



Natural Resources Conservation Service
P.O. Box 2890
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Date: April 24, 2013

Subject: April 1, 2013 Western Snowpack Conditions and Water Supply Forecasts

The following information is provided for your use in describing western climate and water supply conditions as of April 1, 2013. California and Alaska data are updated in this report.

OVERVIEW

March was warmer than normal across California, Nevada, and Arizona ($>+5^{\circ}\text{F}$). Near normal temperatures extended from the Pacific Northwest to eastern New Mexico. Below normal temperatures extended from the eastern slope of the Montana Rockies to eastern Colorado ($<-5^{\circ}\text{F}$). All but the northeastern plains of Colorado and Montana experienced significant precipitation deficits (Fig. 1) following a very dry January and February. Alaska precipitation percent of normal pattern was dominated with below normal precipitation, however some above normal values occurred over the Kenai Peninsula and the north-central region of the state (Fig. 1a). Because of an unusually dry March from a climatological perspective, projected seasonal water supplies in the West have declined in nearly every state and basin, compared to the [March 1 forecasts](#).

SNOWPACK

March began with the least amount of snowpack in the West over the central and southern Rockies and over the Sierra Nevada (Fig. 2). The most snowpack included the Cascades; an isolated drainage in central Nevada; scattered drainages in Arizona; the Upper Columbia River; and southeast, Kenai, and south-central regions of Alaska. Much of the West had decreases in snowpack during March as noted in Fig. 3.

A map containing a daily update of the westwide snowpack is available at the following URL - <http://www.wcc.nrcs.usda.gov/gis/snow.html>

SEASONAL SNOW WATER EQUIVALENT

Despite being in a neutral El Niño Southern Oscillation (ENSO) oceanographic pattern, the atmosphere has been acting more in line with a typical La Niña winter, with the western states north of latitude 41°N experiencing above normal amounts of precipitation and below normal amounts south of 41°N (the central mountains in Arizona are an exception) (Fig. 4). However, large precipitation shortfalls over much of Oregon and northern Nevada are noteworthy exceptions. For Alaska, normal to above normal Snow-Water Equivalent (SWE) values have occurred across the state, with the Panhandle and south-central regions experiencing the largest surpluses and the Upper Tanana and Kuparuk Drainages having the largest deficits.

Monthly and seasonal precipitation maps are available from the following locations - <http://www.wcc.nrcs.usda.gov/gis/precip.html> and <http://www.cbrfc.noaa.gov/wsop/westwide/westwide.cgi>.

SPRING AND SUMMER STREAMFLOW FORECASTS

March was a very dry month over much of the West. Precipitation amounts were less than 25% of average in most basins (Fig. 1). In contrast, the areas receiving above normal precipitation are the northern Washington Cascades, upper Columbia and Kootenay in British Columbia, Flathead in western Montana, upper Snake and upper Yellowstone in Wyoming, portions of the upper Green in southwest Wyoming and northeastern Utah, and the Colorado Front Range. There were a few other scattered areas of average to above average precipitation in isolated pockets, but for the most part Western precipitation continues to exhibit dry conditions.

The Upper Columbia, Yellowstone/Upper Snake, and Upper Colorado basin snowpacks received a much needed increase over the last month. The snowpack in those areas increased, in terms of percent of average, 5% to 10% (Fig. 3). However, the snowpack over the southwestern half of the West continues to deteriorate. The remaining snow conditions over eastern Oregon, California, Nevada, southwest Idaho, Utah, Arizona, and New Mexico are not favorable (Fig. 2). Over Alaska, the snowpack is variable, as one might expect from such a large expanse of land, but it is mostly near average, except in the southwest and northwest (where it is below median) and the southern coastal panhandle (where it is much above median).

The previous discussion about precipitation and snow translates into a very strong gradient from above average spring and summer streamflow runoff prospects from the northern portions of the West, to much below average prospects from the southern regions (Fig. 5). Forecasts in the Upper Columbia Basin increased significantly over the past month. This, along with projected increases in the Upper Snake, bodes well for the Columbia Basin overall. With the exception of the Missouri Basin, where only slightly below average runoff prospects are forecast, the potential spring and summer runoff from rivers in the southern tier of the West is projected by NRCS/NWCC forecast hydrologists to be very much below average (Fig. 6). The potential consequences of very low river forecasts, coupled with below average reservoir storage (Fig. 7) could give rise to difficult decisions from western water managers and could limit the usage of water bodies.

Alaska - The snowpack in Alaska continued to make gains through March. The greatest gains were made in the eastern Susitna Valley Basin and in the Koyukuk Basin, though the Koyukuk Basin still remains below normal. The eastern Bristol Bay area was the only part of the state which had a decline in snowpack, and the Kotzebue and Norton Sound region in northwest Alaska maintained what little snowpack remains. Snowpack in Southeast Alaska through the Gulf of Alaska to the Kenai Peninsula, along with the Tanana Valley and portions of the lower Yukon, remain above normal.

Arizona - As of April 1, snowpack levels are below normal to well below normal in the major basins. Precipitation for March was also below normal to well below normal in the basins. The Salt and Verde River reservoir system stands at 63% of capacity, whereas San Carlos Reservoir is at 1% of capacity. The forecast continues to call for well below normal runoff in all of the basins for the remainder of the spring runoff period.

California – California experienced major storms in November and December which delivered above normal precipitation. Since then, the months of January, February, and March have been some of the driest on record, adding minimal precipitation in the form of rain or snow.

