USES OF NATURAL RESOURCES CONSERVATION SERVICE SNOW SURVEY DATA AND PRODUCTS

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ABSTRACT

In the Western U.S., the annual accumulation of the mountain snowpack and the resulting predictability of streamflow have created a wide range and diverse use of Natural Resources Conservation Service (NRCS) Snow Survey data and products. The key factor in the West is how much snow falls and where it falls for water users to speculate what may happen and plan accordingly. Historically, the NRCS inventoried the mountain snowpack to predict spring and summer streamflow for irrigated agriculture. The installation of the SNOTEL (SNOw TELemetry) Network in the early 1980s and a daily climatic data set has increased the use of this high elevation data. Many customers use this data to assist in their day-to-day decisions, for winter or summer recreation, to hedge financial decisions, or for wise management of water as a natural resource.

This paper discusses the importance of snow in the West, how it accumulates, and melts to provide our water supply, and associated decisions made each season to manage and plan accordingly based on the winter snowfall. A seasonal timeline illustrates when customers need and use Snow Survey data and products. The obvious, but also unusual uses of snow survey data and water supply products are discussed. The many aspects of the work that NRCS Snow Survey and Water Supply Forecast staff does, affects everyone in the West, other parts of the nation, and even other countries.

INTRODUCTION

In the Western US, the annual accumulation of the mountainous snowpack and the resulting predictability of streamflow have created a wide range and diverse use of NRCS Snow Survey data and products. Many users use this data to assist in their day-to-day decisions, for personnel recreation information, to hedge their financial decisions, or for wise management of water as a natural resource. This paper attempts to summarize the different uses of snow survey data and products and when they are requested.

The key factor in the West is the amount of snow and its location for water users to speculate and plan accordingly. This is where NRCS comes into the picture by inventorying and monitoring the mountain snowpack throughout the West to predict the coming year's streamflow. If Mother Nature delivered the same amount of snow each and every winter, it would be nice and consistent and make it easy for water managers to manage and deliver constant supplies for irrigation, fish, and hydropower. Nature does not work this way and often goes through wet and dry cycles. In snow-dominated streams in the West, 75 percent of the annual streamflow originates from the seasonal snowpack. First, lets discuss the importance of snow in the West, how it accumulates and melts to provide our water supply, and then discuss the decisions made each year to manage and plan accordingly based on the winter snowfall.

IMPORTANCE OF SNOW

Here in Idaho, we refer to the mountainous snowpack as Idaho's frozen liquid gold and when it melts, it becomes the lifeblood of the state. The snowpack is like a giant reservoir in the mountains storing and accumulating the moisture that falls in what we refer to as the mountainous snowpack. Each and every winter, storms roll in from the Pacific Ocean crossing the western US. In the spring, the snow gradually melts at an average rate of 1-2 inches a day. That would be the same as receiving 1-2 inches of precipitation for one to three months or until the snow was all gone. The spring thaw and melt produces predictable rise in streamflow across the western US. Over 75 percent of the annual streamflow originates from the melting mountain snowpack and could be over 95 percent if stream baseflows from snow were also included.

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Figure 1. Idaho's frozen liquid gold, somewhere in eastern Idaho, March 31, 2006.

The West is different from the East and Midwest US, as 70-80 percent of our annual precipitation falls from November to March and less than 10 percent of the annual precipitation falls during the July to August growing season. Summer monthly precipitation amounts are 1-2 inches in the mountains and typically less than an inch in populated valleys and agricultural areas, thus creating the need for steady and constant irrigation supplies. Irrigation is critical to agriculture in the US as nearly half of the value of all crops sold comes from the 16 percent of harvested cropland that is irrigated. In the East and Midwest, nature delivers 3-4 inches a month, or an average of an inch a week, enough to sustain dryland farming.

Annual snowfall is variable and analysis of historic snow survey data shows that the West often goes through wet and dry cycles. In recent years, research has indicated that the weather is more volatile when compared to the 1950s and 1960s. Add to this, the increasing and competing demands for water as a limited resource is making it tough to be a water manager to manage a supply that is highly dependent upon the snowfall that falls, accumulates and melts each year in the West. Increased climatic variability has also increased use and need of snow survey data and products.

Let's start and look at how our internal and external users use our data and products in their numerous decisions whether for financial purposes or management of natural resources. The chart below illustrates the typical timeline when water users need and use Snow Survey products. The Preparation, Planning and Operations stages and associated uses will be discussed.

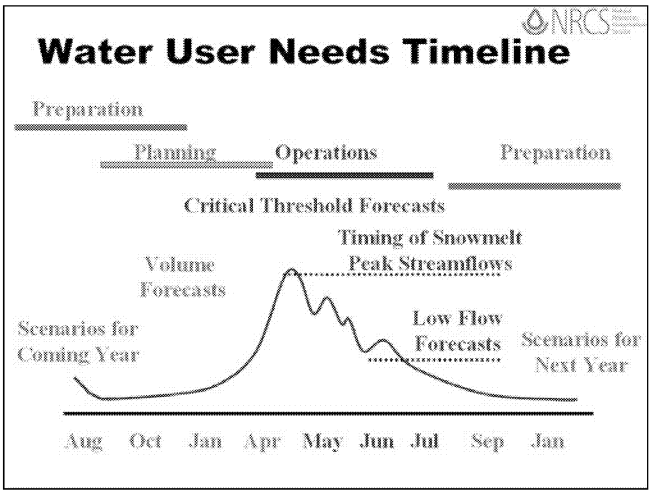

Figure 2. Water user needs timeline illustrating the Preparation, Planning and Operations stages when NRCS Snow Survey data and products are used.

