

2014

Wyoming Snow Survey Program



USDA

Natural Resources Conservation Service

2/28/2014

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Introduction

Snow survey is a year round activity. There are planning meetings and preparation activities in the fall before the first snow survey takes place. Winter and early spring is when all the snow surveys take place and there is a flurry of reports produced from the beginning of December through mid-June. All maintenance occurs in the summer, although maintenance can be delayed due to a late melting snowpack and resultant access issues. This compresses the maintenance season because early to mid-October is usually the end of the window for SNOTEL maintenance. In this paper the people, resources, chronology, and products are discussed.

People

In Wyoming, Snow Survey is a federal and state coordinated activity involving NRCS within Wyoming and NRCS from the neighboring states of Colorado, Montana, and Idaho (Data Collection Offices or DCOs), the National Water and Climate Center (NWCC) in Portland OR, the Bureau of Reclamation (BOR), National Park Service (NPS), the Wyoming State Engineer's Office (SEO), University of Wyoming (hosting our products) and other cooperators.

At the State Office in Wyoming the Snow Survey program is managed by three people. The Program Manager (PM) is James Bauchert, the Assistant State Soil Scientist; a Water Supply Specialist (WSS), Lee Hackleman (0.5 FTE); and Hydrologic Technician (HT,) Ken Von Buettner (1.0 FTE). All three work on state office staff to assist users of snow survey data and products, the Data Collection Offices (DCOs) in neighboring states, the National Water and Climate Center (NWCC), and field offices and cooperators performing snow measurements. Elsewhere in Wyoming, the NRCS field offices which are involved in snow survey include Cokeville (Wade Payne); Newcastle (Ryan Mar); and Lander (Kevin Edinger, backup surveyor). All NRCS snow surveyors conduct snow surveys with an SEO partner. There are no "all NRCS" snow surveys any more.

The DCO states include Colorado, Montana, and Idaho. Wyoming is split roughly into thirds for data collection purposes. All data from snow courses and from SNOTEL goes to the DCOs, regardless of who collects it (NRCS, BOR, SEO, NPS et al.). Data from the northern part of the state (Black Hills, Bighorns, east side Wind Rivers, Absarokas) is sent to or collected by the DCO in Bozeman, Montana. The Montana DCO under DCO Supervisor Scott Oviatt, has the most sites in Wyoming. Data from the western side (Wyoming Range, Salt River Range, Gros Ventre, Tetons, and west side of Wind Rivers) goes to the DCO in Boise, Idaho, DCO Supervisor Phil Morrissey, and has the 2nd most sites in Wyoming. Data in the south (Snowy Range, Sierra Madre, and Laramie Range) goes to the DCO in Denver, Colorado, Acting DCO Supervisor B.J. Shoup. The DCOs (4-6 FTEs) check and edit data, and are responsible for maintaining the SNOTEL sites in their portion of Wyoming as well as in their own states.

At the NWCC in Portland, Oregon, a staff hydrologist, Cara McCarthy, uses the edited collected data from the DCOs to produce projected April through September stream flow runoff amounts at nearly 70 select points on major rivers and streams in and near Wyoming. Cara is the primary NWCC liaison for data and products that go into Wyoming snow survey reports. The Director of the NWCC is Michael Strobel, PhD.

The BOR office based at Jackson Lake Dam in Grand Teton Park measure 6 snow courses and ground-truth measure 6 SNOTEL sites in south Yellowstone Park, the Grand Teton Park,

and adjacent national forests. They also continue to measure 6 inactive snow courses co-located with 6 SNOTEL sites for their own purposes. Liaison for the bureau is Mike Beus in Driggs, ID.

NPS in Yellowstone Park measures 4 snow courses and ground-truth 4 SNOTEL sites for NRCS. The liaison to NRCS in the park is Ann Rodman.

