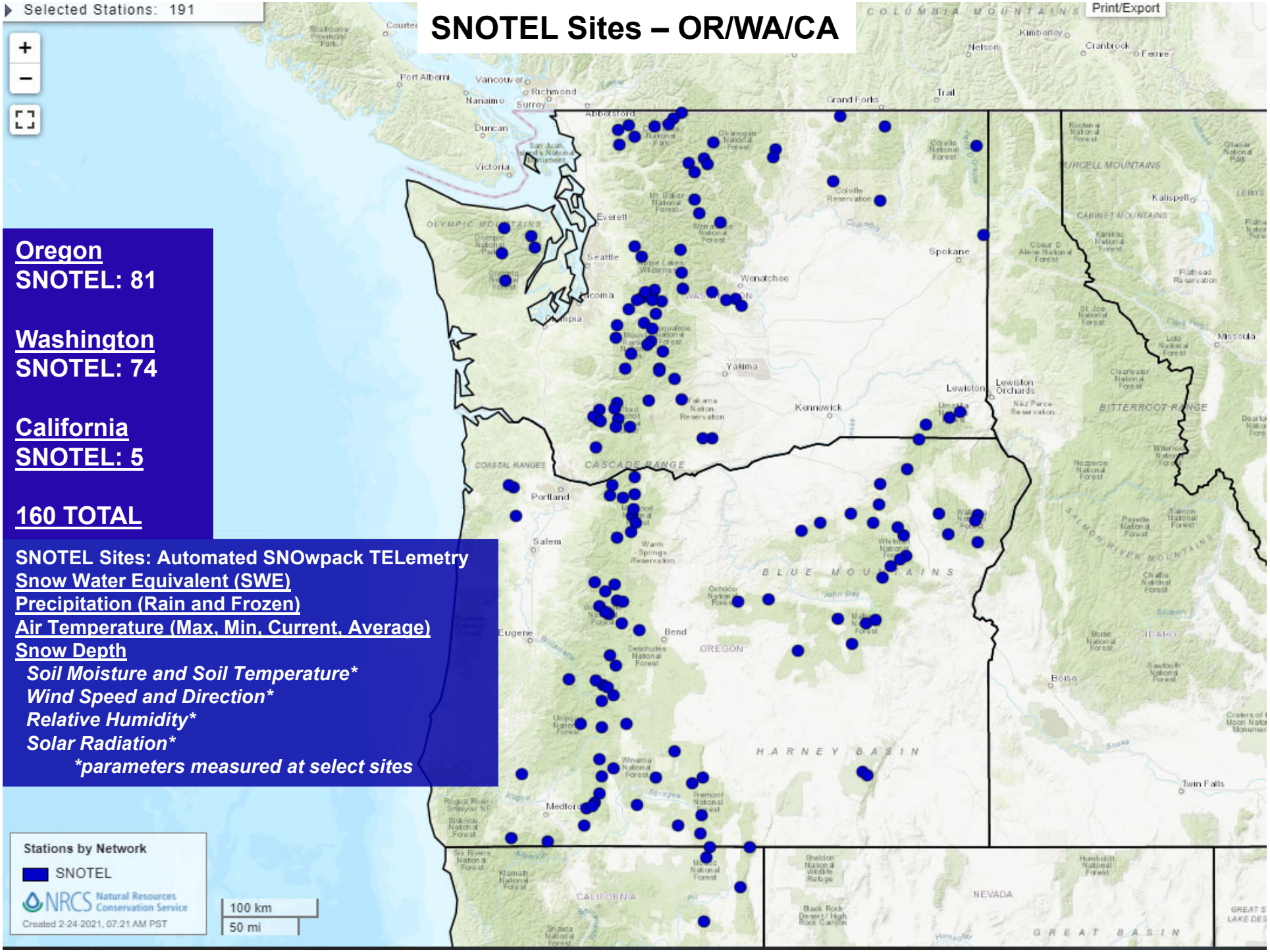
Washington
SNOLITE: 0

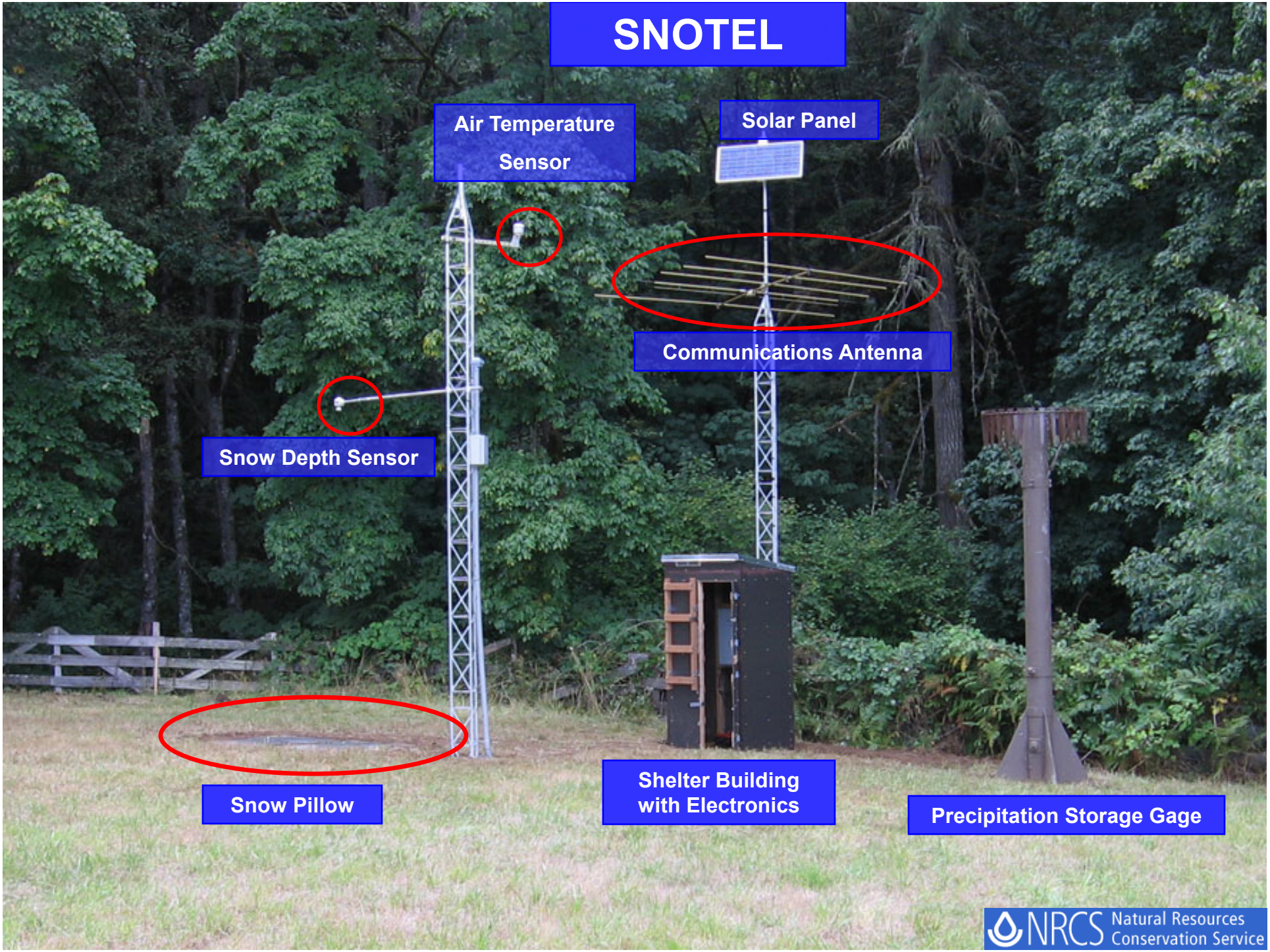
California
SNOLITE: 1

Nevada
SNOLITE: 1

SNOLITE SITES




Selected Stations: 191
Print/Export
SNOTEL Sites – OR/WA/CA
Oregon
SNOTEL: 81
Washington
SNOTEL: 74
California
SNOTEL: 5
160 TOTAL
SNOTEL Sites: Automated SNOwpack TELemetry
Snow Water Equivalent (SWE)
Precipitation (Rain and Frozen)
Air Temperature (Max, Min, Current, Average)
Snow Depth
Soil Moisture and Soil Temperature*
Wind Speed and Direction*
Relative Humidity*
Solar Radiation*
*parameters measured at select sites
Stations by Network
SNOTEL
NRCS Natural Resources Conservation Service
Created 2-24-2021, 07:21 AM PST
100 km
50 mi
Vancouver
Seattle
Portland
Spokane
Yakima
Wenatchee
Kennewick
Lewiston
Boise
Bend
Eugene
Salem
Medford
Twin Falls
Missoula
Kalispell
OREGON
CALIFORNIA
NEVADA
IDAHO
BLUE MOUNTAINS
HARNEY BASIN
GREAT BASIN
CASCADE RANGE
COASTAL RANGES
OLYMPIC MOUNTAINS
BITTERROOT RANGE
CABINET MOUNTAINS
COLUMBIA MOUNTAINS


SNOTEL
Air Temperature Sensor
Solar Panel
Communications Antenna
Snow Depth Sensor
Snow Pillow
Shelter Building with Electronics
Precipitation Storage Gage
NRCS Natural Resources Conservation Service

WATER SUPPLY FORECASTING

NRCS Natural Resources Conservation Service

NRCS Surface Water Supply Forecasting

- SCS/NRCS forecasting was result of legislation to provide water supply forecasts for western agriculture in the 1930s. Snowmelt runoff was considered the most important statistical factor for determining spring and early summer surface water supply