Preparations – Scenarios for Next Year

Each summer and sometimes even before the previous season's snow melts, the news media, farmers and weather watchers call and ask "what's the outlook for next year?" Farmers harvesting their crops are ready to start thinking about the future, especially if it was a bad water year. We use El Nino/ La Nina also referenced as Southern Oscillation Index (SOI) to advise customers about what may happen next year. From July-November, SOI correlates with next winter's snowfall/streamflow in parts of the Pacific Northwest and Desert Southwest. This information allows us to provide scientific advice about next year's water supply. Other sources for next year's forecast are long-range weather forecasts along with the Farmers Almanac. Those interested and occasional phone calls include farmers, stockbrokers, power producers and natural gas suppliers. If the Pacific Northwest has a good or bad snow year, a possible increase or decrease in coal and natural gas production could occur. Bonneville Power Administration provides 40 percent of their region's power with 90 percent coming from hydropower dams on the Columbia and Snake rivers. In an average runoff year, Idaho Power can produce 60 percent of its electricity needs from hydropower. Washington Water Power, now called Avista, generates 40 percent of its hydropower from the Clark Fork plant alone. Each spring, Idaho Power requests power cost adjustments for their consumers through the Public Utilities Commission based on April 1 water supply forecasts, contracts, and 'true up' which is based on our forecast accuracy for the previous year.

El Nino often makes the news in the fall, but don't put all your eggs in one basket, as we have learned in the past, past indicators do not always represent future conditions especially with the stock market and other events that may have human influence, such as climatic change. Other uses of El Nino and sea surface temperatures include an inquiry from a District Conservationist after learning about El Nino at a Snow Survey presentation. His interest was to help decide where to plan his next scuba diving vacation. He learned the ocean water where he went scuba diving was colder than normal and not as warm as they expected. However, more ocean life can usually be seen in cooler water. During another El Nino year, a soil conservationist called to see if there was any correlation between El Nino and spring precipitation in southern Idaho so he could accurately schedule the appropriate number of rain make-up games for the local softball league several months in advance. No such luck, there is very little correlation between El Nino and spring precipitation throughout the West. How can you use El Nino/SOI in your Planning process? For more information see El Nino/SOI correlations verse western states water supplies: http://www.id.nrcs.usda.gov/snow/links/soiwsf3.html

As we move from summer to fall, the days are getting shorter, nights are getting colder, and we know our reservoir carryover storage for next year and have a feeling about how wet or dry the soils are. The fall rains help to get moisture back into the dry soils after the typical dry western summer. If the fall rains don't occur, soil moisture can be the "wild card" to accurately forecast streams next spring. Good antecedent moisture from fall rains means less snowmelt goes into the ground next spring and more drains into rivers and reservoirs for use above ground.

Summer maintenance at SNOTEL sites is done as we wait for the first snowfall of the season - which could be September, October, November or even December in a bad year. Snow survey folks and our customers get excited when the first flakes arrive, it is the dawn of a new season, and the news media starts calling to find how much and where the snow is falling. If last year's water supply was bad for you, then it is time to stop worrying about last year and start speculating and worrying about next year. Each year the Idaho Snow Survey staff provides about 100 news media interviews, multiply this by 10 and you have a good ballpark figure for interviews throughout the west each year given by NRCS Snow Survey offices. We have learned the news media is interested in what we do, likes going snowshoeing with big, heavy cameras, sometimes get lost with snow experts, and most importantly, can get the 'word out' about our current and ever changing water supply conditions better than we can.

Figure 3. NRCS Snow Survey personnel provide approximately 1000 news media interviews each year.

Occasionally, in the fall some states compile a Fall Outlook summarizing accuracy of last year's streamflow forecasts, El Nino/SOI outlook for coming year, streamflow forecasts based on SOI, reservoir carryover for next year, and amount of snow needed to provide adequate irrigation supplies. Perhaps one of our greatest challenges is to provide a snow level threshold for irrigators to watch during the long, cold winter to help monitor if they will have an adequate water supply. Recently, we just started taking full advantage of having 20 plus years of daily SNOTEL data and are able to run daily volumetric streamflow forecasts starting on October 1 of each year. To learn more and their accuracy or skill level, see: http://www.id.nrcs.usda.gov/snow/watersupply/

Planning – Volume Forecasts

It is now January, the snow is falling and starting to accumulate, but we are only 40 percent of the way through winter. In January, NRCS starts providing monthly or bi-monthly volume forecasts for users to start Planning and thinking ahead about their financial decisions. Before 1990, we did not start forecasting until February because we were not even halfway through winter. Now, because of availability of daily SNOTEL data and more accurate statistical forecast procedures, we are able to meet these user requests and forecast streams with reasonable error bands in January. These volume forecasts allow users to start thinking ahead, Planning and making decisions based on the water supply forecasts for the coming season. If our volume forecasts are not available timely, customers (hydropower, irrigations districts, etc.) start calling and asking 'when they will be available' for their meetings, which are usually the first week of each month, or to verify their decisions and their forecasts. NRCS and NWS coordinate streamflow forecasts and provide the 'official public forecasts.' Other agencies may forecast for their internal operations. However, many users call NRCS for their forecast numbers and even request the 'uncoordinated value' to compare to their predictors so they can independently decide which forecasts to favor for their decision and Planning purpose. Most private irrigation districts and reservoir operators do not forecast and rely on NRCS forecasts. Volume forecasts are used by hydropower producers to help answer the critical question: how much hydropower can be produced, and if they need to start securing power from other sources at a reasonable price.

