United States Department of Agriculture
Natural Resources Conservation Service

Idaho NRCS Snow Survey
2010 Fall Report

This report provides a summary of water year 2010 and an outlook for 2011, as well as other new developments water users may be interested in. Online readers can use the embedded links and linked graphics for additional information.

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2010 Water Year Summary

Water Year 2010 was a complex year which taught us a lot of lessons. Precipitation started slow, but when the caffeine finally kicked in, copious amounts of rain fell during the snowmelt season changing the water supply picture drastically.

Snow and Precipitation: ***October*** 2009 brought unusual snow amounts to the Boise and Salmon basins. For example, Trinity Mountain received 2 feet of snow in 24 hours on October 5th. The month of October had above average precipitation, ranging from 129% of average in the Willow, Blackfoot and Portneuf basins near Pocatello, to almost 230% in the Little Lost and Medicine Lodge basins in central and eastern Idaho. After October, El Nino conditions kicked in and prevailed through the rest of the winter. Storms avoided the Pacific Northwest while the Desert Southwest received above normal precipitation (Figure 1). The ***November –***

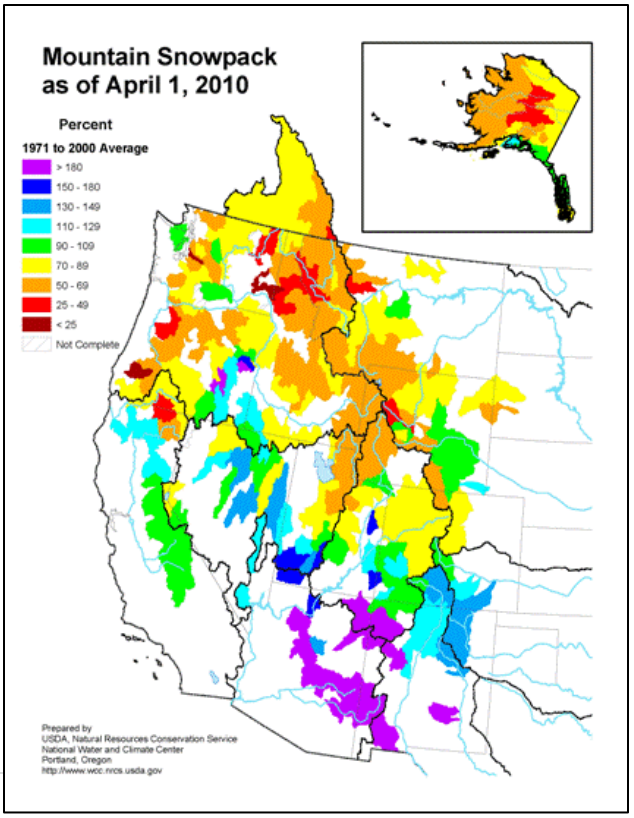

Figure 1: April 1, 2010 Snowpack

March period resulted in record low precipitation for 22 of 115 SNOTEL sites since records start in the early 1980s. Overall, about 90 SNOTEL sites saw precipitation ranking between first and fifth driest. April 1 snowpacks ranged from 50-70% of average in Idaho. Snow in the Clearwater basin was almost as low as 1977, one of the lowest years on record. In the Upper Snake Basin the snow was the fourth lowest since 1919 at Lewis Lake Divide SNOTEL. Only the Owyhee and Bruneau basins were far enough south to benefit from the El Nino storm track and ended up with a near normal April 1 snowpack.