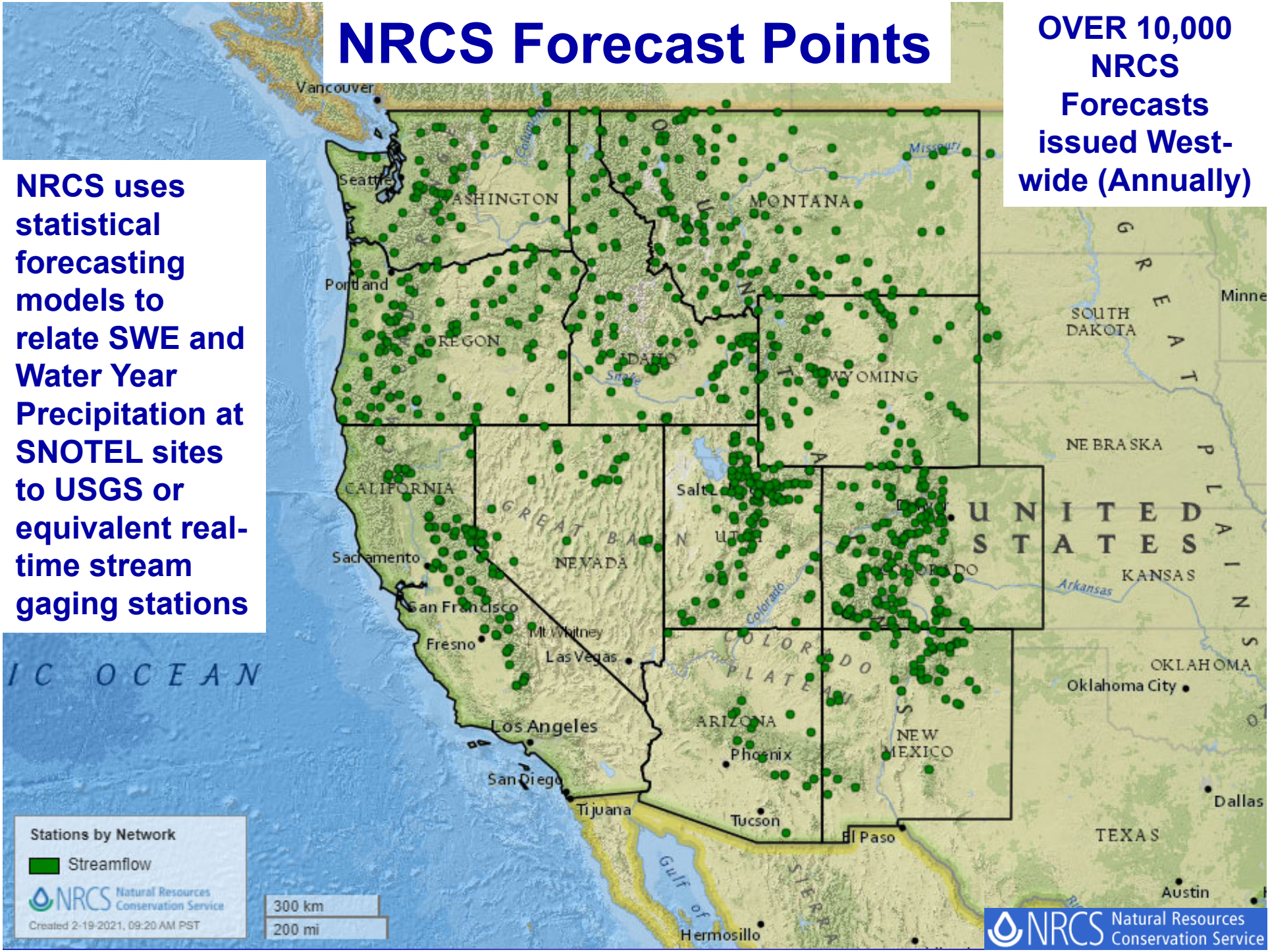
- Forecasts concentrated on small headwater basins, primarily for irrigation purposes such as flow past USGS stream gages and reservoir inflows

- Statistical seasonal volume forecasts are issued on the first of each month (from January through June). Refers to the volume of water (Thousands of Acre Feet) forecast to pass by a real-time stream gaging station. NRCS statistical volume forecasts apply probability statistics (10%, 30%, 50%, 70%, 90%, etc.). Statistics relating SWE and precipitation from basin SNOTEL sites with real-time USGS (or equivalent) stream gaging

NRCS Forecast Points

OVER 10,000 NRCS Forecasts issued West-wide (Annually)

NRCS uses statistical forecasting models to relate SWE and Water Year Precipitation at SNOTEL sites to USGS or equivalent real-time stream gaging stations



TYPES of FORECASTS

- Seasonal Volume (Primary NRCS Mission)
- Peak or Stage
- Recession (Low-Flow)
- Full Hydrograph

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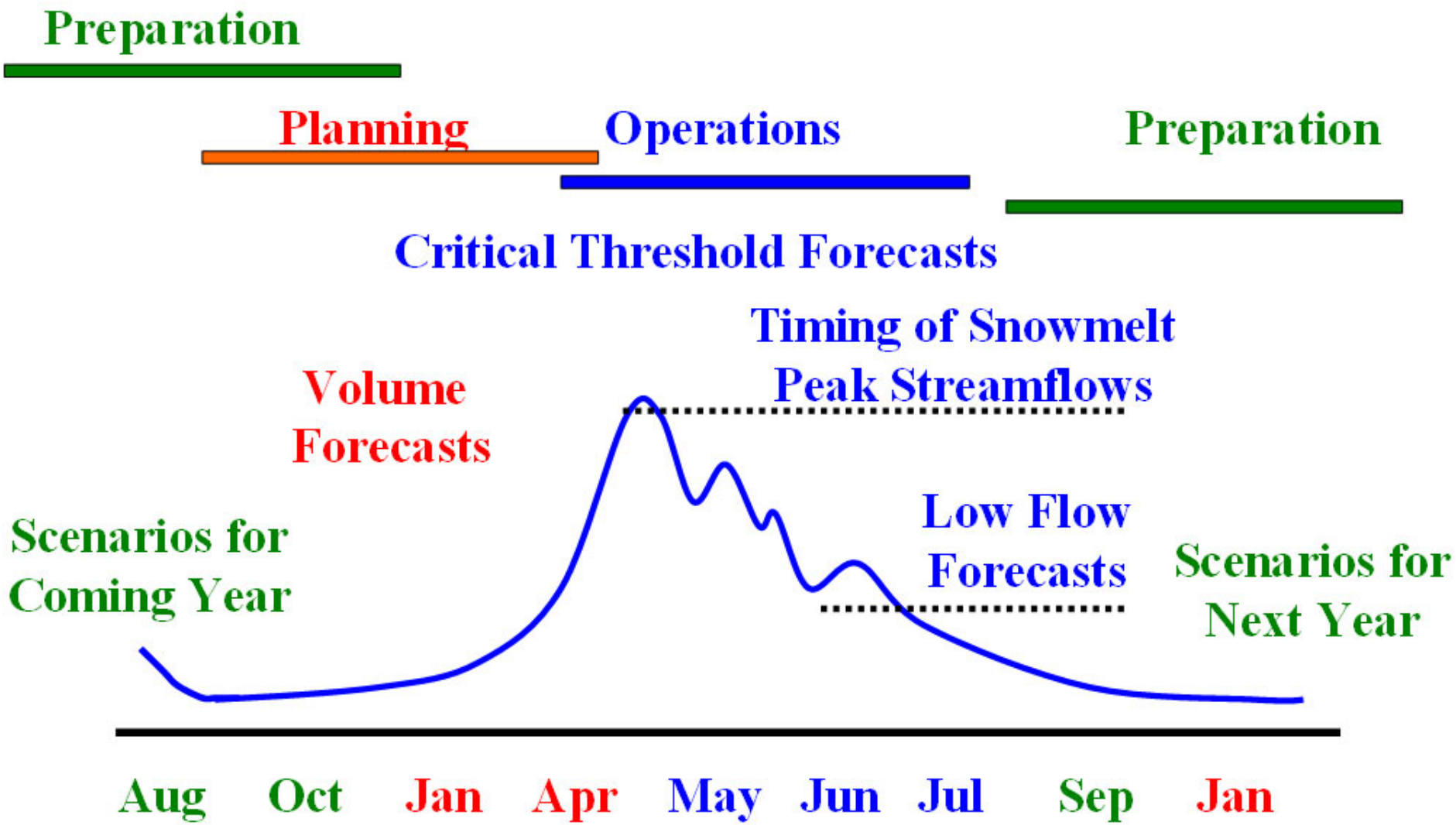
Water User Needs Timeline



Forecasting Challenges

- Early season forecasts (January, February) have many unknowns based on future conditions
- Forecasting future weather/climate precipitation and temperature variability
- Unknown basin physical processes
  Geomorphology, Soils, Vegetation Influences
- Extremes: record precipitation, variable temperatures, streamflow
- Multi-year persistence (lack of analogous comparison years)

USERS and USES of NRCS Data, Forecasts, Products, and Reports

Federal Agencies

- USGS
- USFS
- Other USDA
- USACE
- USBR
- National Weather Service
- NWS - River Forecast Centers
- NOAA
- NASA
- NPS
- NIDIS

Irrigation is critical to agriculture in the US. Nearly 50% of the value of commodities sold comes from the 16% of irrigated cropland.

State and Local Groups

- OWRD
- ODF
- ODFW
- ODA
- Local Water Managers
- Irrigation Districts and Companies
- Municipalities
- State Water Supply Availability Committee
- State Drought Readiness Council
- Power Companies
- University Researchers
- Avalanche Centers
- Producers and Ranchers
- Recreationists and Tourism Groups

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Future Developments

Snow measurements:

- **Fluidless snow pillow and precipitation systems**
- **Remote-sensed Gamma, LIDAR, NASA ASO other**
- **Modeled snowpack (SNODAS)**
- **Continued manual measurements to supplement automated readings**
- **Ground-based data collection will be required to verify/calibrate/validate remote sensing data in the foreseeable future**

Improving forecasts:

- **More accurate measurement data**
- **Additional data and data types**
- **Improving weather forecasts**
- **Development of physical hydrologic models that can adjust to changing snowpack and precipitation conditions through the seasons or following extreme events**

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2021 Current Conditions Synopsis