In mid-January and with half the winter still to come, which could change the water supply outlook for the better or for the worst, farmers start making decisions and signing contracts for growing crops and use our volume forecasts to guide their Planning decision. It may be too early for some producers to tell if they will have a full water supply or not, if they need to factor in additional costs for groundwater pumping or use a secondary irrigation source. From January-March, water managers use our forecasts for Planning and to shape their reservoir storage and releases by passing more or less water depending upon snow amounts at SNOTEL sites and associated volumetric streamflow forecasts. Some producers are lucky, and can put their decisions off until May to decide to plant higher money producing crops rather than grains in a low water year. In consecutive drought years, some farmers decided to (or had to) get a secondary job since they knew they would be out of irrigation water by mid-summer. State Department of Labor agencies use our water supply outlook reports to gauge migrant worker employment needs. You can bet that if a farmer is looking for a second job, then they won't need as many hired hands.

Let's change snow hats and discuss use of our snow data while it is still frozen in the mountains. Winter recreation use of SNOTEL data has grown over the years, especially with the invention of the automated snow depth sensor in the late 1990s. We are now able to collect snow depth along with new snowfall and monitor snow

density on a daily basis to help determine when the snowpack is ripe to melt. To view reports that we have created for our customers and learn more of these uses, and even a new snowboard with a depth sensor, see: http://www.id.nrcs.usda.gov/snow/recreation/

Snow depth is as important to some as the amount of snow water in the snowpack is for hydrologists and engineers to manage water as a natural resource. Snow depth and snowfall is used for determining big animal migration, avalanche forecasting, snow loads, when Sandhill Cranes return, and more. Everyone likes to hear the optimistic snow reports about the big dumps, snowfall in the hundreds of inches. Some snow stories are like the 'big fish' that got away and we have learned that a good snowpack means more tourist and travel dollars for the local economy. Let's talk about some of these other uses in more detail.

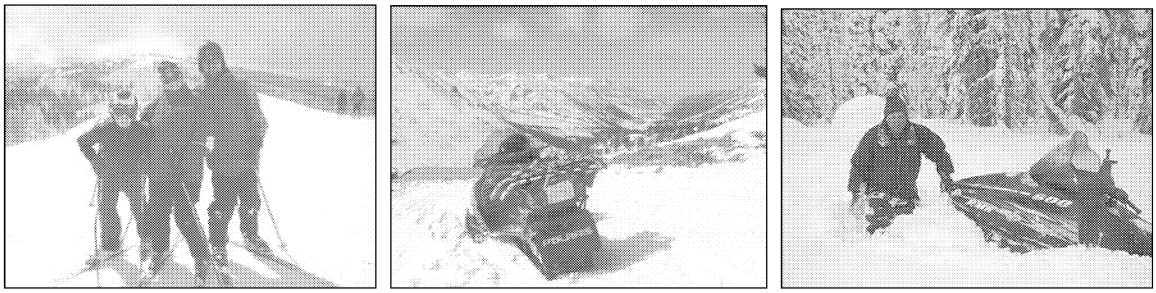

Figure 4. Recreational use of NRCS Snow Survey data: resort or backcountry skiing, snowmobiling and digging out on a powder day.

Have you ever tried sampling snow on groomed ski trails? We did to help determine if there was enough snow on the race course to host a ski race or if the ski area had to move the race to another resort. Moving the race means loss of revenue for the ski club, ski area, and local economy. We have also assisted the Forest Service to determine if plowed snow would end up in a river and affect salmon habitat, and helped an elderly lady determine how much snow was at scenic Redfish Lake in Idaho in the middle of winter so she could spread her husband's ashes who had recently passed away. Our advice was to wait till spring. We have even loaned snow tubes to determine how much snow and water may have to be removed because of a high elevation petroleum leak, and assisted law enforcement officials about how much snow was at the scene of the crime and if the road was passable where a body was found. CSI (Crime Scene Investigation) would be impressed.

Building managers and city personnel use SNOTEL data to determine snow loads and to be proactive in sending crews to shovel roofs that maybe under-designed for mountain snowloads. The Idaho Snow Survey staff received numerous calls about snow loads in the winter of 2005-2006 because folks had not seen an above average snowpack in over six years. For more information on snow load calculations see: http://www.id.nrcs.usda.gov/snow/data/geninfo/snowload.html