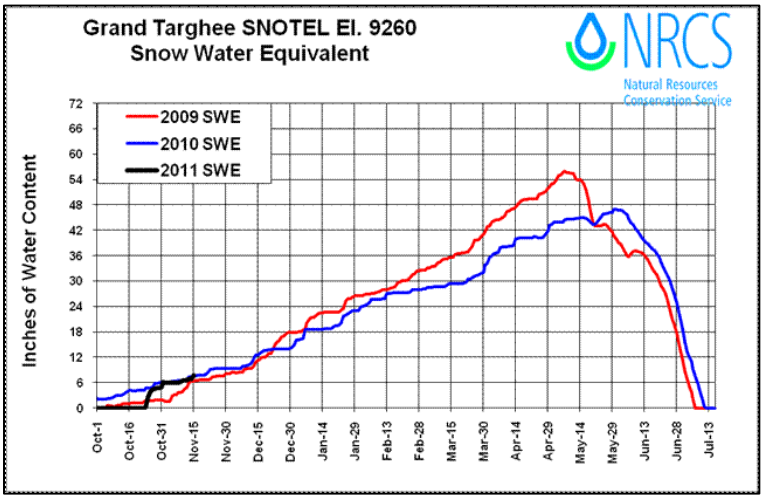

Figure 2: After El Nino snapped, Grand Targhee SNOTEL's snow water peaked on May 28, 2010

By ***April 1*** the water supply picture was very grim for most of Idaho. Streams were forecast from 40-65% of average and water managers and users were scrambling to deal with a potential devastating summer. Fortunately El Nino snapped, bringing cool temperatures and above average precipitation from ***April-June.*** The Boise, Weiser and Payette basins had up to 256% of normal precipitation in June and Grand Targhee SNOTEL site did not reach its peak snow water content until May 28 (Figure 2). Cumulative precipitation for water year 2010 ended up better than expected and ranged from 83% of average in the Upper Snake to 99% average in the Weiser basin (Figure 3).

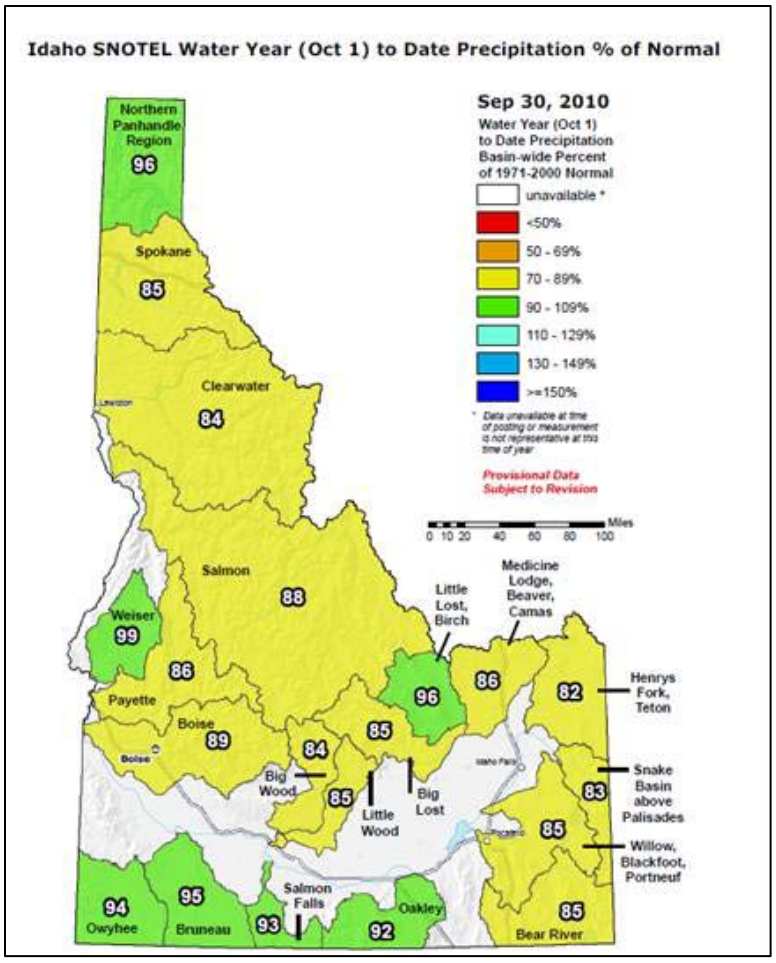

Figure 3: Water Year 2010 Total Precipitation

Streamflow: The cool, wet spring delayed snowmelt and prevented rivers from peaking early. Cold May temperatures resulted in record or near record low flow levels in mid-May across parts of Idaho and the Upper Snake River. This resulted in May streamflow volumes that were only half of average. Farmers were concerned that fields were too wet and soils too cold to begin planting; an unexpected turnaround after the El Nino winter.