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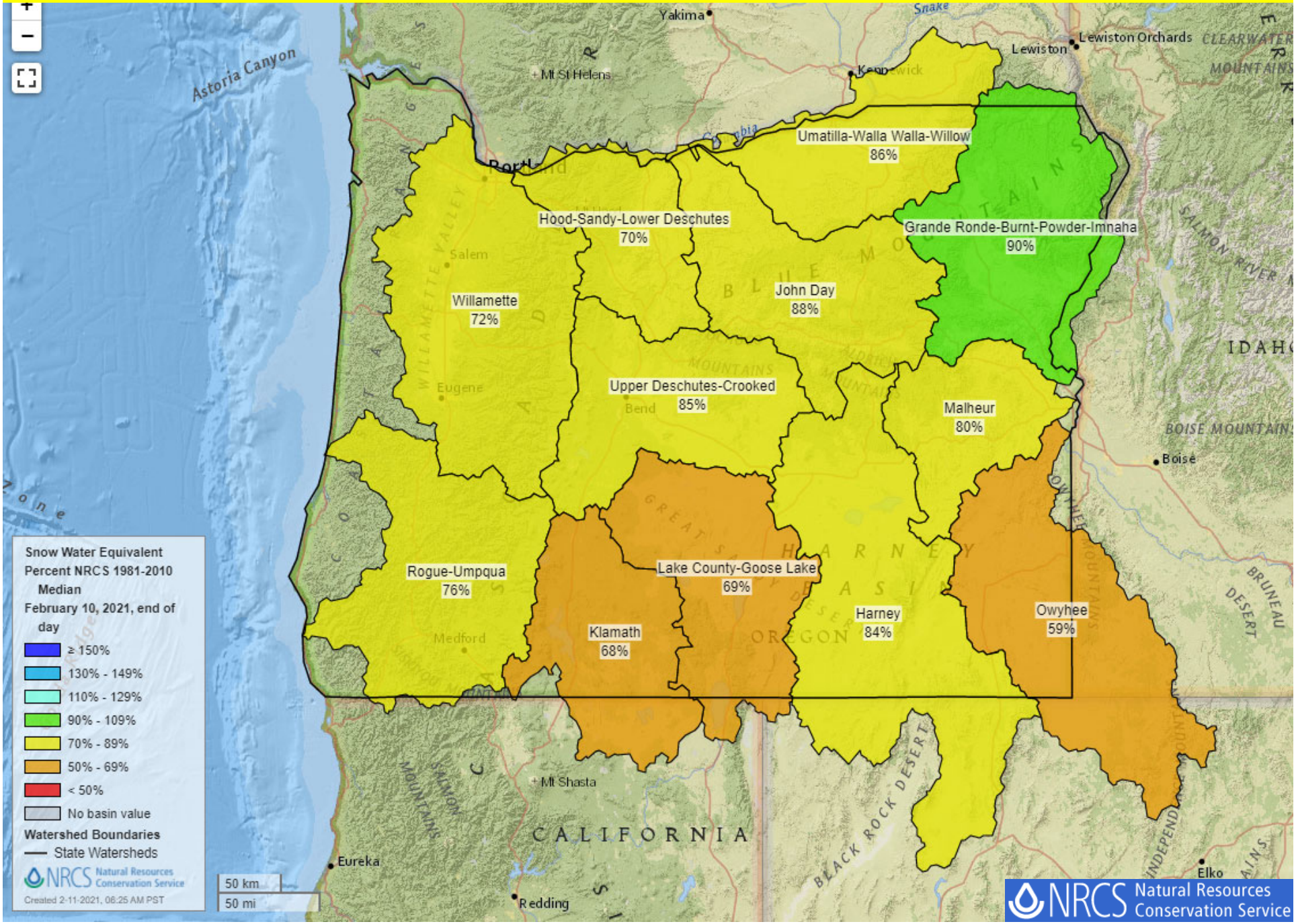
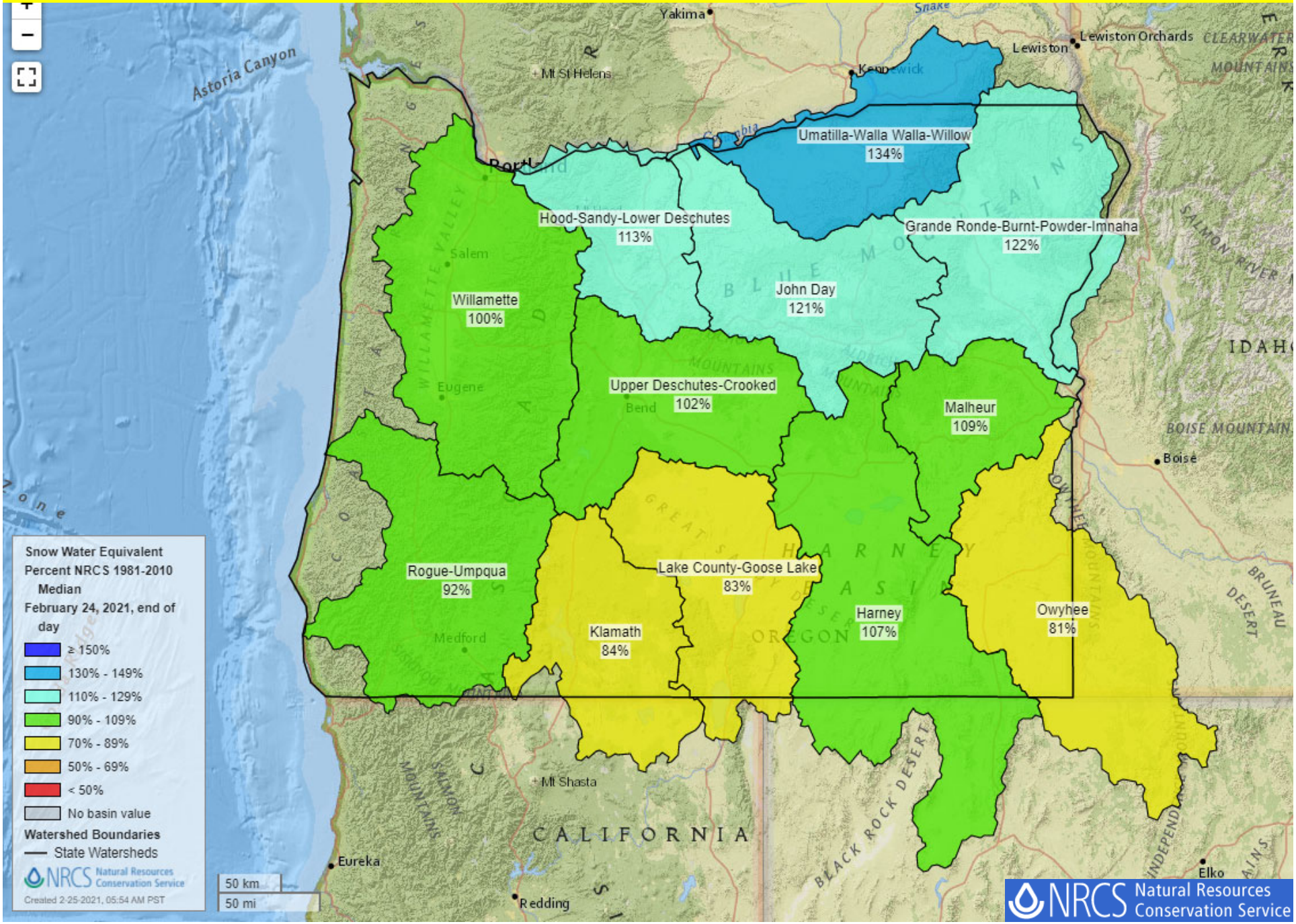
SNOWPACK

NRCS Natural Resources Conservation Service

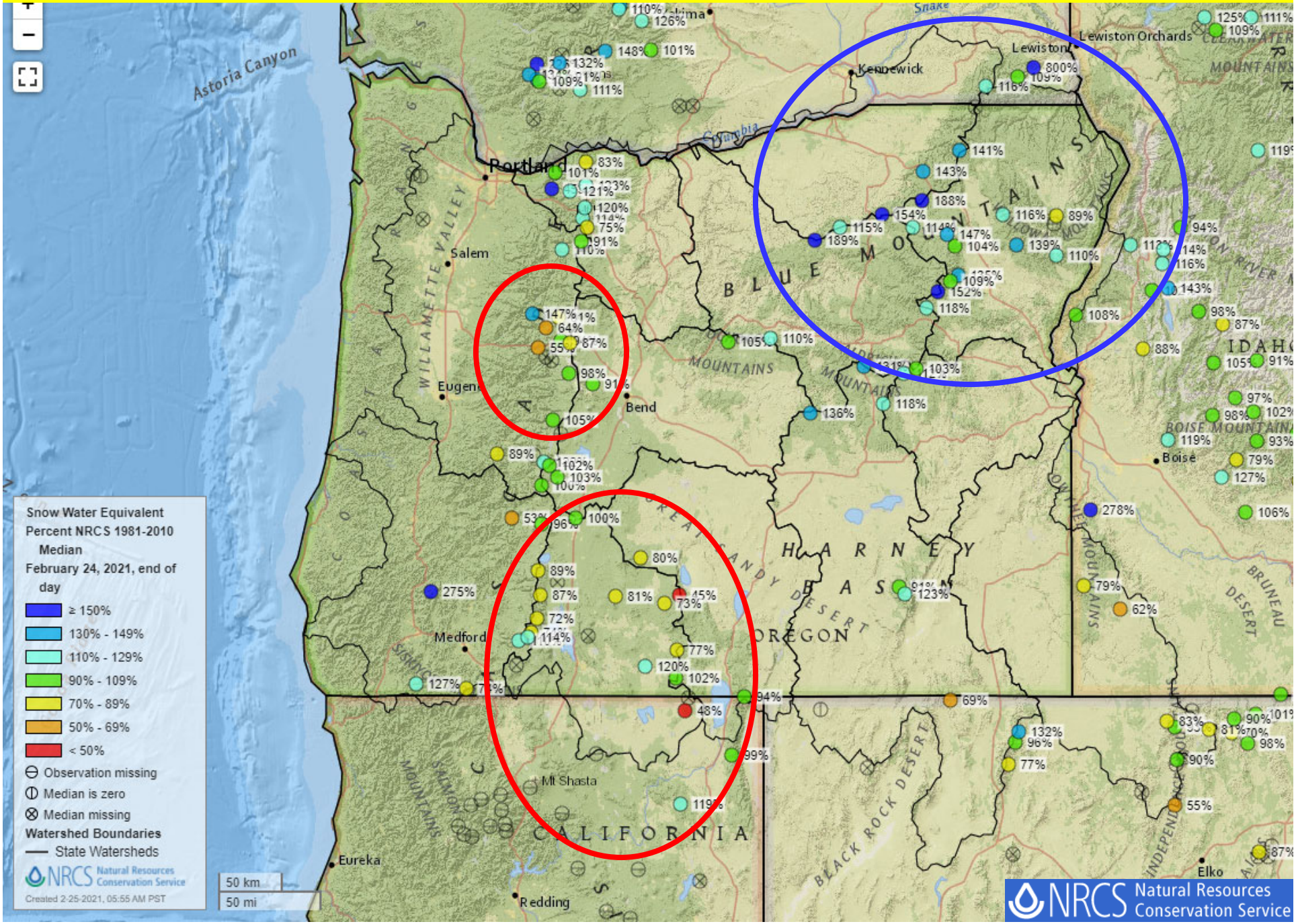
February 11th Oregon Statewide SNOTEL Snowpack was 77% of normal