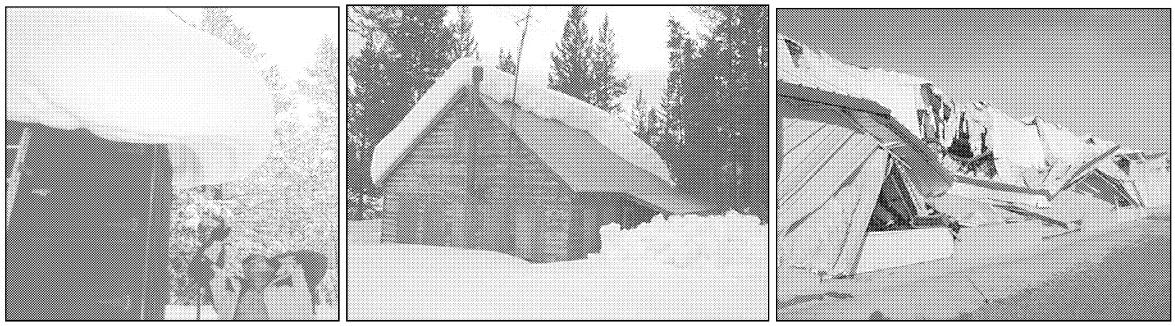

Figure 5. Use of NRCS Snow Survey data to determine snow loads and what could happen: studying snow loads, properly designed roof and roof failures from snow.

Other users of NRCS snow data, Planning forecasts and Surface Water Supply Index (SWSI) products include: bank loan officers and USDA Risk Management Agency analysis of our forecasts to assist with loans and crop insurance needs. The Federal Reserve Board and Natural Gas Company use snow survey and water supply

information to gauge the economy and population growth in southern Idaho and other areas of the West where water availability may influence or limit future residential growth. Anheuser-Busch headquarters in St. Louis uses our information to help determine their barley and hops outlook in many western states and Canada.

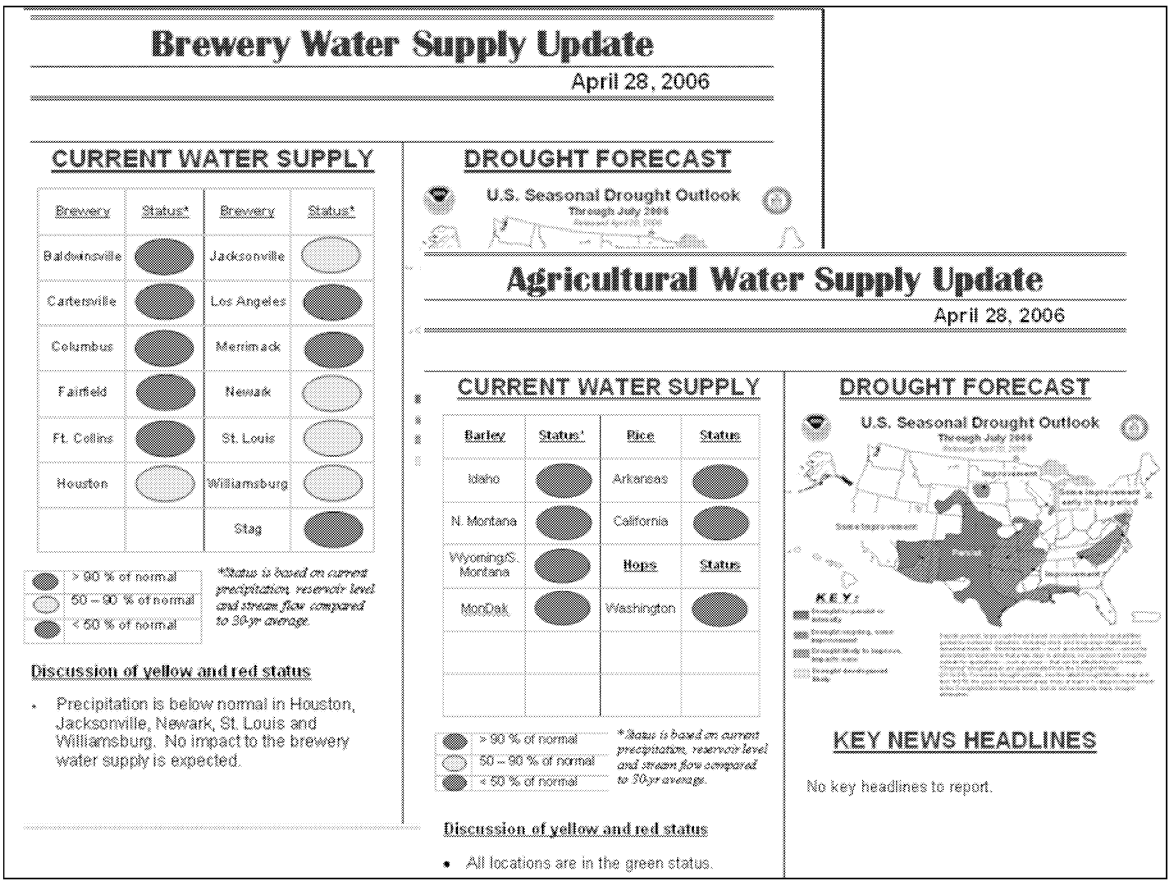

Figure 6. Stoplight diagram of Anheuser-Busch use of water supply information to help guide their operations.

SNOTEL data and water supplies are not just a western issue; SNOTEL data is available 24/7, updated hourly on the Internet and available to you no matter where you live. Program officials have provided advice or helped install automated snow measuring stations in Iraq, South Africa, China and Antarctica, and to develop SWSI in Iran. As long as our data and products are available on the Internet in a timely manner, we don't usually hear from our customers. Nor do we know all the details on how they are using snow survey and water supply information in their Planning and Operation decisions, unless the data or products are not available. For numerous and different reasons, this is why the SNOTEL system is the only aspect of the USDA NRCS program that is listed as a 'mission critical' program for USDA.