Late May and June rains reversed the dire water supply conditions. The mountains received several inches of rain that combined with the snowmelt to create rapidly rising rivers that quickly filled reservoirs. On June 1, Brundage Reservoir SNOTEL site received 3.5 inches or rain, combined with 0.8 inches of snowmelt water for a total of 4.3 inches of runoff in one day. June streamflow volumes were near to above average in Idaho; with the highest monthly flow at 163% for the Lemhi River. River runners adjusted their schedule to either hit or avoid peak flows depending on individual comfort zones. The MF Salmon River peaked at almost 9

feet, near 15,000 cfs, on June 9th; much higher than was expected from a 64% of average April snowpack.

Spring precipitation combined with reduced irrigation demand helped water managers fill most reservoirs, including Dworshak Reservoir which was not expected to fill because of the near record low snowpack. The dam tender at Jackson Lake mentioned that he had not released that much water from the reservoir since the record breaking snowpack of 1997. Lewis Lake Divide SNOTEL in Yellowstone National Park, received 7.5 inches of rain in the first 11 days of June, causing concern for reservoir operators who didn't expect much runoff excitement from the 54% of average snowpack for the Snake River above Palisades Reservoir.

Streamflow Forecast Accuracy: The abundant spring precipitation caused observed summer runoff volumes to exceed the 50% chance of exceedance forecast. April-July observed flows were more in line with the 30% and 10% chance of exceedance forecasts. This situation is expected when extreme weather occurs and demonstrates the value of publishing five exceedence forecasts which take into account the range of historic conditions. April-July observed runoff volumes ranged from a high of 127% of average in the Lemhi River to 46% in the Bear River. Elsewhere, most basins were in the 70-95% of average range. The Snake River near Heise April-July streamflow was 73% of average, but it is estimated that it would have been about 60-63% of average without the abundant spring moisture. Figure 3 is a visual comparison of predicted and observed streamflows for 2010.