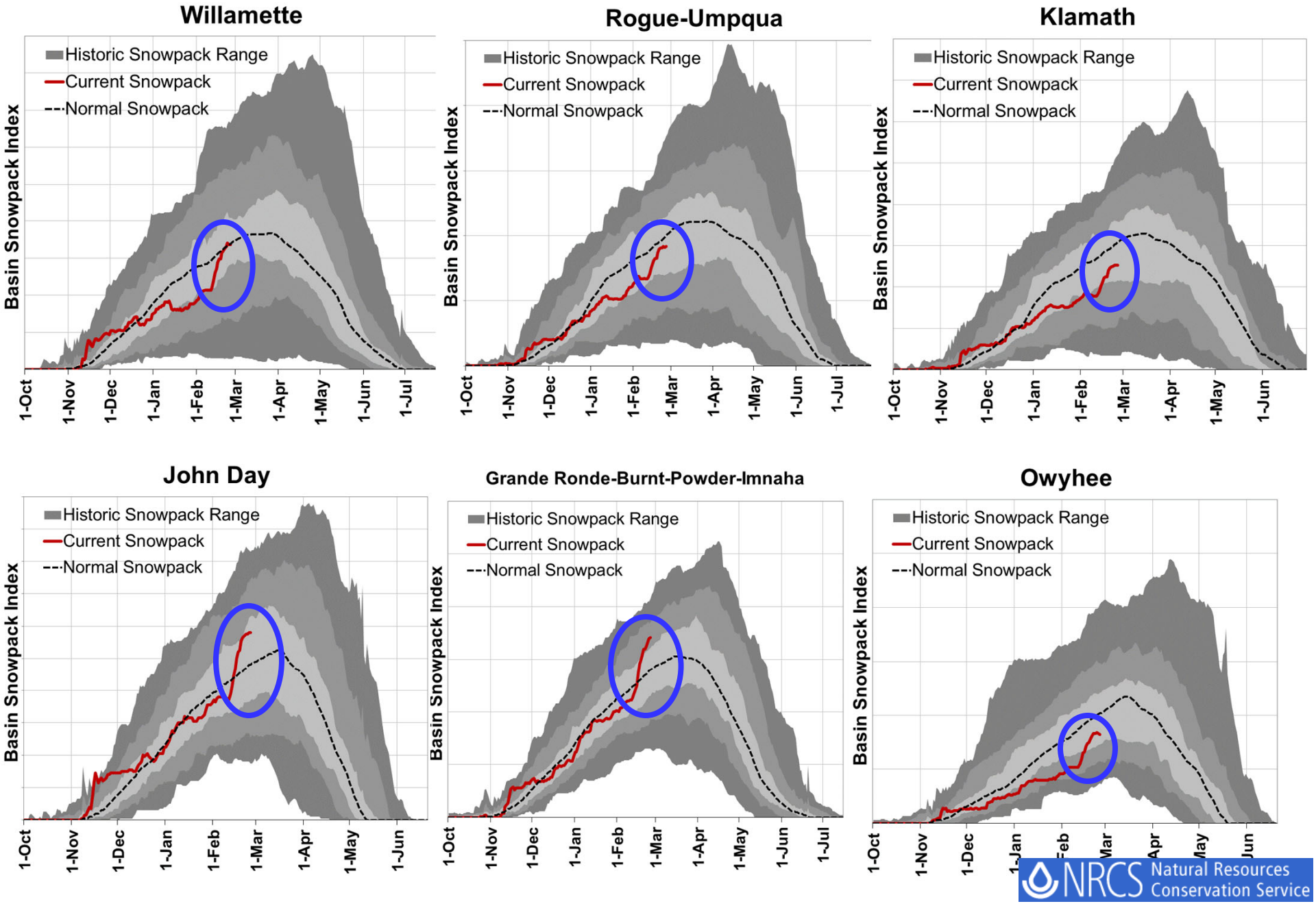
February 25th Oregon Statewide SNOTEL Snowpack is 106% of normal



February 25th Oregon SNOTEL % of median by station



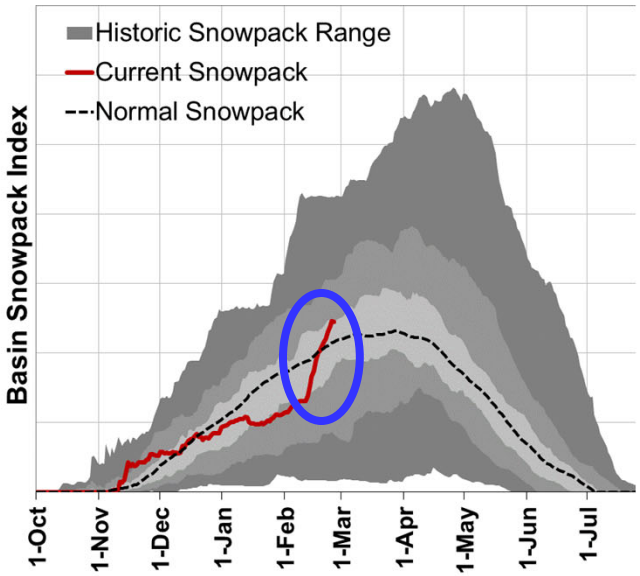
OREGON SNOWPACK GRAPHS – February 25, 2021



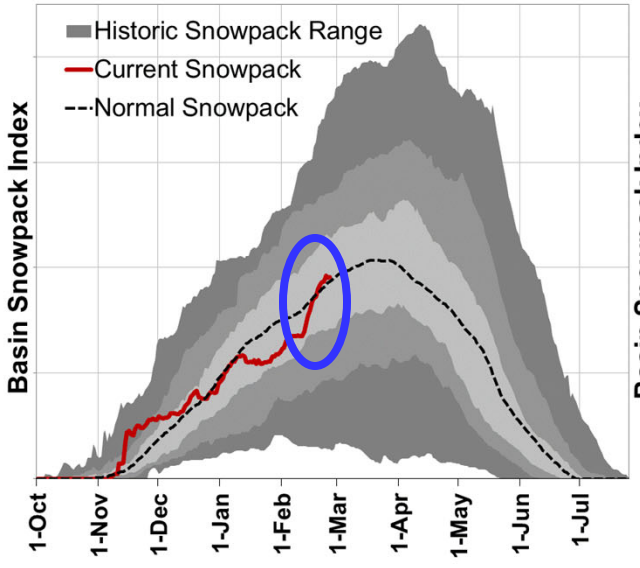
NRCS Natural Resources Conservation Service