The snowpack in general is far below median conditions. Snowpack in terms of SWE is also much below median for this time of year in the Northern, Central and Southern areas of the Sierras. In fact, the SWE for these areas of the Sierras is approaching the amount recorded for the 1976-1977 water year, which is considered one of the driest on record.

Most major reservoirs in California, especially those fed by the Central and Northern Sierra Mountains and Foothills, are still at average storage for this time of year, even with the lack of precipitation during January, February, and March. Lake Oroville is at 108% of normal storage, Lake Shasta is 101% of normal storage, Lake Comanche is at 132% of normal storage, and New Hogan is at 96% of normal storage.

In general, streamflow forecasts project below average flow, based on the respective 30-year averages. For example, streamflow forecasts in the Truckee River Basin are approximately 47% of average and the Lower Colorado River is at 34% of average.

Colorado – Unlike last year, the month of March continued to bring snow to Colorado. However, the state's snowpack as of April 1 only showed a nominal increase from last month's report. Contributing storms and relatively cool temperatures helped maintain the snowpack in the mountains but were not able to bring it closer to median conditions. This marks the fourth, consecutive month of below median snowpack for the state as well as the third, consecutive month of below average precipitation in the mountains. Forecasts for spring and summer streamflows are well below average across the entire state with many streams expected to produce volumes that are below 50% of average.

Colorado is still experiencing the effects of last year's below normal snowpack and the resulting streamflow runoff into our reservoirs. The majority of the state's major river basins are reporting well below average reservoir storage. Judicious use of the state's existing supplies will be critical in minimizing impacts this season. There is always the potential for unexpected late season snowfall and above average spring precipitation to help ease the impacts of a less than average snowpack.

Idaho – Another dry month added little to Idaho's snowpack. In years with near-normal precipitation, snow levels would maintain from month to month. However, this year snow percentages decreased. Last fall, Idaho got off to a good start by receiving some moisture on the ground and snow in the highest elevations. However, March is the third straight month of below normal precipitation in Idaho.

This month's streamflow forecasts across Idaho illustrate the diverse climate, snow accumulation, and storm tracks in Idaho. The highest forecasts call for 100% of average runoff in Idaho's Northern Panhandle region whereas the Bear River, in southeast Idaho, is forecast at only 6%. From north to south streamflow forecasts then drop to 80% of average in the Spokane basin and increase to near average in the Selway and Lochsa Basins because of the steady track of storms this winter in the Clearwater Basin. The Salmon River headwater streams are forecast just above 80% of average due to better high-elevation snowpack, and decrease to 77% for the Salmon River at White Bird. Across the rest of the state, forecasts are as low as 40% of average in the lower elevation streams such as Mores, Owyhee, Camas, and parts of the upper Bear River, and increase to 80% of average in the Big Lost River basin. The Upper Snake streams reflect this similar elevation pattern with the headwater streams for the Snake River above Jackson Lake at 90% of average and decreasing to the mid-80s downstream, and to 67% for the Salt River which originates along the Bear River divide. The Snake River near Heise is forecast at 74% of average, whereas the Henrys Fork is a little better at 82%. Minimal water will pass Milner Dam this season with the exception of fish augmentation or other predetermined releases. Because of limited inflows this season, reservoirs will be drafted to near minimum levels by summer's end, which means carryover storage will be low for next year across most of the state.

Montana – Through the month of March, the weather patterns continued to favor the northern portions of the state, whereas the central and southern parts of the state experienced long periods of high pressure, which led to an influx of warm southern air, above average

temperatures, and significantly below average precipitation. During the month, central and southern Montana received a 3-9% decrease in the snowpack percent of median, while the basins in northern Montana saw a 4-7% gain. Overall, the variability in the weather patterns across the state balanced out during the month of March changing the statewide snowpack percentage of median only 1% below where it was on March 1.

The downward trend of the March precipitation mimics what was seen during the month for snow accumulation, with northern mountains and valleys seeing precipitation through the month. The southwestern portion of the state received significantly below average monthly precipitation with mountain precipitation values ranging from 57 to 74%. Valley precipitation during the month was significantly below average in the central and southern regions.

State-wide reservoir storage was 106% of average.

State-wide, spring and summer streamflows are forecast to be 83% of average. West of the divide streamflows are forecast to be 88% of average. East of the divide are forecast to be 79% of average.

Nevada - This year is ending with fairly similar snow and precipitation numbers as last year. Although the Sierra Nevada range started the new year with large snowpack numbers, a dry January, February, and March have left Western Nevada in very dry shape. The remainder of the state has fared just as poorly with dry conditions dominating the region for a second year in a row. A hoped for strong February or March failed to materialize, leaving April to try to recover from the deficit the state is currently in. Although reservoir storage is adequate for the main populated areas of the state, meeting all water needs this summer is going to be very difficult to do, leaving many areas facing shortages and having to make some difficult decisions regarding irrigated agricultural acreage. Water users will need to work closely with their suppliers to determine the extent of any restrictions that may apply this year. Areas with poor reservoir storage or agricultural areas that get their water directly from a watercourse can expect these flows to decline earlier than normal this year.