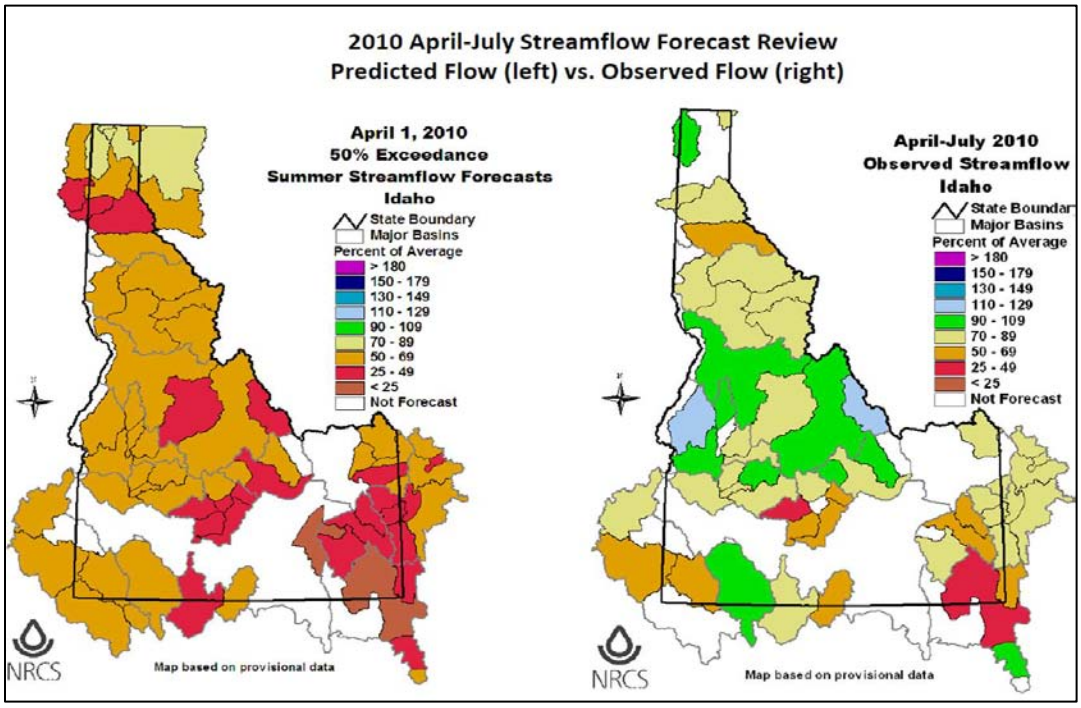

Figure 4: Predicted and observed streamflow for April-July period.

2010 Little Lost River Streamflow Model Results:
An Enhanced Snowmelt Runoff Model (SRM), that utilizes MODIS snow covered area and downscaled 10 day temperature and precipitation forecasts, was run by contactors in 2011. Daily runs and observed results are linked here with the observed flow in black and 5 exceedance forecasts which reflect 1, 3, 7 and 10 day future streamflow forecasts produced on that day. This model was calibrated and tested because of the lack of high elevation SNOTEL sites in the area. The model performed well considering the variable spring weather of rain falling in the valleys, while snow accumulated in the unmonitored, high elevation mountains of the Little Lost basin.

2011 Water Year Outlook:

Soil Moisture Summary: Idaho's soils typically need 2-5 inches of fall rain to overcome dry soils left behind by summer. Fall streamflows are also an indicator of soil moisture and used as variables to predict next year's runoff. Fall flows are not unusually high or low this year. Additional moisture is needed to fill the soil moisture void from past summer.
See Idaho's SNOTEL Soil Moisture and Soil Temperature Graphs for current conditions and past years. There is a tremendous amount of soil moisture and soil temperature data now being collected. Time and research is needed to take full advantage of these data and incorporate it into our water supply operations. The NRCS staffs in Utah, and at National Water and Climate Center in Portland, are taking the lead role in producing new soil moisture products. Hopefully Idaho will soon reap greater benefit from their work.

Climate Outlook:
Climate predictors are signaling a strong La Nina this winter. This usually provides good a snowpack in the Pacific Northwest. Expect a winter snow line elevation that is 500 feet lower than normal and an increase in the number of days with snowfall. In addition, a cool phase of the Pacific Decadal Oscillation, may be pointing towards a one-two punch for a cool, wet winter this year.

The transition from a major El Nino year to a strong La Nina year has only occurred several times since 1949. This year cool summer temperatures kept irrigation demand down while a late frost extended the irrigation season across southern Idaho; this produced a growing season that started and ended late. Boise did not experience its first hard freeze until November 9th; this was one of the latest on record at the airport. In general it is rare for a warm October to lead to into a cold winter; however that rule is not true when a strong La Nina is in play as illustrated in Figure 5 and 6, which shows a composite of two warm Octobers (1942 and 1988) followed by La Nina conditions and cold January-February temperatures that winter. If past history means anything, there is a good chance this winter may follow the same pattern.