OREGON SNOWPACK GRAPHS – February 25, 2021

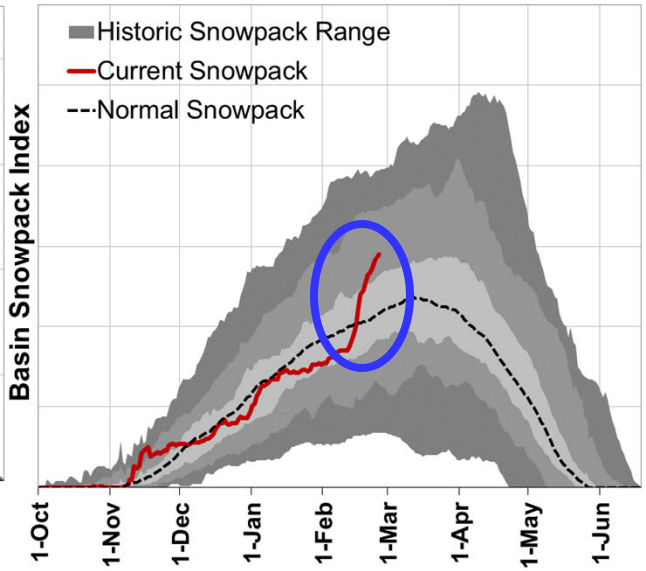
Hood-Sandy-Lower Deschutes



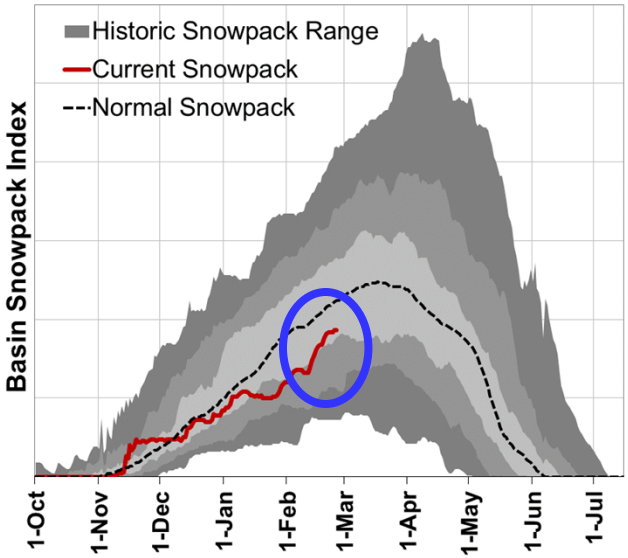
Upper Deschutes-Crooked



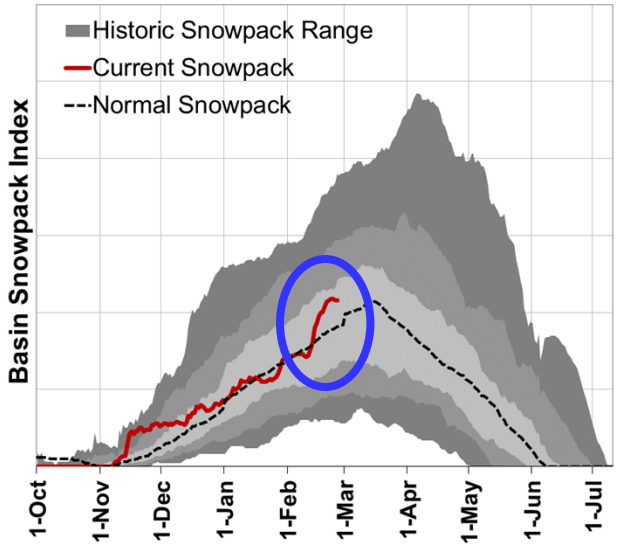
Umatilla-Walla Walla-Willow



Lake County-Goose Lake

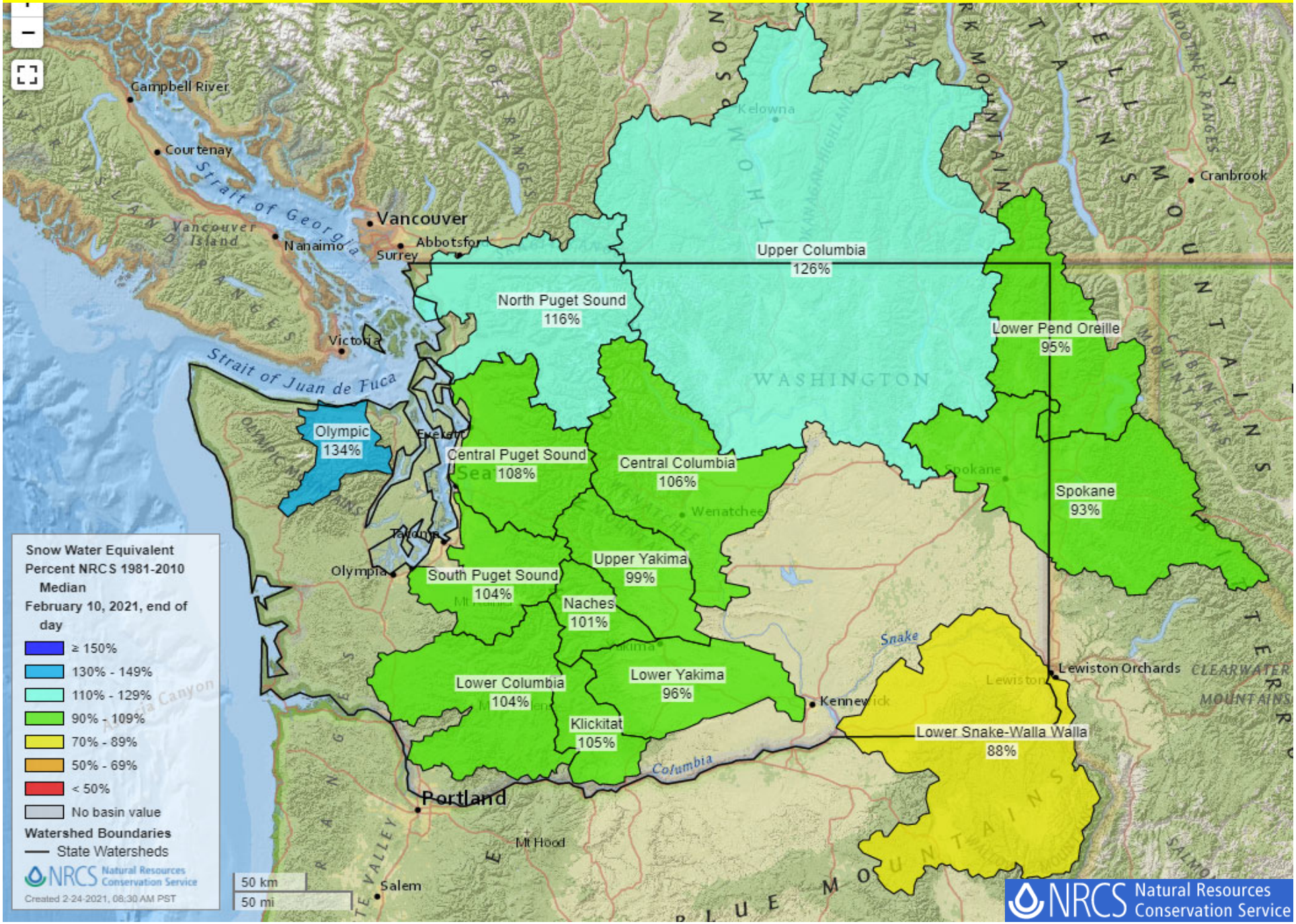


Harney

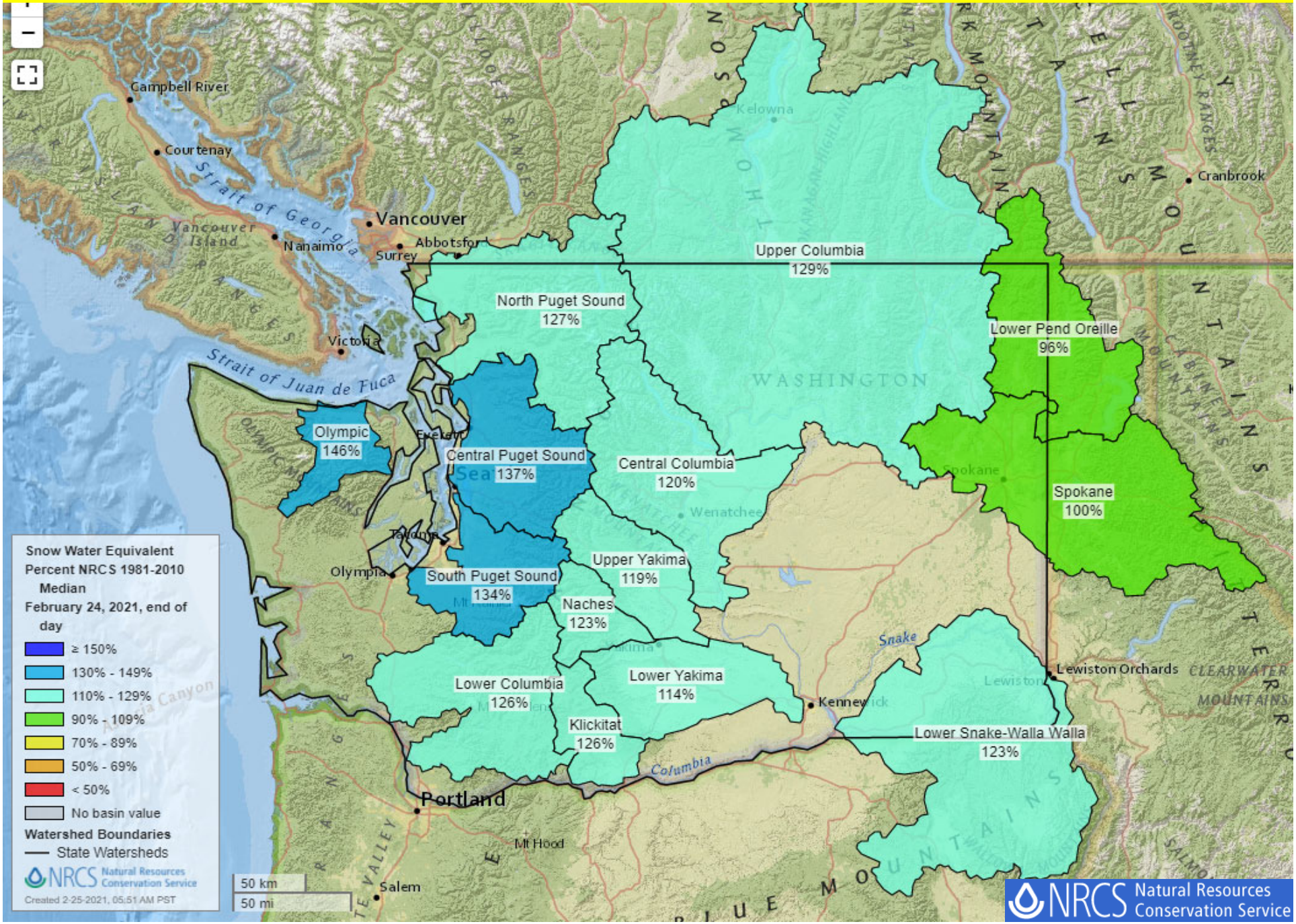


NRCS Natural Resources Conservation Service

February 11th Washington Statewide SNOTEL Snowpack was 108% of normal



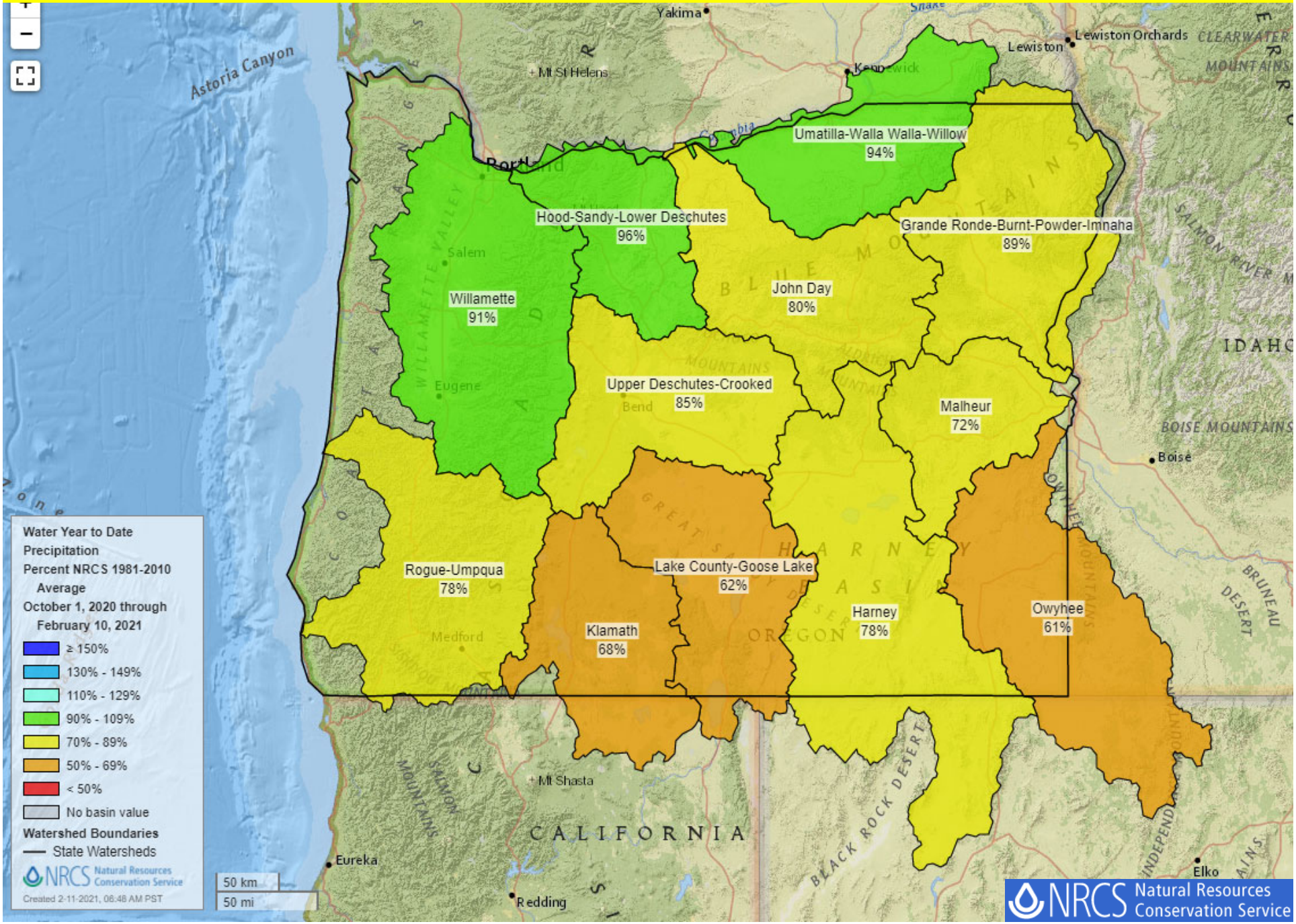
February 25th Washington Statewide SNOTEL Snowpack is 126% of normal