In a low snow year, a mint contractor called to see who would be water-short and who would have water through August. He needed information to help determine where to sign contracts with farmers. Mint plants need water in late season to produce the valuable oil. In this case, the Idaho Surface Water Supply Index (SWSI) provided him the necessary information to determine where surface agricultural irrigation shortages may occur, and also illustrate where farmers may need crop insurance. This graph illustrates when shortages typically occur in the upper Snake River basin: http://www.id.nrcs.usda.gov/snow/watersupply/swsi/snake_heise/apr.html. More detailed information on the index can be found here: http://www.id.nrcs.usda.gov/snow/watersupply/swsi-main.html. Water managers also use the volume forecasts to set the price of rental water in water banks each year.

Operations – Critical Threshold Forecasts

It is now early April; the snowpack is reaching its peak water content for the season throughout the West, snow depth on the ground peaks in mid-March. The Planning volume forecasts have been useful, but now, let the fun begin as we shift gears and enter the Operations – Critical Threshold Forecasts period. This period is when the

snow starts melting, streams start rising and we'll soon see how accurate our forecasts are and their usefulness for our customers. We'll hear them thank us or hear their complaints about under forecasting wet years and over forecasting dry years, which is typical when using multiple regression forecasting. The extreme years are the critical years to get right; it is easy to forecast streams and be a water manager in normal runoff year when water management decisions are fairly standard. We have lots of excuses about what went wrong, and often say "spring precipitation can make or break our forecasts." In the 1960s and 1970s, weather was less volatile and the job as a water manager was easier with fewer demands placed on this limited resource. More recently, we have seen more volatile weather and are wondering how many curve balls Mother Nature can throw at us. Have we seen them all in the past 20 or 50 years of climatological data we base our projections on? As a result, greater climatic variability is encouraging our users to ask more specific questions about Timing of Snowmelt Peak Streamflows and Low Flow Forecasts. Now, we can accurately answer them because of 20 plus years of high elevation daily climatic data that Congress has invested in known as the SNOTEL Network. The annual Snow Survey and Water Supply Forecasting Program budget was $10.5 million dollars in 2006. What a bang for your tax dollar.

Let's get back on track and move on… Up until April everyone wants to know how much snow is 'up in them hills' and what the water supply outlook looks like. They'd like to hedge one way or another about their future decisions, which is dependent on this year's snowpack and resulting water supply. Water users monitor the accumulation and melting of the pack at their favorite SNOTEL site, some even use SNOTEL graphs as screen savers on their home computers to remind them of their water source which provides them with the water to grow crops, to put food on their table (and ours) and provide their family income.

How an individual uses water or wants to use the water determines how they want the snow to melt. There are strong feelings on how the snow should melt depending if you have a reservoir water right or surface water right, not to mention a groundwater right or a combination of them. Reservoir irrigation water right holders prefer a quick melt to flush the water out of the mountains to fill reservoirs and their water right. Natural streamflow irrigators and reservoir hydropower producers would rather see a gradual melt to maintain streamflow levels and their water supply through the dry summer months. In some small towns, neighbors gather at the local worship place and have their unofficial assigned seats. Groundwater users sit on the left and surface water users on the right because you know the other guy is stealing your water. But after a series of drought years, it is amazing how a good snowpack can bring out smiles, change your attitude about life and bring joy to you and your neighbor. How do you put a dollar value on this? Even river runners have a preference on how the snow 'should' melt depending if they like big whitewater in the spring or want a gradual melt to maintain adequate flows for a family friendly whitewater rafting trip.

Now that May is here, things are heating up and snowmelt is in full swing. The rivers have peaked once, the questions that NRCS Water Supply Specialists get each spring are "is that all there is," "is there more runoff to come," "have the streams peaked," or "is there enough snow up there to produce one more peak," "will the next peak be higher than the last," "can we close the gates on the reservoir and do final fill," and "is it safe for whitewater river runners to put the boats on the river?" The same questions are asked each and every year in snow-dominated streams; the answers assist water users in wise management and use of water as a natural resource.

Following is narrative and graphical illustration of recent streamflow variability for a stream in central Idaho, which shows why users are asking these types of questions. Hot weather in 2006 melted snow quickly, increased the flow above flood stage and to new record high levels since measurements started in 1916. A year like 2003, resulted in a single peak but the locals that live by the river got lucky as the snow ran out just prior to reaching flood stage while irrigators downstream saw only one month of above average flows; April-September runoff volume was only 46 percent of average and a water short irrigation season materialized as predicted. Mild temperatures during the snowmelt season in 1998 produced multiple streamflow peaks for nearly two months. With the snowpack at only half of average in 2001, produced streamflows that were only 36 percent of average and resulted in change of crops planted and reduced acres plant as irrigation water ran out in July!