By far the largest contribution to snow survey comes from the people under Mr. Pat Tyrell, the Wyoming State Engineer. Nearly three-quarters of all measurements in Wyoming involve personnel from SEO, who are hydrographers and water commissioners. These folks regulate water during the warmer months, and mostly work on reports in the winter. SEO gives NRCS Snow Survey in Wyoming \$2000 annually as part of a Reimbursable Agreement. The agreement delineates NRCS and SEO responsibilities. NRCS provides snowmobiles and trailers, pays for the fuel, oil, and parts involved. SEO locations performing snow survey are in Riverton, Saratoga, Laramie, and Sheridan. A state engineer office-assigned employee from Sundance assists with measurements made by NRCS Newcastle, and 2 people from SEO in Cokeville assist the NRCS field office.

Administratively, the State Engineer's Office is divided into 4 water divisions, each headed by a superintendent. These superintendents are the supervisors of the snow surveyors. Division I encompasses the southeast part of Wyoming, directed by superintendent, Brian Pugsley, based in Torrington. Division II is northeast Wyoming and includes most of Bighorns, led by superintendent, Carmine Loguidice, in Sheridan. Division III has northwest Wyoming (non-federal lands), the superintendent is Loren Smith in Riverton. Division IV is southwest Wyoming, led by superintendent, Jade Henderson of Cokeville.

Other cooperators in Wyoming involved in snow survey are the US Forest Service (1 surveyor), Teton Conservation District (1 surveyor), and the Teton Science School (2 surveyors). Between the four of them they measure two of the snow courses in the Jackson area.

Resources

To perform snow survey, NRCS owns and operates 12 snowmobiles and 6 associated snowmobile trailers. There are two-each snowmobiles with trailer in the following locations: Sheridan, Newcastle, Casper, Riverton, Cokeville, and Laramie. In addition, there are 2 more "reserve" snowmobiles plus trailer in Casper, one of which is service-ready, and the other needing about \$3000 in repairs that is "mothballed" for the time being. The state engineers in Saratoga that do snow survey use their own snowmobiles. Thus SEO in Sheridan, Riverton, and Laramie have custody of and use NRCS-owned snowmobiles and associated trailers. Each of the SEO locations except for Laramie and Saratoga has federal government vehicle credit cards. Snow Survey also has a Utility Terrain Vehicle (UTV) 2-seater and associated trailer for use during summer maintenance. Other cooperators (BOR & NPS) use their own snowmobiles, or measure snow courses that are walk-into sites. All snow surveyors use NRCS-owned snow tubes that are supplied and maintained by the DCOs.

Chronology

A yearly meeting takes place each fall between Wyoming Snow Survey and the Wyoming State Engineer, to discuss SEO participation in the program for the upcoming year. The meeting is attended by the WSS and HT and may include the STC and PM. SEO usually will have a superintendent or two attending as well as the SEO snow survey coordinator, Matt Hoobler. At the last meeting, in December 2013, the formal written agreement (RA) between NRCS and SEO was finalized and is in effect for 2 years (expires Sep 30, 2015).

On the first Tuesday of each month at 10 a.m. and running from October through June is the statewide Water Forum. This meeting is always held in Cheyenne, on the 4th floor of the Herschler building. The meeting is hosted by the State of Wyoming, but NRCS is invited. Each agency attending gives a short update of what's happening. It's possible to teleconference in to the meeting and view the slides being shown. There is normally a presentation by some agency at each meeting. It normally lasts 2 hours.

Another annual meeting in the fall occurs between Wyoming Snow Survey, the neighboring state DCOs, the Forest Service, Bureau of Reclamation, and National Park Service. This is the annual snow survey coordination meeting to discuss the past year's snow survey, SNOTEL site status/improvements, problems, and to plan for the upcoming season. The meeting alternates its physical location between Jackson and Mammoth (Yellowstone).

At the beginning of the Water Year (WY) which runs from Oct 1st through Sep 30th of the following year a schedule is published matching up Field Offices to snow courses to be measured and SNOTEL sites to be ground-truthed. This schedule is pre-coordinated with the DCOs, SEO, NWCC, and other cooperators.