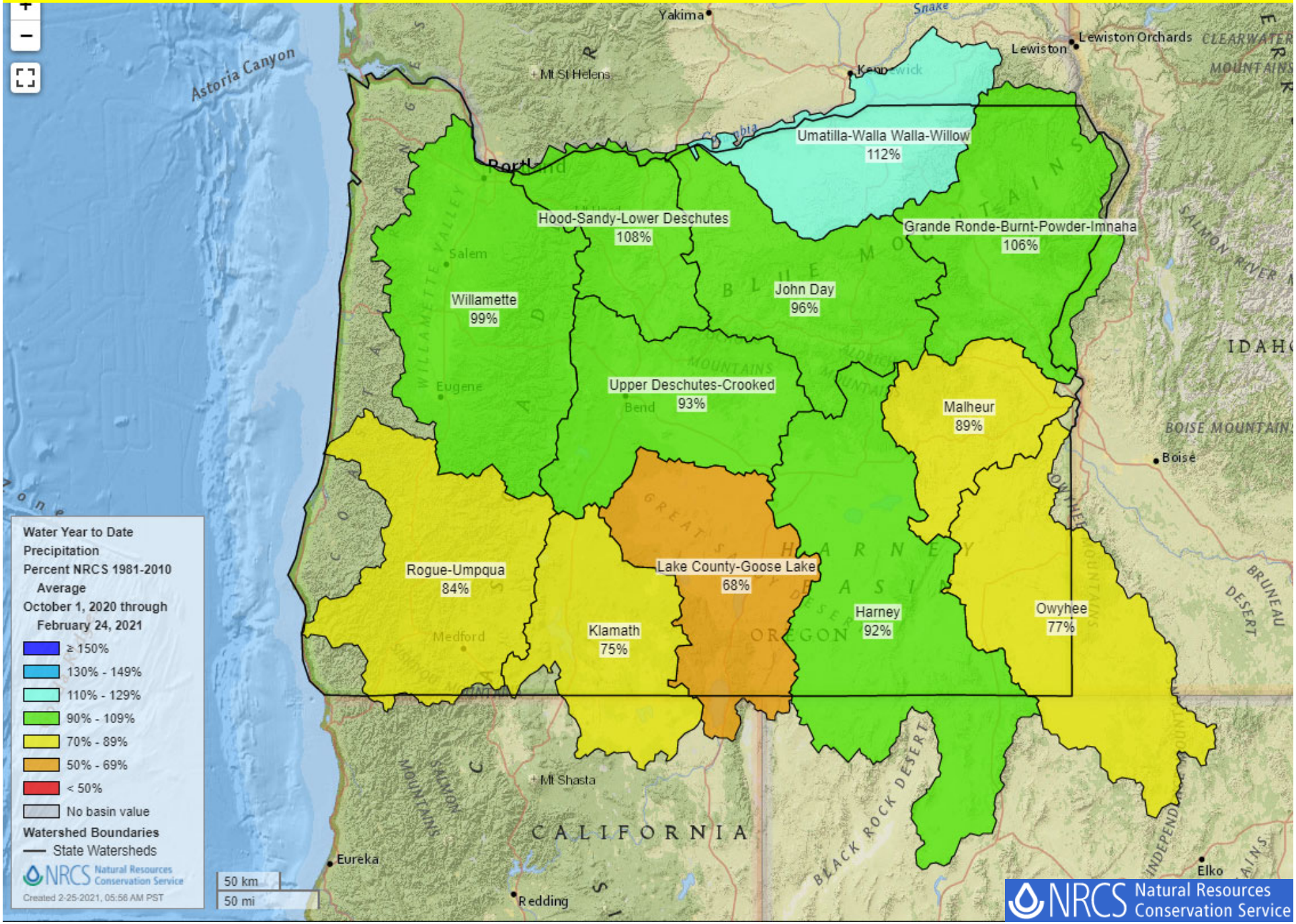
WATER YEAR PRECIPITATION

NRCS Natural Resources Conservation Service

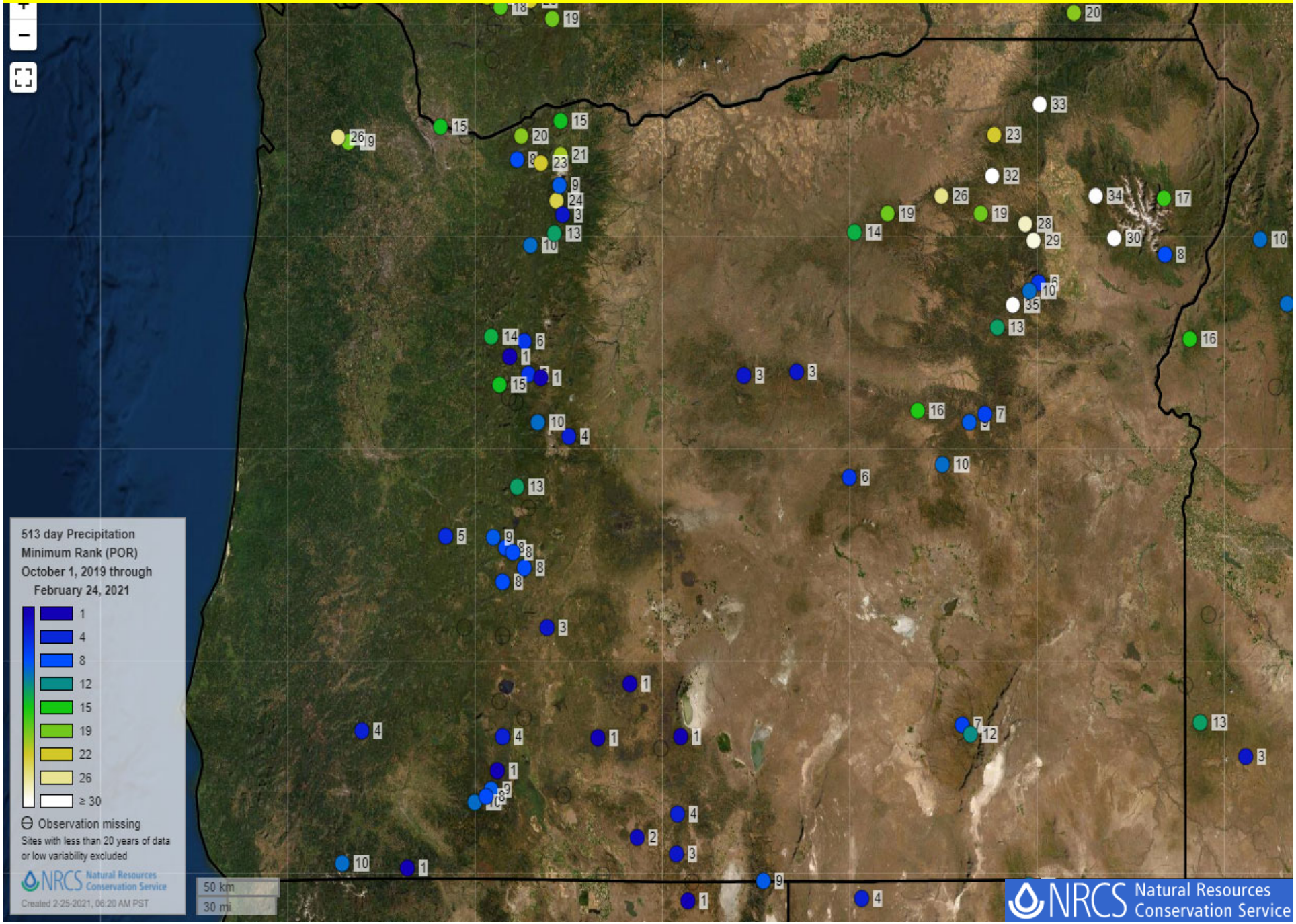
February 11th Oregon Statewide SNOTEL Water Year Precipitation was 87% of average



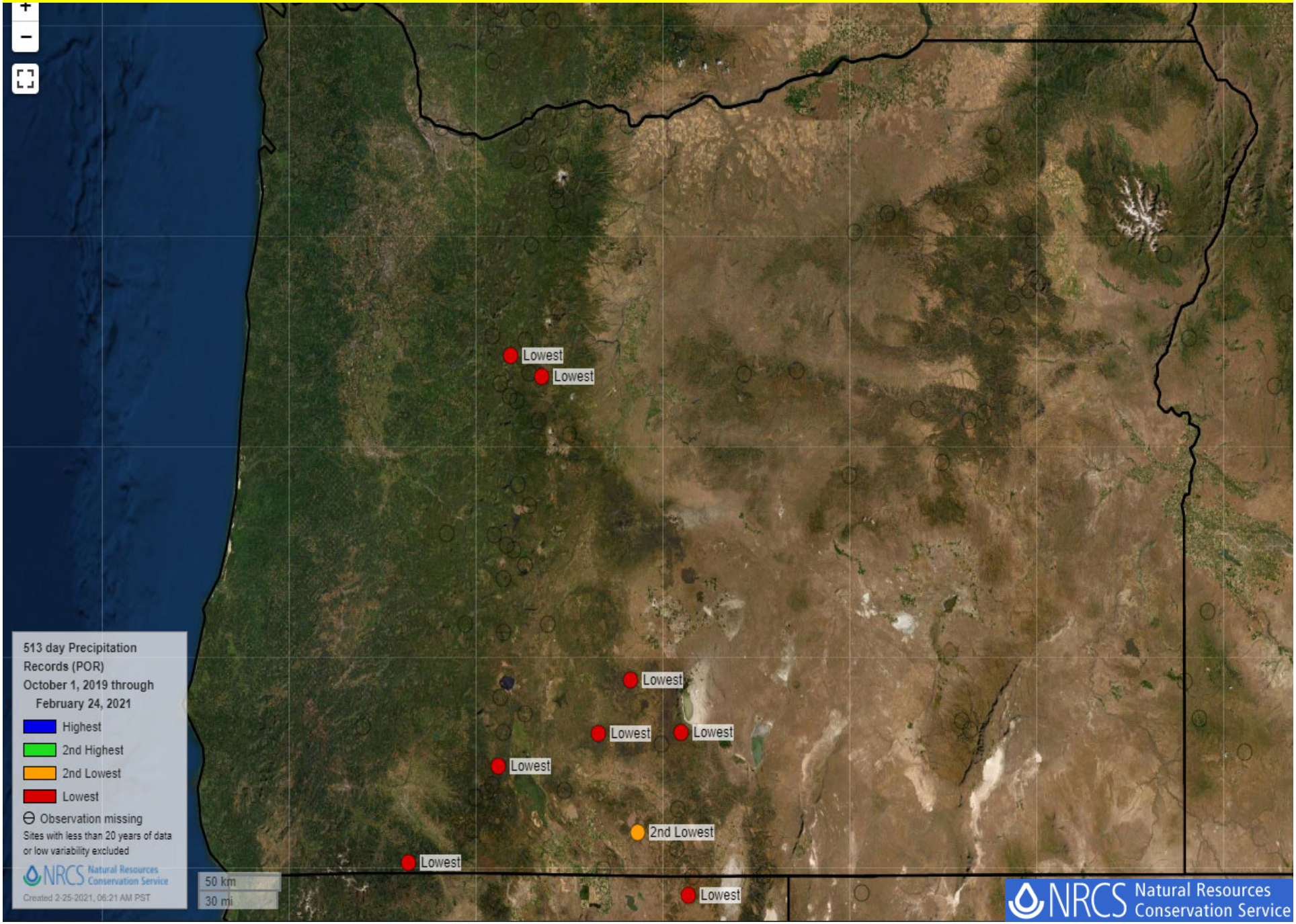
February 25th Oregon Statewide SNOTEL Water Year Precipitation is 96% of average