New Mexico - The weather pattern during March for most of New Mexico remained dry and somewhat warm, with all of the state seeing well below average snowfall and precipitation. Warm and windy conditions dominated for the latter half of the month, intensifying the already dry conditions and leading to significant snow melt and possible sublimation. With the extremely dry fall that was recorded in 2012, runoff levels from the melt-out are also being reduced due to infiltration into the soil profile. Some basins have already melted out the majority of the snowpack, with only small peaks registering at stream gauging stations in the area. Overall, it would appear that New Mexico is set up for another very dry spring. This will not only affect runoff and water users; it will also contribute to another year of high fire danger for residents around the state.

Oregon – Oregon has experienced two months of below average precipitation. These are very critical months for summer water supplies, and the lack of moisture during February and March led to below normal snowpacks as of April 1 for much of the state. In addition to below normal peak snowpack levels, spring snowmelt started a couple of weeks earlier than normal, especially in parts of southern and eastern Oregon. Only northwestern Oregon managed to maintain a near normal snowpack for this time of year.

Runoff volumes in coastal drainages and lower Columbia River tributaries are expected to be near normal this spring and summer. Water supplies throughout the rest of the state are expected to be below to well below normal. From the John Day basin east to the Owyhee and south to Klamath, Lake, and Harney counties, water users should prepare for reduced irrigation water supplies. The flurry of storm activity at the end of February and into early March provided

an opportunity for snowpacks to increase and water supply conditions to improve. However, March turned out to be an unseasonably dry and warm month. Southeastern Oregon was especially hard hit with water supply forecasts dropping 20-50% of average over the course of the March. At this stage in the season, these areas have little chance of recovering to near normal conditions and water users should prepare for marginal water supplies.

The latest drought monitor update has outlined expected drought persistence in the regions of southern and southeastern Oregon. Updated information can be found on this website:

<http://drought.unl.edu/>

Utah – March was the third consecutive month of well below normal snow accumulation in Utah. Fortunately, there wasn't a wind event like last year which would make a bad situation worse. Even at that, there are only a handful of the highest elevation SNOTEL sites that are not currently experiencing melting. Snowpacks across the state are low (62% on the Weber River to 90% on the Beaver River) and declining quickly. March precipitation was much below normal statewide ranging from 44% to 63% of average. This brings the year to date precipitation to below normal statewide at 77%. Current soil moisture saturation levels in runoff producing areas are: Bear – 73%, Weber – 72%, Provo – 73%, Uintah Basin – 51%, SE Utah – 48%, Sevier – 64% and SW Utah – 63% of saturation. Soil moisture values are near normal in northern Utah and very dry in the southeast. Low snowpacks and dry soils will lead to lower runoff efficiency and less streamflow this season. Reservoir storage is down 17% from last year's figures and similar to 2010 and 2011. General runoff conditions are much below average across the state and are expected to continue declining. Surface Water Supply Indices range from 4% for Joes Valley to 47% for the lower Sevier. Water managers should prepare for early streamflow, shorter duration, longer irrigation season, low volumes, and low peak flows. The National Climate Prediction Center forecast is for warm and dry across the state.

Washington – Washington received median mountain snowfall for much of March, even though above normal temperatures dominated the region during the final week of the month. Snowpack appears to have reached its apex in most areas and has begun to melt and run off into Washington's rivers. Though April 1 usually marks the peak of snow accumulation, historically have been good accumulations through April, but mostly in the high country. Weather forecasts are calling for slightly below normal temperatures but equal chances of below normal or above average precipitation over the next few months. The Climate Prediction Center has announced the continuation of ENSO neutral conditions for the foreseeable future. Cooler temperatures will be good news for a slow, sustainable melt cycle. The April 1 statewide SNOTEL readings were 112%, down slightly from last month. Manual snow surveys found a very good snowpack this month with snow densities near to well above 40%, which is slightly ahead of normal. Snow typically begins the full melt phase at 47%-50% density. During the month of March, the National Weather Service and NRCS climate stations reported below normal precipitation in all river basins, with the exception of the northwest corner of the state and the western Olympics, which reported slightly above normal precipitation.

Wyoming - SWE across Wyoming is below normal for this time of year at 82%. SWE in the northwest portion of Wyoming is now about 88% of normal (87% of last year). Northeast Wyoming SWE is currently about 95% of normal (103% of last year). Southeast Wyoming SWE is currently about 77% of normal (119% of last year). Southwest Wyoming SWE is about 75% of normal (104% of last year).

Last month's precipitation was below average across Wyoming. The Cheyenne Basin had the highest precipitation for the month at 113% of average. The Tongue and Lower North Platte Basins had the lowest precipitation amount at 57% of average.

Streamflow yield for April to September is expected to be below average across Wyoming. Most probable yield for the entire state of Wyoming is forecast to be about 67% (varying from 34-95% of average). The Snake River and Madison River Basins are expected to yield about 74% and 88% of average, respectively; with 66-88% of average for the various forecast points in the basins. Yields from the Yellowstone and Clark's Fork are expected to be 88% and 88%, respectively. Yields from the Wind and Bighorn River Basins are expected to be about 52% and 57% of average; varying from 39-89% of average in the basins. Yield from the Shoshone River Basin of Wyoming is expected to be about 87%, varying from 80-89% of average. Yields from the Powder and Tongue River Basins are expected to be about 84% and 65% of average, respectively; varying from 65-105% of average. Yield for the Cheyenne River Basin is expected to be about 96% of average. Yields for the Upper North Platte, Sweetwater, Lower North Platte and Laramie Rivers of Wyoming are expected to be about 46%, 38%, 34%, and 66% of average, respectively; varying from 34-67% of average. Yields for the Little Snake, Green River, and Little Bear of Wyoming are expected to be 42%, 51%, and 53% of average, respectively; yield estimates vary from 39-75% of average.