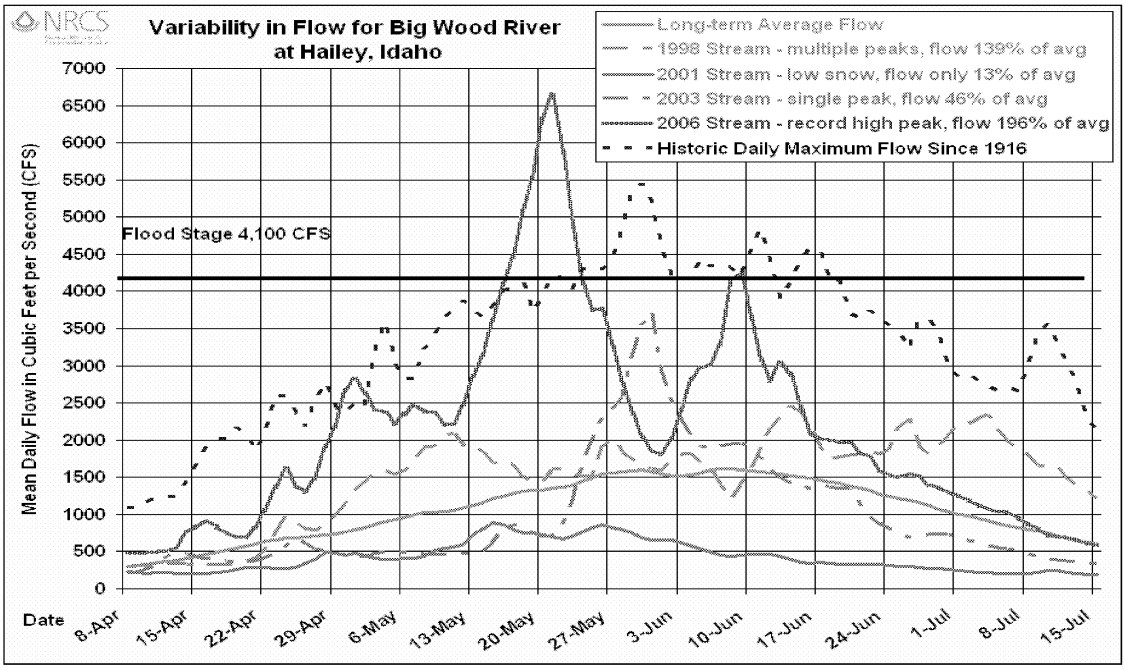

Figure 7. Graphical illustration of streamflow variability in recent years illustrating type of questions that NRCS receives each year in snowmelt dominated watersheds.

Who is interested in peak flow? Everyone from river runners, dam operators, hydropower operators, fish management and more are interested in not only peak flows but also magnitude and duration of the high streamflows. Farmers and irrigators may not be as interested in the peak flows as they are in their total water supply to fill their water right for irrigation. Let's discuss some of those interested that have used our services in the past.

Hardcore whitewater river runners travel the West looking for big water each spring and want to know if the river has peaked or if there is potential for higher flows, which may be more dangerous. Boy Scout Troop leaders want to know if flows will be above their level of confidence before taking troops on a raft trip. This was an excellent learning example in providing advice to the trip leader as he knew his 'comfort zone' for boating and only needed to know if the flow would exceed this level on a certain date. Everyone has their own 'comfort zone' on a river and it is difficult to explain the potential that rivers are capable of going 'big' if the optimum weather conditions occur in the spring.

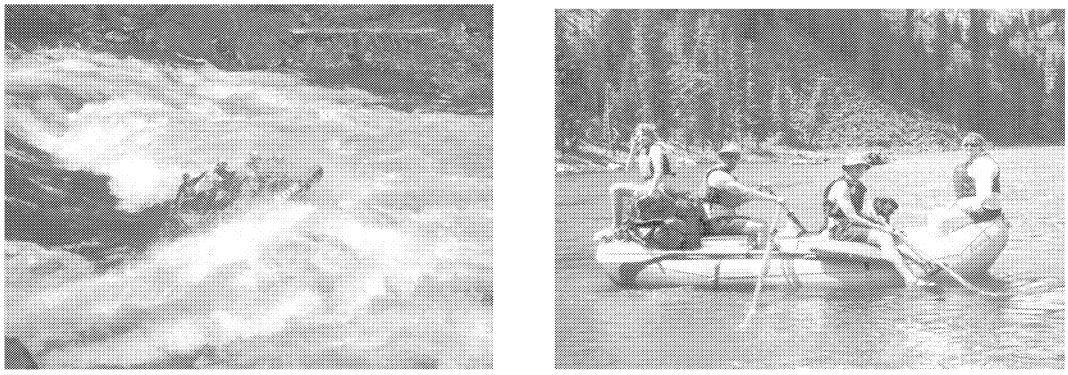

Figure 8. Filming whitewater rafting conditions in Idaho on Lochsa Falls Rapid on the Lochsa River for The Weather Channel June 8, 2006, and family boating on the Salmon River in the Frank Church River of No Return Wilderness Area, July 2005.

On the other hand, if you are into sunny skies and family whitewater raft tips in July, you would like a gradual melt to maintain adequate boating levels in the summer. This allows many to enjoy whitewater rafting without encountering high dangerous flows or low late summer flows that often occur in non-reservoir controlled western streams.