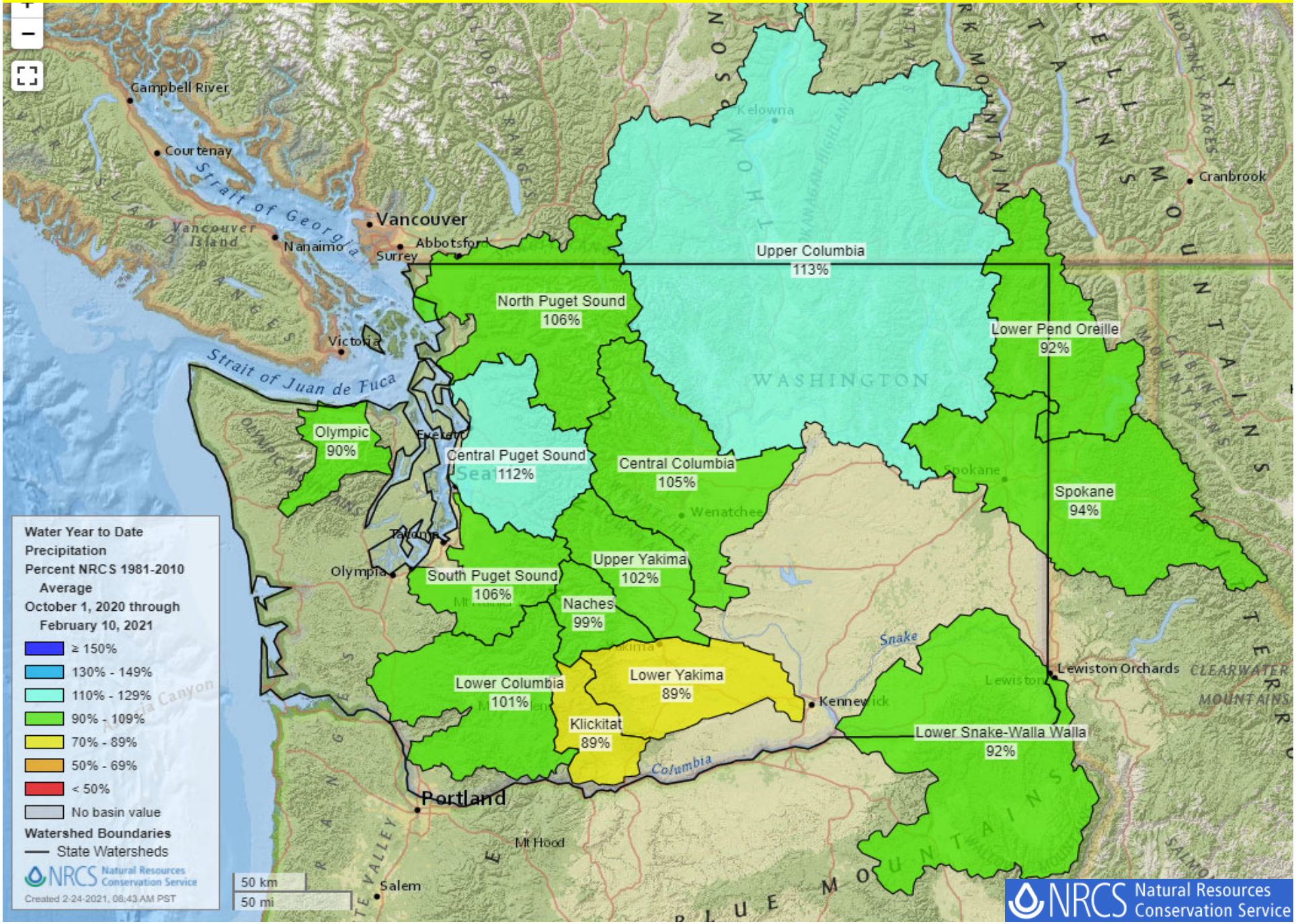
SNOTEL 513-day Precipitation Minimum Rank (POR) October 1, 2019 – February 24, 2021



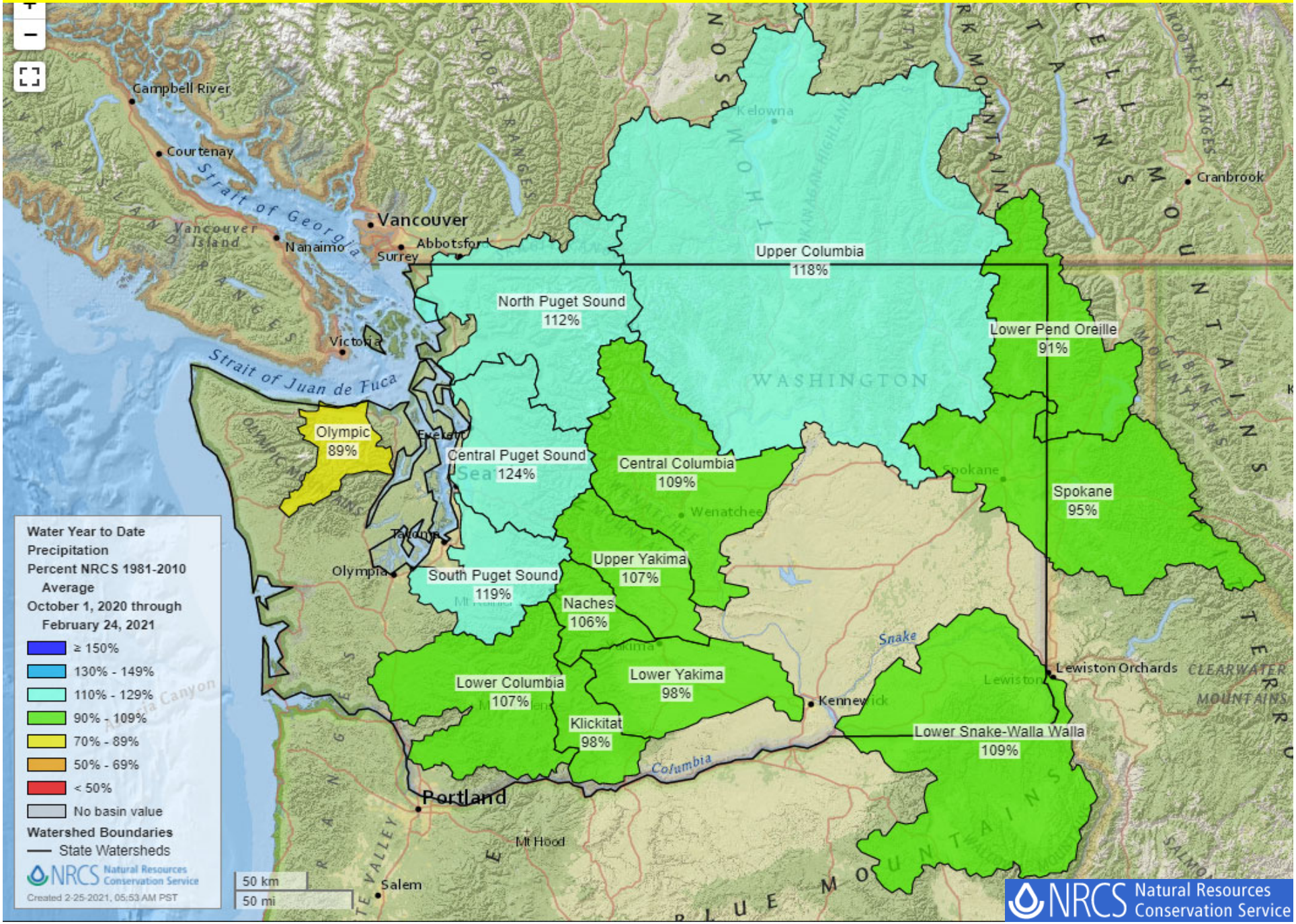
SNOTEL 513-day Precipitation Records (POR) October 1, 2019 – February 24, 2021



February 11th Washington Statewide SNOTEL Water Year Precipitation was 105% of average



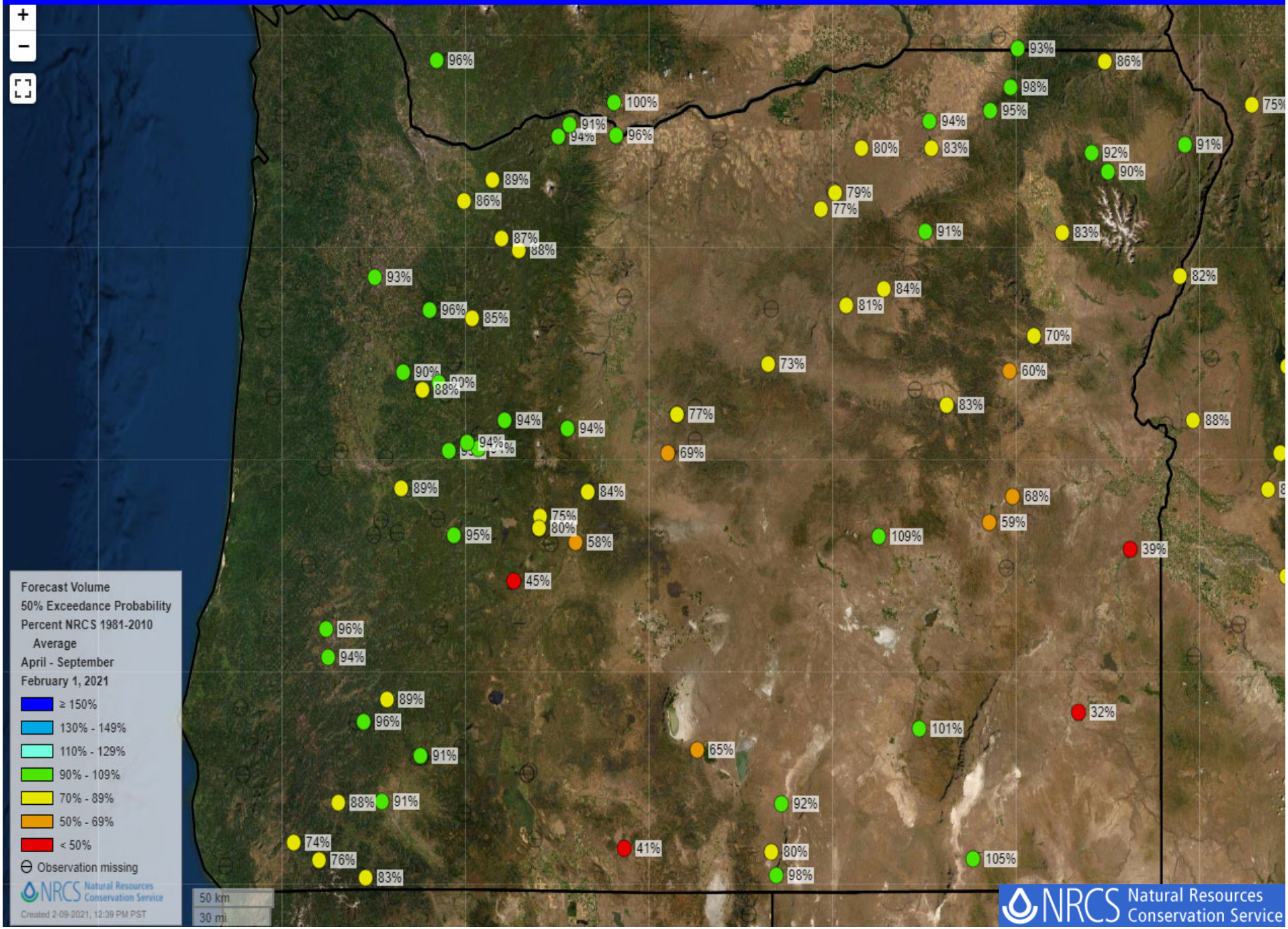
February 25th Washington Statewide SNOTEL Water Year Precipitation is 112% of average