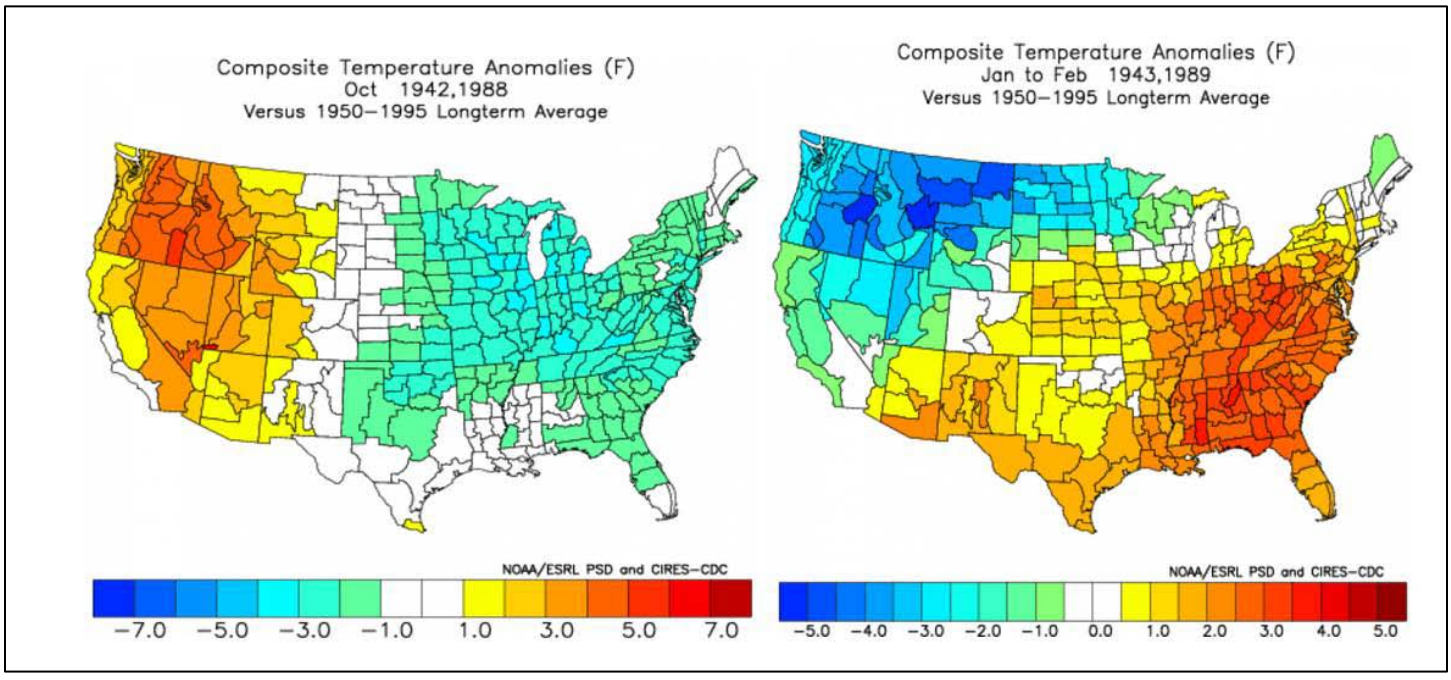

Figure 5: Warm October temperature anomalies for 1942 and 1948 in the Pacific Northwest.

Figure 6: Cold Jan-Feb temperature anomalies for 1943 and 1949 in the Pacific Northwest.

A year like 2010, with such dramatic swings, is not common. While one month of record low or record high precipitation won't impact Idaho's water supply too much, in 2010 multiple months of below average precipitation produced near record low April 1 snowpack. This was followed by a 180 degree change to record high spring precipitation, cool temperatures and delayed melt. These factors resulted in a challenge to predict, plan and manage our water supply. Future weather and associated climatic variability is always challenging to predict, however each year we learn more about how much we should rely on past climatic trends to help decision makers hedge one way or another. Let's hope La Nina brings plentiful snow to make it easier for water users to plan 2011.