Early in the water year or before the fiscal year ends if money is available is the time when preparations are made for the upcoming snow survey season. Snow surveyors are queried for equipment needs. In the past four years equipment costs have ranged from \$2000 to \$5000, depending on needs and influx of new surveyors. Snow survey supplies surveyors with their personal equipment. Also, we have seven active SPOT devices utilized by the surveyors around the state. Each SPOT device costs \$150 annually for the subscription to the service. A subscription includes the SPOT tracking feature. SPOT use is mandated by an STC-signed instruction. All the snowmobiles are taken in to a dealer for a pre-service inspection and oil change. The pre-service costs \$150-\$200 per sled, so multiplied by 12, it adds up. If any problems are discovered during the inspections, those costs are added as well. It is normal to replace snowmobiles when they have about 3000 miles on them. If there is end-of-year money, fleet replacements are considered. The snow surveyors also let us know if their trailer needs work, and generally the trailer gets looked at concurrently with the sleds are getting inspected.

Snow surveyors are required to have refresher training and an annual physical. They must be current in first aid, CPR, and Hantavirus precautions. Each surveyor must get an annual snow survey physical and be certified by HR prior to the first snow surveys. Although these are NRCS requirements, the SEO complies with this training and physical, and they pay for all of these themselves.

In the fall, prior to the first snow surveys, the state office HT will distribute to each snow survey field office location a copy of their Emergency Operation Plan (EOP) from the previous year. The field offices are required to revisit their plan and make appropriate changes. The HT will check these EOPs for suitability, but it is the field offices which are responsible for developing them. A copy of the finished plans is printed and kept in a folder at the HT's desk. Electronic copies of all plans are maintained on the state office shared drive at:

S:\Application Data\snow\SNOW SURVEY\emergency plans\2013-14

Previous year's plans can be viewed by navigating to a higher folder.

The first field measurements begin the end of December for the January forecast. Most of the measurements in the state begin the end of January (the February 1st forecast). Measurements

take place the last five days of each month running through the end of April (the May 1st forecast). The last forecast is made for June 1st, but does not include snow course measurements. Most snow survey field office locations are making four snow surveys then (end of Jan-Apr) which can take up to three to four days each. In addition, about half of the SNOTEL sites get ground-truthed once during a season. Ground-truths verify the SNOTEL collected data, and are made between mid-February and mid-April, sometimes, but not always, in conjunction with snow surveys.

The state office HT generally goes out with one of the snow survey field offices each month during the season. According to the Engineering Business Plan, 5% of measurements are to be “spot-checked” for correct data collection procedures and technique, and to verify data accuracy. The spot checks are a metric, but not required. Other states do not plan for spot checks, but look over snow notes and train as necessary.

Snow surveyors trailer the sleds into the mountains, usually to trailer parking areas near groomed trails. Some sites are off the trail nowhere close to groomed trails and these can be difficult to access due to parking and lack of snow. Besides the SPOT device which is shared between the 2-man survey team, each surveyor wears an avalanche beacon. Snow survey runs generally do not traverse avalanche prone terrain, but when this occurs it is for short sections. When all the snow surveys for the week are complete, the surveyors send their data to the applicable DCO prior to the first of the month.

Occasionally during the winter, a SNOTEL site has a problem and the DCO responsible may ask for assistance with fixing the problem. This may entail a visit by the HT during the winter with someone to accompany him, or the HT accompanying a DCO maintenance technician coming from another state. Oftentimes, a DCO can send parts to one of the field office locations and they can make the repair. Late May or early June commences the maintenance season. During the summer, the State Office HT performs maintenance at manual snow courses, and assists the DCOs with maintenance at SNOTEL sites. Snow courses get maintenance about every three to four years.

All 91 SNOTELS in the Wyoming WSS area are visited by NRCS DCO personnel. In some years there are new site installations. 2009 had two installs. In 2010 four new SNOTEL sites were installed; in 2011 there were no installs; in the summer of 2012 1 SNOTEL was installed in the Snowy Range. 2013 had no installs. The DCOs are all different in the way they go about maintenance. When possible, a DCO schedule of planned site maintenance is sent to the snow survey office, but not always. In the past, SEO has helped out some with site installs and with regular SNOTEL maintenance.