FEBRUARY 1, 2021 WATER SUPPLY FORECASTS

NRCS Natural Resources Conservation Service

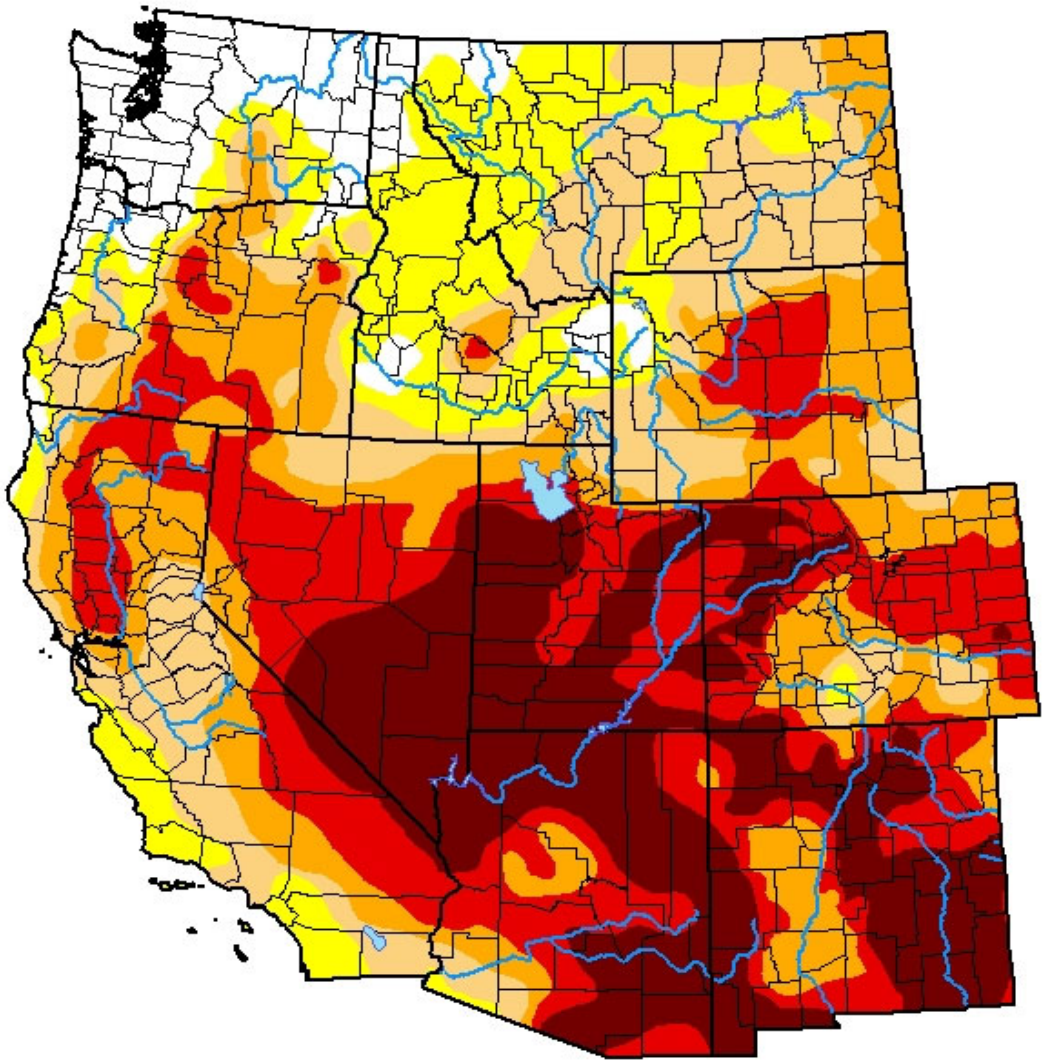
February 1, 2021 – Forecast Volume, 50% Exceedance Probability (April – September)



CURRENT DROUGHT STATUS

NRCS Natural Resources Conservation Service

U.S. Drought Monitor
West



February 23, 2021
(Released Thursday, Feb. 25, 2021)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	7.35	92.65	78.93	61.18	42.13	20.43
Last Week *02-16-2021*	7.24	92.76	79.30	62.00	43.09	19.47
3 Months Ago *11-24-2020*	11.06	88.94	75.60	60.85	44.08	19.48
Start of Calendar Year *12-29-2020*	11.57	88.43	78.63	65.18	46.49	22.16
Start of Water Year *09-29-2020*	8.51	91.49	76.07	54.55	33.11	2.31
One Year Ago *02-25-2020*	53.17	46.83	20.48	3.02	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

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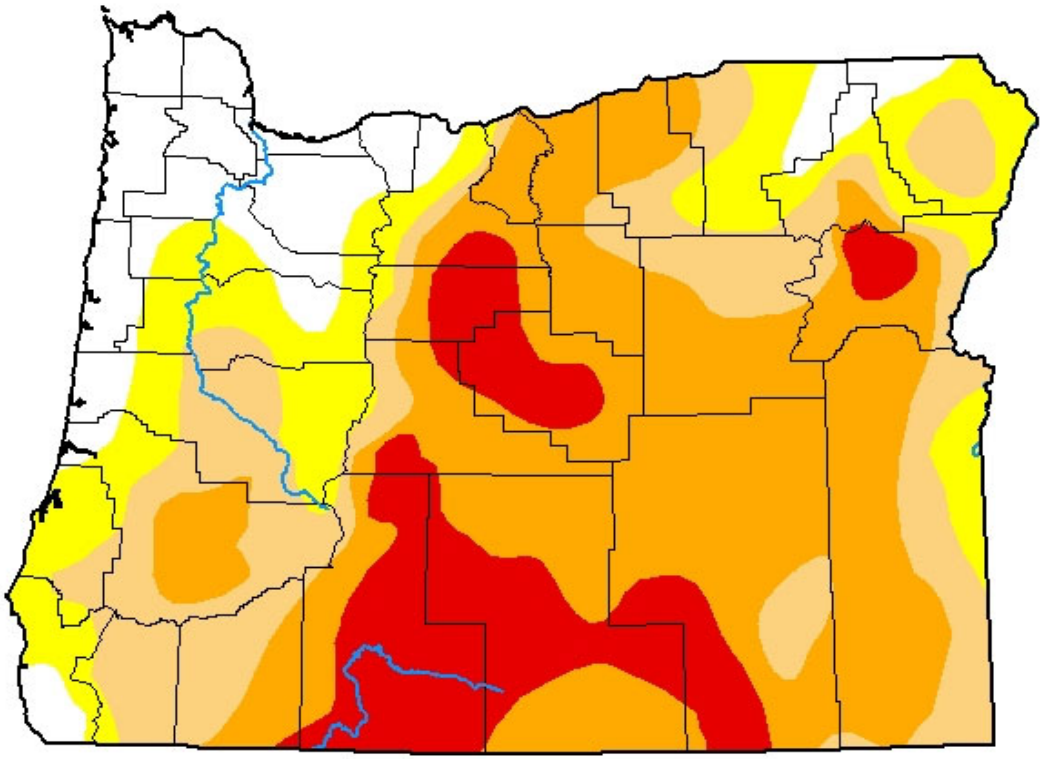
droughtmonitor.unl.edu

NRCS Natural Resources Conservation Service

U.S. Drought Monitor

Oregon



February 23, 2021

(Released Thursday, Feb. 25, 2021)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	12.69	87.31	71.82	51.11	14.34	0.00
Last Week *02-16-2021*	12.02	87.98	73.84	54.56	19.39	0.00
3 Months Ago *11-24-2020*	8.67	91.33	84.36	69.68	34.27	0.00
Start of Calendar Year *12-29-2020*	8.57	91.43	83.53	68.71	27.74	0.00
Start of Water Year *09-29-2020*	6.50	93.50	84.77	65.53	33.59	0.00
One Year Ago *02-25-2020*	20.28	79.72	31.83	0.00	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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NRCS Natural Resources Conservation Service

NEW NRCS OREGON WEB PAGES

NRCS Natural Resources Conservation Service

NRCS Oregon Snow Survey Web Pages

https://www.nrcs.usda.gov/wps/portal/nrcs/main/or/snow/

USDA Natural Resources Conservation Service
Oregon
United States Department of Agriculture

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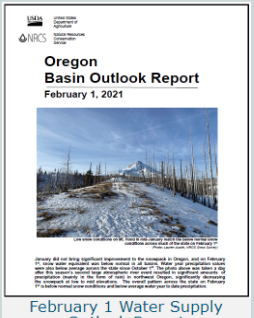


February 1 Water Supply Outlook Report

Post-Fire/Flood Awareness - Snowpack Conditions

NRCS Oregon Snow Survey

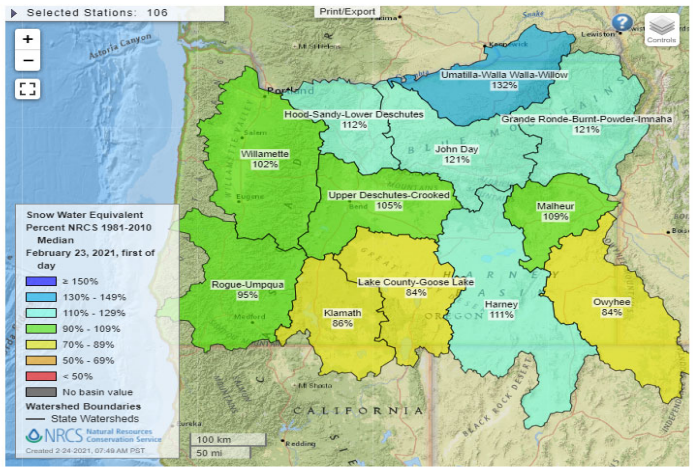
NRCS Oregon Snow Survey collects mountain hydroclimatic data that is used to produce volumetric streamflow forecasts and generate products that quantify surface water supplies and inform natural resource management.

Learn More

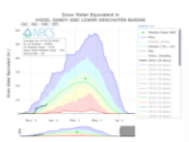
» Daily Conditions Highlights

Using the drop-down menu below, select a parameter for a daily statewide overview. To view a full-screen version of the interactive map with more customizable parameters and site information, click here.

Snow Water Equivalent – Basin Percent of Median



» Product Highlights



FEATURED: CHARTS

Time Series

These charts show current SWE, precipitation and temperature data for basins or sites in comparison to the historical record.

Go to Page

FEATURED: MAP

Interactive Map

The interactive map provides an interface allowing users to quickly view and access parameters associated with a site or basin.

Explore Map

FEATURED: REPORT

Daily Update

The Daily SNOTEL Update Report provides provisional data for SWE and precipitation values at each site.

Choose a State

NRCS Natural Resources Conservation Service

Thank you – Questions?

American Meteorological Society - Portland Oregon Chapter Meeting
February 25, 2021

Diamond Lake SNOTEL
Burned in Thielsen Fire – 09/09/2020
Klamath Basin

Diamond Lake SNOTEL
Re-Installed – 10/21/2020
Klamath Basin

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