State Basin Outlook Reports can be accessed at: <http://www.wcc.nrcs.usda.gov/cgibin/bor.pl>.

RESERVOIR STORAGE

Statewide (average) reservoir levels (Fig. 7) show no significant changes since last month with the exception of a moderate decrease in Arizona's level. California, Idaho, Montana, Utah, and Wyoming are near normal. The remainder of the western states are below normal, especially Nevada and New Mexico. California data will be provided at a later date.

FOR MORE INFORMATION

The USDA-NRCS National Water and Climate Center Homepage provides the latest available snowpack and water supply information. Please visit us at <http://www.wcc.nrcs.usda.gov>

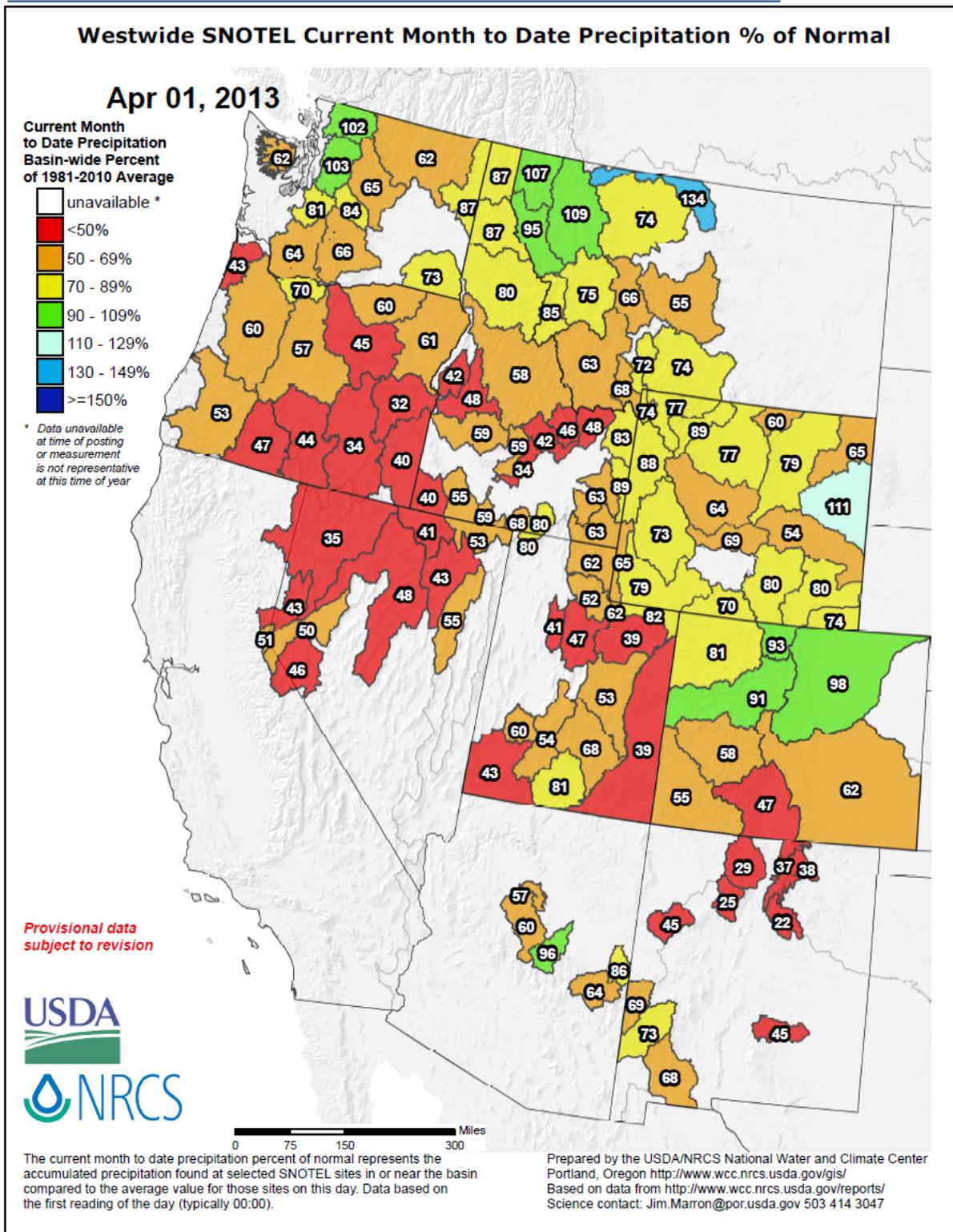


Fig. 1: For March 2013, precipitation was generally well below average west-wide, with the exception of the northern Washington Cascades, northern Montana Rockies, and some river basins along northern Colorado and eastern Wyoming, where values were closer to the long-term median. Basins over Oregon and northern Nevada with percentages under 50 reflect record or near record dryness during the first three months of 2013.