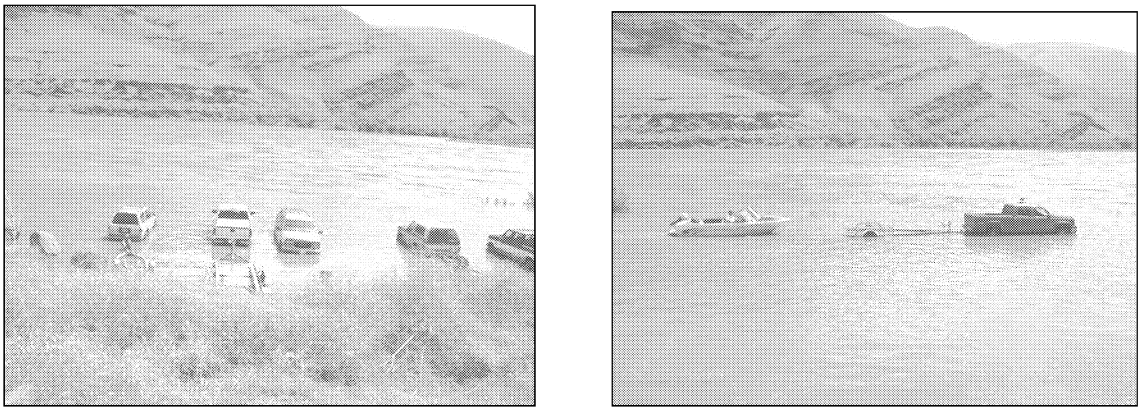

Figure 9. Boat launch at Heller Bar on lower Snake River, May 31, 2003 when the river rose quickly from hot temperatures producing rapid snowmelt in Idaho's Salmon River basin.

Be careful where you park your vehicle because streams can rise quickly even in years with a below normal snowpack, like in 2003. A delayed snowmelt in May gave way to record high temperatures melting two inches of snow water per day, increasing streams rapidly and to levels much higher than folks expected with a below average snowpack. River runners and land management agencies also monitor the melting snow at SNOTEL sites to determine when mountain forest roads will open and if you'll be able to drive to the river put-in. If roads are closed, river runners may have to cancel their 'once in a life time trip' or pay an additional expense to use over snow vehicles or fly gear to the river put-in. Likewise in the late summer, if rivers are too low to launch from the normal put-in. It pays to plan ahead and the SNOTEL Network provides key information for making these decisions.

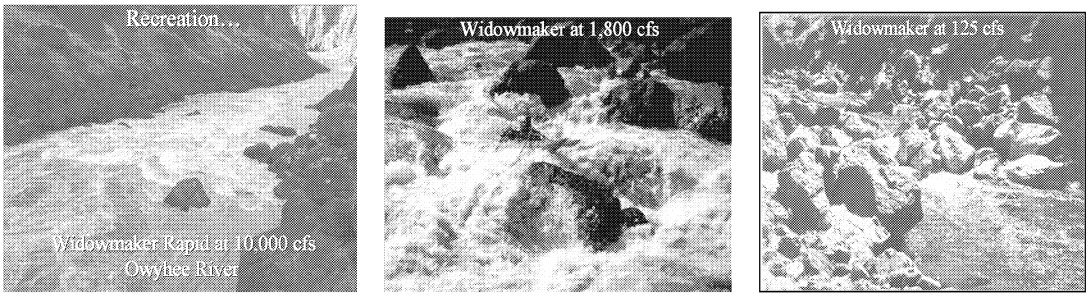

Figure 10. Widowmaker Rapid on Owyhee River at 10,000 cfs, 1,800 cfs, and 125 cfs (cubic feet per second).

Dam operators and hydropower producers are interested and aware of consequences of maintaining a full reservoir to produce power verse not planning properly and flooding if Mother Nature throws curveballs in the winter or spring producing inflows too big to manage.

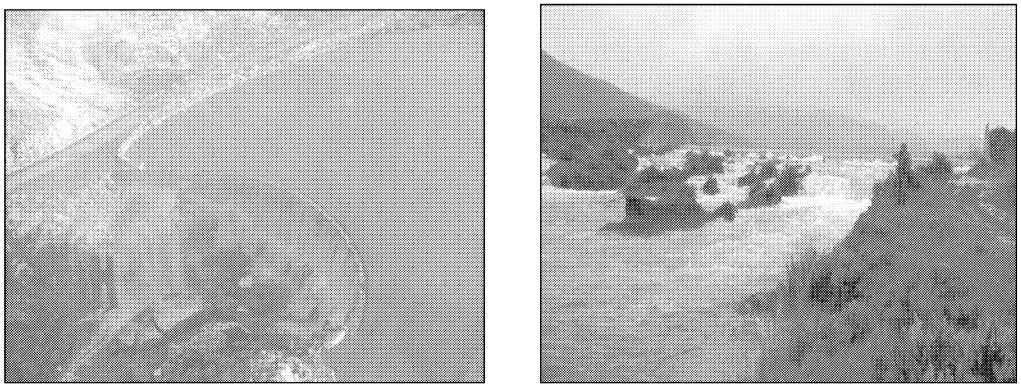

Figure 11. Lower Enterprise Dam (left) in southern Utah January 12, 2005 after heavy precipitation event and Little Wood Reservoir spillway in central Idaho May 18, 2005 after two inches of rain fell in one day plus snowmelt.

It is now July; streams have receded from the snowmelt. Monthly precipitation amounts are less than an inch in the valleys and an inch or two in the mountains. This is enough for dryland farming to squeeze by in some western states, but not enough for growing irrigated crops. The lack of summer precipitation is the reason why our winter snowfall is so crucial for meeting summer water supply needs.