Dry conditions increase fire potential, increasing the risk for SNOTEL sites to be damaged or even destroyed. When feasible, some DCOs like to remove the electronics in advance of an approaching fire. In 2013, two Wyoming SNOTEL sites were destroyed by fire. This was a matter of extreme bad luck because the number of fires was not as bad in 2013 as 2012. Plans were made to attempt a reinstall of one of the sites but the government shutdown prevented this.

Products

During snow season, Wyoming snow survey publishes a number of products. A “Monday Morning Snow Report” is published weekly detailing the percentage of normal of each Wyoming basin for that date, the percentage of normal at this date one year ago, and a color-coded graphic of the state. This report is emailed each Monday. It can also be found here:

<http://www.wrds.uwyo.edu/wrds/nrcs/nrcs.html>. While the report itself is published each Monday, it is possible to see the color-coded graphic on a daily basis.

A “Wyoming Basin Outlook Report” is published monthly during snow survey season. This product includes narrative information as well as charts, graphs, and percentages of normal for snow (SWE), precipitation, reservoirs, and stream flow forecasts for each of the Wyoming basins. The report is disseminated electronically to most customers, but printed copies are mailed to customers without email or needing a hard copy. The report is also available here: <http://www.wrds.uwyo.edu/wrds/nrcs/snowpack/snowmap.html>. It normally takes about a week to produce, so look for the report around the 7th of each month (published January through June).

Another product produced monthly is the Surface Water Supply Index (SWSI) or swa'-zee as it is called. This report uses stream flow forecasts and reservoir storage data to arrive at an index value similar to a drought index. A SWSI value is determined for each Wyoming basin. Values near 0 indicate normal conditions, negative numbers are indicative of dry conditions, and positive values reflect wetter than normal conditions. The SWSI is found here:

<http://www.wrds.uwyo.edu/wrds/nrcs/swsimap/swsimap.html>. The SWSI report is generated January through June.

The “Forecast Trends for Snow Water Equivalent” product is also generated twice monthly, January through June. This graphic by basin depicts the current trend of SWE, but also includes 30 year normals as well as maximums and minimums. The report can be found here: <http://www.wrds.uwyo.edu/wrds/nrcs/snowtrend/snowtrend.html>. Like the three previous products, the Forecast Trends is hosted on the Wyoming Water Development Commission’s (WWDC) Water Resources Data System (WRDS) homepage of the University of Wyoming (UW). This hosting of our snow survey data and products by UW is unique, as most of the other western states have their data and products accessible from an NRCS page.

Remarks

The snow survey program in Wyoming is multi-faceted with many participants. The program has reached sort of a plateau in that currently there is not much interest by the DCOs for additional SNOTEL site installs in Wyoming and with money tight and inconsistent amounts of funding and inconsistent hiring there is some movement to close snow courses and reduce NRCS personnel involved. SEO is against the closing of any snow courses although most of the snow courses are not used in streamflow calculations. Moreover, some SNOTEL sites are not used in streamflow forecasts, but little more than talk about closing any of them. As it is now, the DCOs are maxed out in the amount of SNOTEL maintenance they perform. Undoubtedly there is inefficiency in the program, but with so many heads involved it may be difficult to coordinate a plan. The programs are very different between the states. Wyoming relies heavily on cooperators so there is minimal personnel cost. Other states use NRCS people and have paid contractors. Wyoming pays much less for training and annual physicals than other states. However, because Wyoming is a WSS state, it receives much less in snow survey funding than DCO states.

Table of Wyoming Snow Survey Statistics

	Total	Seasonal Measurements
SNOTEL Sites under Wyoming (includes 2 in SD)	91	
SNOTEL Sites -w- manual ground truth (of the 91 above)	52	52
Active Manual Snow Courses (each measured 3-5 times/season)	54	218
		270
<u>Manual Snow Course Measurements</u>		
Manual Snow Course measurements solely by SEO		112
Manual Snow Course measurements solely by NRCS (with SEO partner)		55
Manual Snow Course measurements by others (NPS, BOR, et al)		51
		218
<u>Snow Surveyers</u>		
NRCS Personnel (includes backups)	4	
State Engineer Office Personnel (some part time)	14	