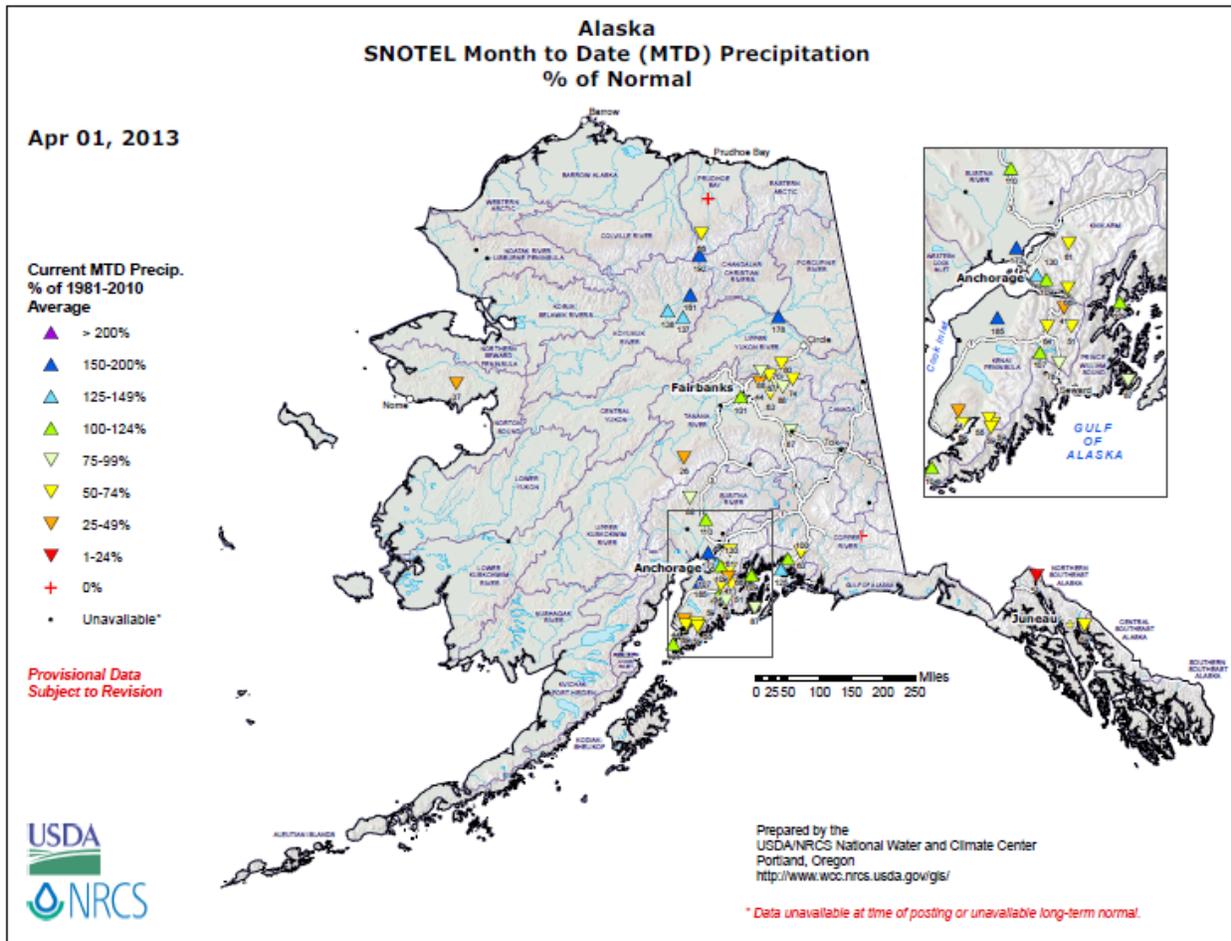
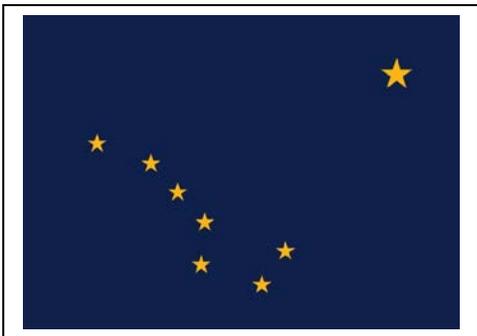


Fig. 1a: For March 2013, [Alaska](#) first class weather station summaries can be found at:

- [Annette](#)
- [Yakutat](#)
- [Bethel](#)
- [Cold Bay](#)
- [Kodiak](#)
- [Anchorage](#)
- [King Salmon](#)
- [McGrath](#)
- [Saint Paul](#)
- [Valdez](#)
- [Barrow](#)
- [Fairbanks](#)
- [Nome](#)
- [Kotzebue](#)

March is typically a dry month across the state and although most areas experienced below average precipitation, a few SNOTEL sites in the Chandalar-Christian Rivers Basin (north-central region) and Kenai Peninsula resisted the trend and experienced above normal precipitation.