Fish managers use peak and low flow forecasts to determine if, and when or where they should plant hatchery fish in the spring or if the streams may dry-up and reduce fish habitat. Later in the summer months, low flow forecasts are used to determine if the fishing season should be curtailed due to low flows and warm water temperatures that stress the fish. Low volume and flow forecasts are also used to let the public know streams may open for salvage fishing as some streams dry-up in low snow years. Water supply information is also used as guidance for passing salmon flow water from the upstream reservoirs in Idaho and Wyoming through the Snake River dams to the Columbia River.

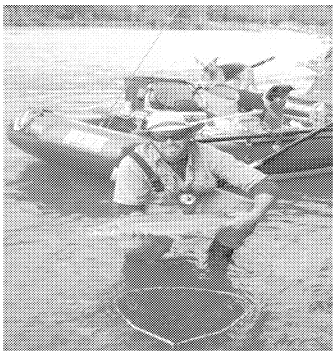

Figure 12. Fish managers use snow survey data for hatchery stocking and curtailing fishing season due to low streamflows.

It is now late summer and fall is coming, reservoir operators have learned it is financially better to rent excess water during the summer season then flush it in the fall or gradually release water to produce hydropower in the summer when the price of electricity is higher.

Who Did We Miss?

- Hunters – keep their eye on the sky watching snow data in the fall to see if weather and snow are driving big game down from the higher elevations.
- Tire sales – did you know that Mother Nature is the best sales ad for getting people to buy or put their winter tires on? A good old fashion snow storm in November or December increases sales, while a winter snow drought hurts tire sales. Likewise, windshield repair businesses are busy and hire more employees in good snow years.
- School bus drivers and highway departments – use SNOTEL data to monitor new snowfall before sending vehicles out and maybe even use it to call a "Snow Day"!
- Teachers and school children – access data for the Adopt–a-SNOTEL Program, for more information see: fttp://ftp.wcc.nrcs.usda.gov/downloads/centennial/article2120060522.pdf
- Ski rental stores thanked us – for providing encouraging information when El Nino conditions were threatening but had not happened yet in November and December 2006. They have learned that once the public had the mindset of a bad snow year, their income decreases.
- Powerboat sales – after hearing how local a ski area correlated their financial income to winter snowfall, a powerboat dealer did the same thing and now advertises by mentioning snow and water supply in their ads.
- Enron spin-off company – to buy or sell hydropower based on the flashy side of the market, demands and streamflow peaks.
- Homeowners – use the snow and soil moisture data to help determine how long they need to run their sub-pumps to keep water away from their house foundation.
- Fire weather forecasters – use climatic and soil moisture data for monitoring, predicting and determining forest fire potential, crew deployment, and ideal time for controlled burns to reduce forest fuels.
- Range managers – use snow data and soil moisture data to determine range readiness and when to turn the cattle loose in the high county.
- Pizza sales - a take-n-bake pizza chain requested temperature data because they noticed a decrease in pies sales as temperatures rose. Nobody wants to turn their stove on when temperatures are 90 or 100 degrees F. Our suggestion was 'if temperatures were above 85 F, give 5 percent off; above 90 F, give 10 percent off;

above 95 F, give 15 percent off; and if it sets a new record high, give the first 10 customers the next day free pies.' See this link for more information: http://www.id.nrcs.usda.gov/snow/watersupply/usdanews.htm

Who else – navigation on the Columbia and Missouri, global change research, glacier recession, lake water quality studies, leaky sewer lines, sizing evaporation ponds, weekly updates for the US Drought Monitor, and weekly reports summarizing snow water around Mount St. Helens (in case it blows). I'm sure there are more stories of how folks use NRCS Snow Survey data and products for their personnel or financial decisions. If you have a good use, let your local snow surveyor know.

Recipients of Idaho Water Supply Outlook Report

November 2002 breakdown of the recipients on the mailing list for the Idaho Water Supply Outlook Report:

Count	Customer Group
132	Federal Government
111	Private Total – Business / Industry / Consultant
43	Private – recreation
33	Private – industry
28	Private – hydropower
9	Private – bank
7	Private – consultant
94	Agriculture Group – irrigation district
86	Other – unknown, individual or landowner
61	State Government
34	News Media
28	Educator
21	Local Government
14	Agricultural Rural Group
9	Tribal Government
5	Congress Staff – federal
4	Community non-profit Organization
599	Total Count

Thirty-nine Idaho NRCS Field Offices also receive the report but are not included in above list. One hundredth twenty-three or 20 percent of recipients are from outside of Idaho. The list does not include users accessing the Idaho Water Supply Outlook Report from the Internet. In 2006, there were over 16 million web hits or accesses for data and information on the NRCS National Water and Climatic Center computer. This count does not include web hits at the NRCS state level, nor users that access SNOTEL data from other sources such as National Weather Service, Western Region Climatic Center, Mesonet Network or Weather Underground.

SUMMARY

The NRCS Snow Survey and Water Supply Forecasting Program provides a wealth of data and products for the public to access for their decision making process. High quality data is important and critical in our analysis and yours. How the snow falls, accumulates, melts and runoffs each year is different, but it is amazing how the weather or lack of weather affects all of us one way or another.

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