Climate and Water Supply and Links:

IDWR's 2010 Fall Climate Impacts Group Meeting: NRCS Presentation | All Presentations

Climate Impacts Group Fall Newsletter

Water Year 2010: Climate Summary by Jan Curtis, NRCS, NWCC Portland, OR

"Water Year Starts with Two Aces" by Cindy Snyder, Ag Weekly, November 15, 2010

Southern Oscillation Index Statistical Correlation with Spring Runoff in the Western US, NRCS

"An Introduction to ENSO, AMO, and PDO – Part 1" Bob Tisdale's Blog on Climate Observations

Multivariate ENSO Index (MEI) – See page 5 of other years that changed from El Nino to La Nina including 1949, 1954, 1964, 1970, 1973, 1988, and 2010.

2011 Snowpack Needed for Adequate Surface Irrigation Supplies:

Each fall we estimate the snowpack, as a percent of average on April 1, which is needed to provide adequate surface irrigation supplies for the coming summer season. The calculation is based on the September 30, 2010 reservoir carryover storage, which is projected to estimate March 31, 2011 reservoir storage. The streamflow needed to meet surface irrigation demands is the difference between March 31, 2011 reservoir storage and the total amount of water needed to meet surface irrigation needs. These demand levels were determined in the mid-1990s when the Surface Water Supply Index (SWSI) was developed for Idaho and illustrates when shortages occurred in the past. Finally, the snowpack percent is determined by looking at years when there was a good snowpack but 'worst case scenario' for runoff occurred; these include years in the middle of consecutive dry years, years with low soil moisture and/or groundwater levels, or years with a dry springtime. 1989 is a good example of a poor runoff year that had a near average April snowpack. Spring and summer streamflow in 1989 was much below average due to a dry spring and cumulative drought effects. Other poor runoff years with a good snowpack are also listed in analysis below.

Snow amounts needed in 2011 vary by basin and reservoir carryover storage, but in general, an April 1 snowpack of 70-120% of average is needed to produce adequate April-July volumes if that 'worst case scenario' happens again. Streamflow volumes needed range from 45-100% of average, with the exception of the Bear River, as it is a unique basin that utilizes Bear Lake for storage and delivery of water in the allocation formula. More basin specific information is available in this report: 2011 Snowpack & Streamflow Needed for Adequate Irrigation.

What's New for 2011?

New Streamflow Forecast Points: ***SF Salmon River near Krassel***
Johnson Creek at Yellow Pine

The NRCS will start forecasting streamflow runoff volumes for the SF Salmon River near Krassel Ranger Station and Johnson Creek at Yellow Pine this year. The new forecasts have been added to fill a request from the Nez Perce Tribe. This forecast will help the Tribe better manage their fish traps.

New SNOTEL and Snow Course Sites:

Larsen Creek SNOTEL (Green River, Wyoming): Last August, our Boise snow crew was joined by staff from the Wyoming NRCS and State Engineers' Office to upgrade Larsen Creek Snow Course to a SNOTEL. While the Green River doesn't produce water for Idaho, one use of Larsen Creek SNOTEL data might interest Idahoans. The State of Wyoming is in the midst of a pilot program to evaluate the effectiveness of cloud seeding as a method to augment the snowpack. Larsen Creek is located in the southern Wind River Range which is one of two study areas for cloud seeding in Wyoming. The SNOTEL data will be useful to scientists as part of this project. For more information here is a link to the Wyoming Weather Modification Pilot Program.

George Creek SNOTEL (Raft River, Idaho/Utah): The same week the Idaho crew installed Larsen Creek, our counterparts in Utah were busy upgrading George Creek Snow Course to a SNOTEL site. George Creek SNOTEL is located just south of the Idaho border, near Yost, Utah. Up until now, the Raft River only had two snow courses in its headwater mountains; this left a data gap between measurements. Adding this SNOTEL site will produce new daily data for water users. After enough years of data have been collected to develop a meaningful statistical relationship with the original snow course, the snow course will be discontinued.