Mountain Snowpack as of April 1, 2013

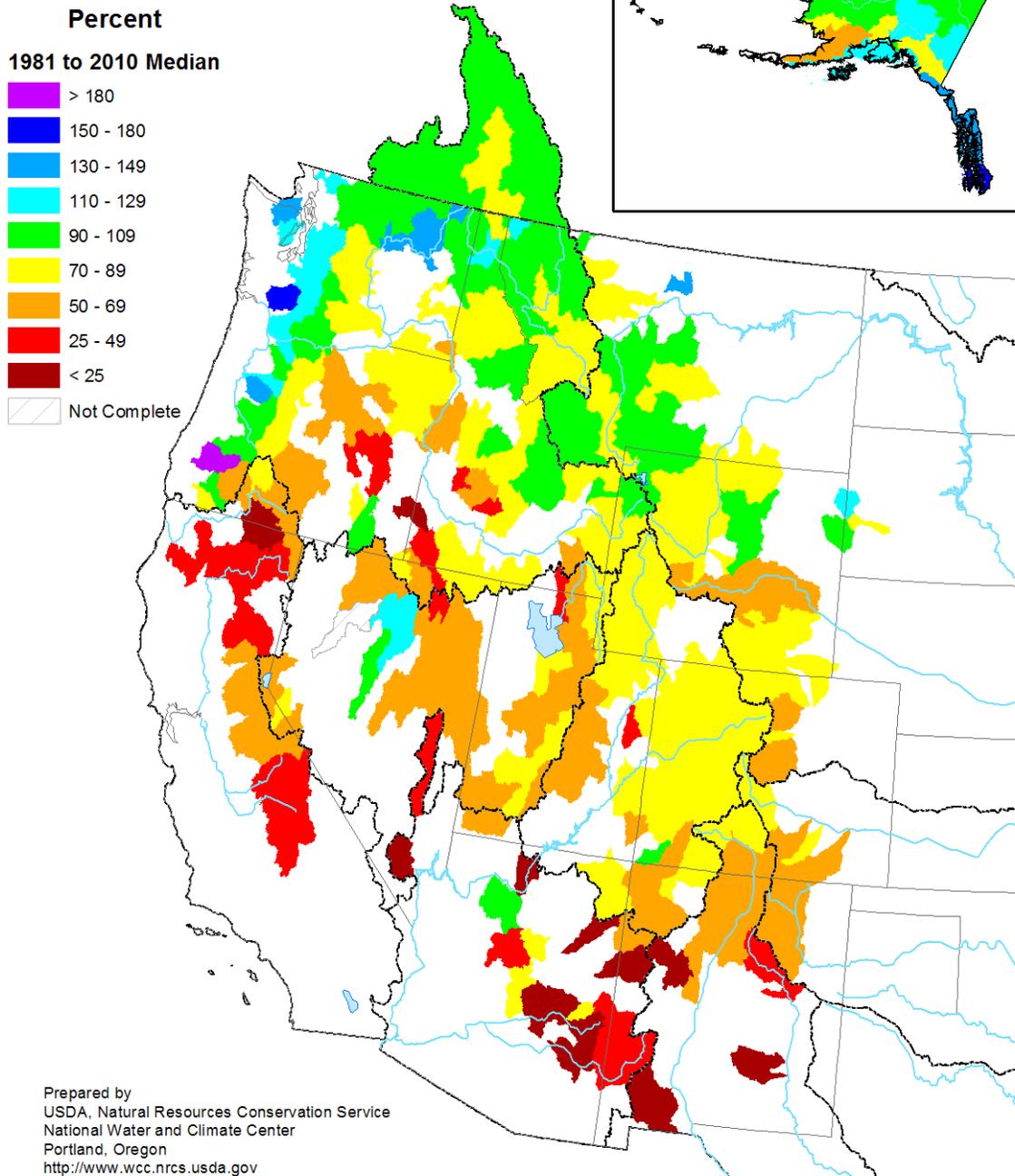


Fig. 2: Snowpack values on 1 April 2013. While much of the Cascades, Upper Columbia River, Northern Rockies, and Black Hills have surpluses or near normal conditions, most of the remainder of the West is experiencing significant deficits. Sites over Arizona and the southern half of New Mexico usually peak by mid-March. Alaska shows a complex pattern of surplus and deficit with the Panhandle and southern interior regions having the greatest snowpack and the Alaska Peninsula and northwest region of the state having the least.

Mountain Snowpack Change between March 1 and April 1

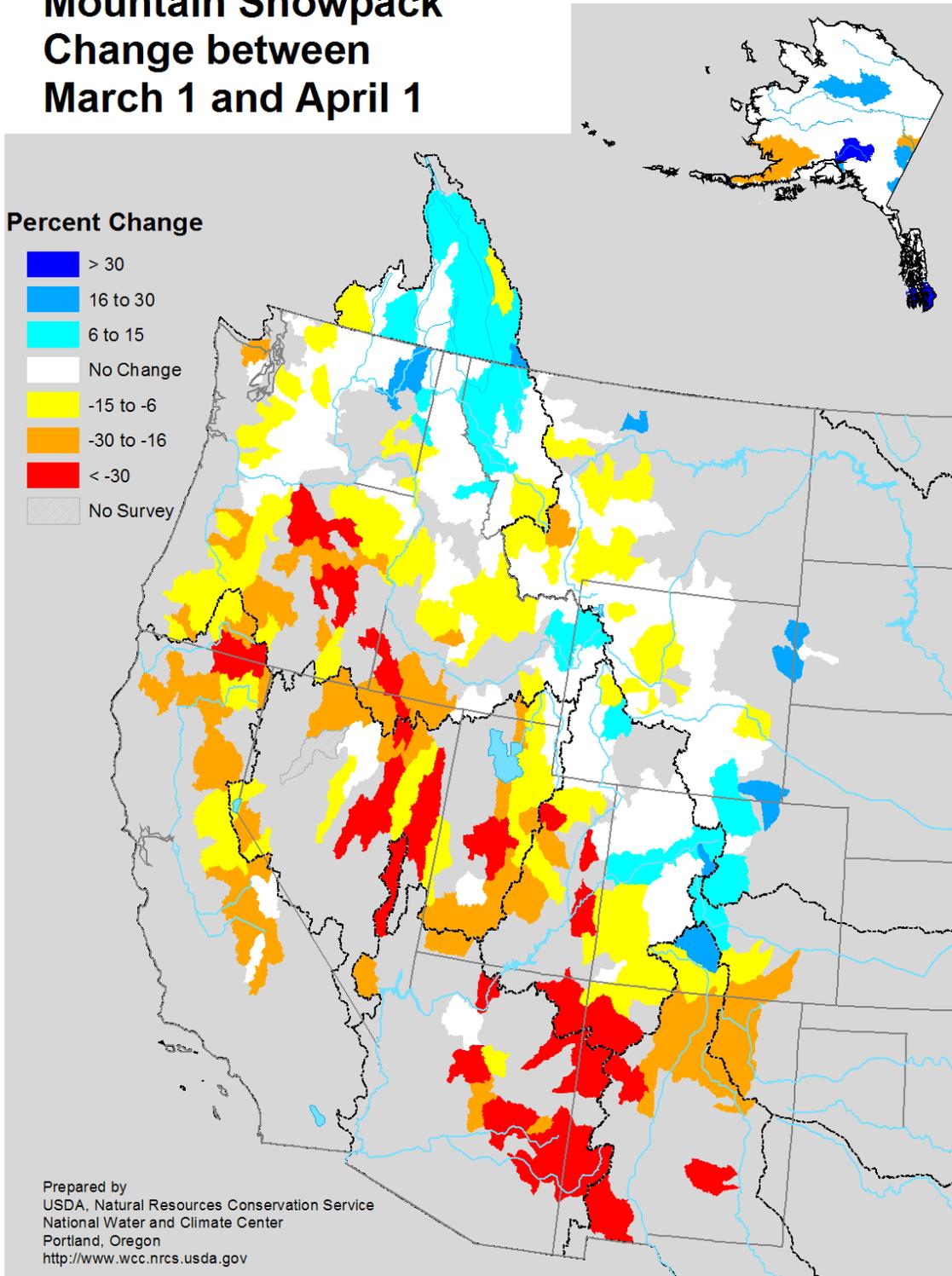


Fig. 3: Mountain snowpack changes between March 1 and April 1, 2013. While parts of the Washington Cascades and the Montana and Central Colorado Rockies have seen some improvement, most river basins west of the Continental Divide have not. Alaska experienced some gains and some losses across the state.