John Evans Canyon Snow Course (Oneida County, Idaho): A snow course was selected and measurements will start this winter. While doing snow course maintenance this summer in Oneida County, the Soil & Water Conservation District discussed their need for new sites with the NRCS work crew. It was agreed that a new site would provide better information on water supply and drought conditions to land owners, irrigation companies and citizens of Oneida County. The NRCS will provide snow tubes and training and the SCD offered to measure this site and the two other sites in the county. This is a win-win situation to reduce our measurement costs while providing important information at the local level.

Snow Data Collection Network Review:

The Idaho Snow Survey Office and the National Water and Climate Center are reviewing Idaho's snow data collection network on a basin by basin level. A complete GIS analysis is being used to consider which snow courses would be the best to automate or certain snow courses could be discontinued. The analysis is also picking out data void areas. End user input is helpful and important for this project. Basin analysis information will be posted when completed. To be added to our email distribution list for current water supply information and newsworthy information, please contact Adam Birken at Adam.Birken@id.usda.gov

New Snow Depth and Soil Moisture Sensors:

Snow depth sensors were installed at Bear Canyon, Camas Creek Divide, Cozy Cove and Schwartz Lake in Idaho; Hams Fork, Larsen Creek, and Willow Creek in Wyoming. This leaves only 28 of our 118 sites that still need to be equipped with a snow depth sensor; a four or five per year project.

Soil moisture and soil temperature sensors were installed at the following SNOTEL sites: Mosquito Ridge and Savage Pass in Idaho and at Larsen Creek in Wyoming. At this point 41 of our 118 sites are equipped with the soil moisture sensors. Sensors are installed as funds, time and personnel allow.

Snow Courses Proposed for Discontinuation:

The NRCS Snow Survey will be discontinuing eight snow courses starting this winter.

The following stations are highly correlated ($R^2 > 0.90$) to either a co-located or nearby SNOTEL:

- ***Smith Creek Snow Course*** (Boundary County, Idaho) - Replaced by Hidden Lake SNOTEL
- ***Moscow Mountain Snow Course*** (Latah County, Idaho) -Replaced by Moscow Mtn SNOTEL
- ***Squaw Meadow Snow Course*** (Valley County, Idaho) - Replaced by Secesh Summit SNOTEL
- ***Schwartz Lake Snow Course*** (Lemhi County, Idaho) - Replaced by Schwartz Lake SNOTEL
- ***Silver City Snow Course*** (Owyhee County, Idaho) – Replaced by South Mountain SNOTEL

The following station is being moved at the request of the land owner:

- ***Thorson Cabin Snow Course*** (Washington County, Idaho) will be replaced by Thorson Cabin #2

The following sites have difficult or unsafe access

- ***Corner Creek*** (Hayden Basin) - Also highly correlated to Fourth of July Summit Snow Course
- ***Sage Creek Saddle*** (Hayden Basin) - Also highly correlated to Lower Sand Creek #2 Snow Course

For a detailed description of the analysis that went into the discontinuation decision, please click here. Analyzing and optimizing the NRCS snow data collection network in Idaho is an ongoing effort to achieve multiple objectives related to the best use of limited agency resources. Safety is a big concern; many existing sites are well off any groomed trails and surveyors may be at risk from both avalanche danger and just getting stuck in certain conditions. Converting snow courses to automated SNOTEL sites will reduce the need for people to be out measuring in hazardous conditions and also greatly increase the amount and availability of climatic data where only limited snow water content data was previously obtained. The added benefit of discontinuing redundant manual sites and automating others is a real savings in employee and contractor time and dollars that can be targeted to the SNOTEL network. If there are other needs or concerns for these proposed sites for discontinuation, please contact Phil Morrisey at 208-685-6983 or email Phil.Morrisey@id.usda.gov

Major Snow Course Maintenance Work Completed in Summer of 2010:

The summer of 2010 featured an extensive effort by the Snow Survey staff to visit and complete necessary maintenance issues at nearly every manual measurement data site that comprise Idaho's snow course network. Keep in mind the work season in the mountains is shorter than valley growing seasons, so it is a challenge to get to this many sites in one year. Snow courses are permanently marked locations where manual measurements of snow depth and snow water equivalent are taken by trained observers near the first of the month (with mid-month measurements made at some locations) during the winter and spring. Idaho snow courses typically consist of five sample points laid out along a transect extending several hundred feet and are often located in small forest openings protected from the wind. Several snow courses in Idaho represent some of the earliest organized snow surveys performed in the Western United States and provide important continuous long-term climatic data for the scientific community. For example, Fourth of July Summit and Kellogg Peak, in northern Idaho's Coeur d'Alene basin, were first established in 1923 and 1928, respectively, and represent over eighty years worth of snow measurements.

From May through October of 2010, field excursions were made to sixty-seven snow courses located throughout the state of Idaho. An important objective of this summer's effort was to generate a comprehensive inventory of Idaho's snow course network by recording the GPS coordinates of individual sample points, verifying and updating site sketches and field maps, revising mileage logs that detail summer and winter access routes, and taking several photos featuring the sampling area.

Other activities performed at each snow course included installing new "NRCS Snow Course" signs that mark the end-points of sampling transects, replacing missing or damaged fence posts and metal number tags that designate individual sample points, as well as, removing any encroaching vegetation and overhanging tree canopy that could alter how snow collects.

Figure 7: Volunteers from the 2010 summer snow course maintenance season. Thanks for your help!

Ensuring the accuracy of snow measurements taken at every snow course was the primary goal of this project. We could not have completed this year's sizable workload without the large number of volunteers who donated their time and energy in order to make this summer such a success. This summer we received volunteer help from the following organizations:

Idaho NRCS Field Offices: Idaho Falls, Malad, Nez Perce, Rexburg, Rupert, Sandpoint, Soda Springs, and St. Anthony

US Forest Service: Council, Island Park, Ketchum, and Powell Ranger Districts, the Salmon-Challis National Forest Supervisor's Office, and Priest River Experimental Forest,

BLM – Idaho State Office, Twin Falls Canal Company, Falls Irrigation District, Weiser Irrigation District, Avista Corp., Idaho State University, Silver Mountain Ski Resort, Thompson Creek Mine, Oakley Canal Company, a number of Soil and Water Conservation Districts and our contractors. **THANKS SO MUCH!**

Other Information:

Changes in Idaho Daily SNOTEL Update Report:
With the installation of George Creek SNOTEL site in the headwaters of the Raft River in northern Utah, we plan to add the Raft basin and rename the Oakley basin to Goose basin in the Idaho SNOTEL Update Reports. The new Goose basin will no longer include Howell Canyon SNOTEL since its runoff contribution is downstream of Oakley Dam. Although we prefer to include a minimum of three sites in a basin analysis, considering the large amount of terrain and few sites in this area, we decided these changes would help locals better monitor their water supply. If you have other suggestions about how the update report could be changed to better meet your needs, please contact Ron.Abramovich.

Idaho Snow Survey Website Upgrades:
After feedback from online users we decided to create a Snow Quick Links Webpage to simplify access to our most useful products. This page is accessible from the navigation bar on our Homepage. The "Basin Map Format" maps (pdf's dead center of "Quick Links" page) are a relatively new product. These maps offer a visual alternative to the table format update reports. We've also added more obvious links to our snow course data on the "Quick Links" page.

CoCoRaHS - Community Collaborative Rain, Hail & Snow Network:
This is an interesting network of "backyard" measurements that may be helpful to you.

Adopt-a-SNOTEL Site Program:
This program helps teachers use Natural Resource Conservation Service (NRCS) SNOTEL sites throughout the west to teach lessons in science, math, hydrology, water quality, the environment, and conservation using real world data and concepts their students can relate to. For more information, please contact your local NRCS Field Office or Jeff Anderson.

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