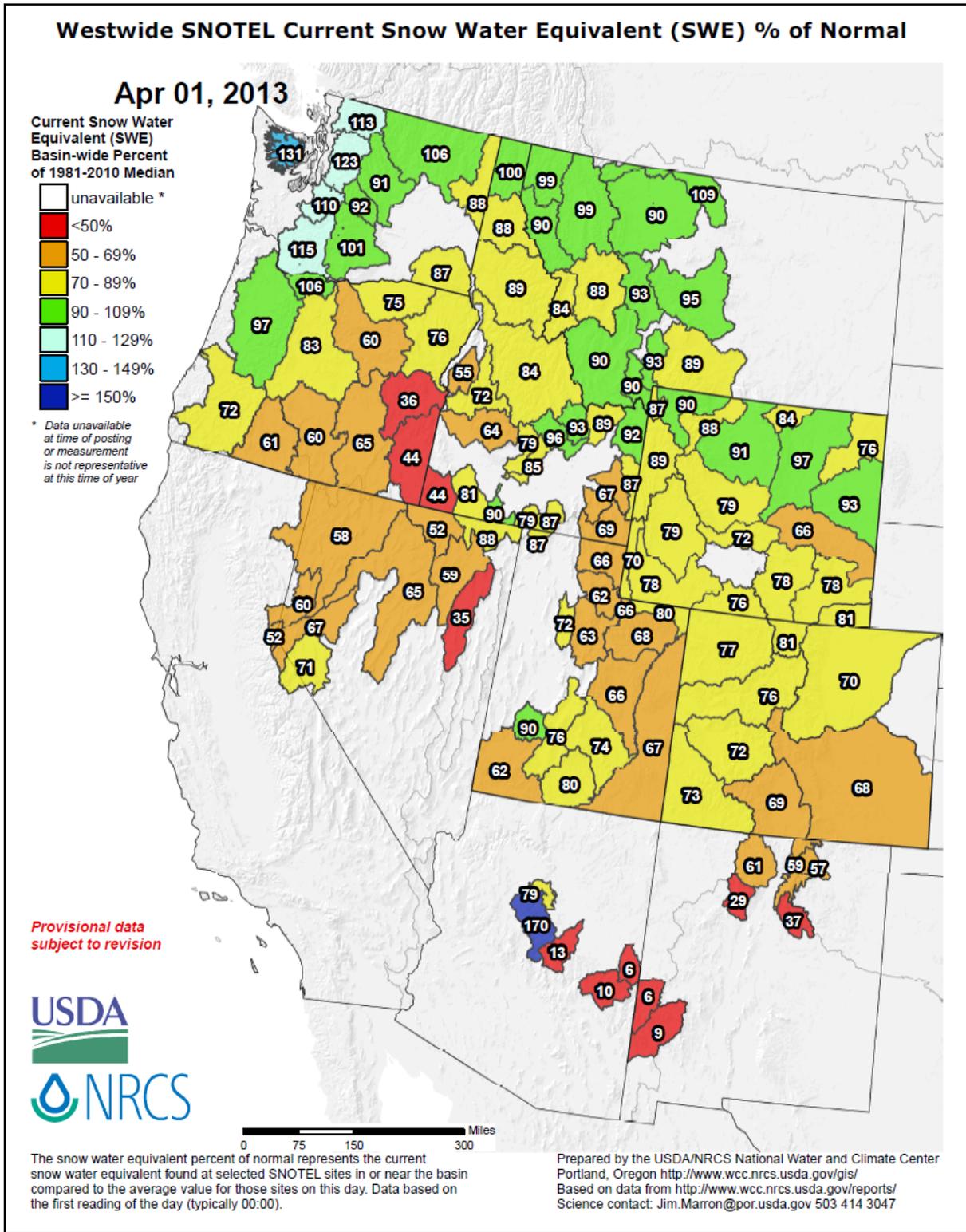


Fig. 4: As of [April 1, 2013](#), Snow Water Equivalent (SWE) percent of normal map reveals surplus values over the Washington Cascades. Near average conditions exist over parts of the Northern Rockies and northern Oregon Cascades. The high value over central Arizona is a statistical quirk reflecting a little amount of snowpack where normally none exists by the beginning of April. The remainder of the West reflects substantially low snowpack. Select this [link](#) for an up-to-date version of this map.

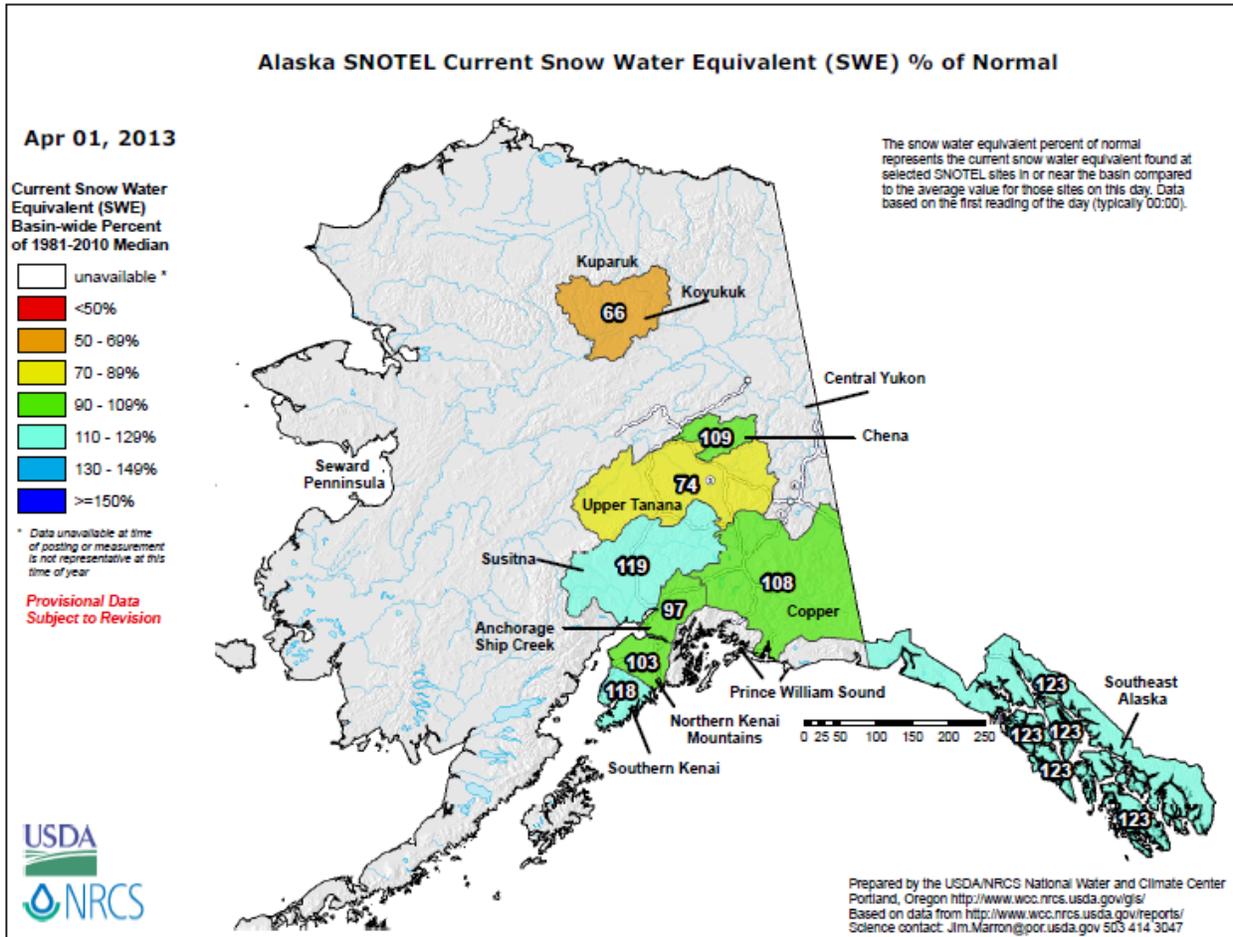


Fig. 4a: As of April 1, 2013, the [Alaska](#) Snow Water Equivalent (SWE) map indicates that much of Alaska has normal to above normal values. The Upper Tanana and Kuparuk Basins have the greatest deficits thus far this Water Year. Select this [link](#) for an up-to-date enlarged version of this map.

Spring and Summer Streamflow Forecasts as of April 1, 2013

Percent
1981 to 2010 Average

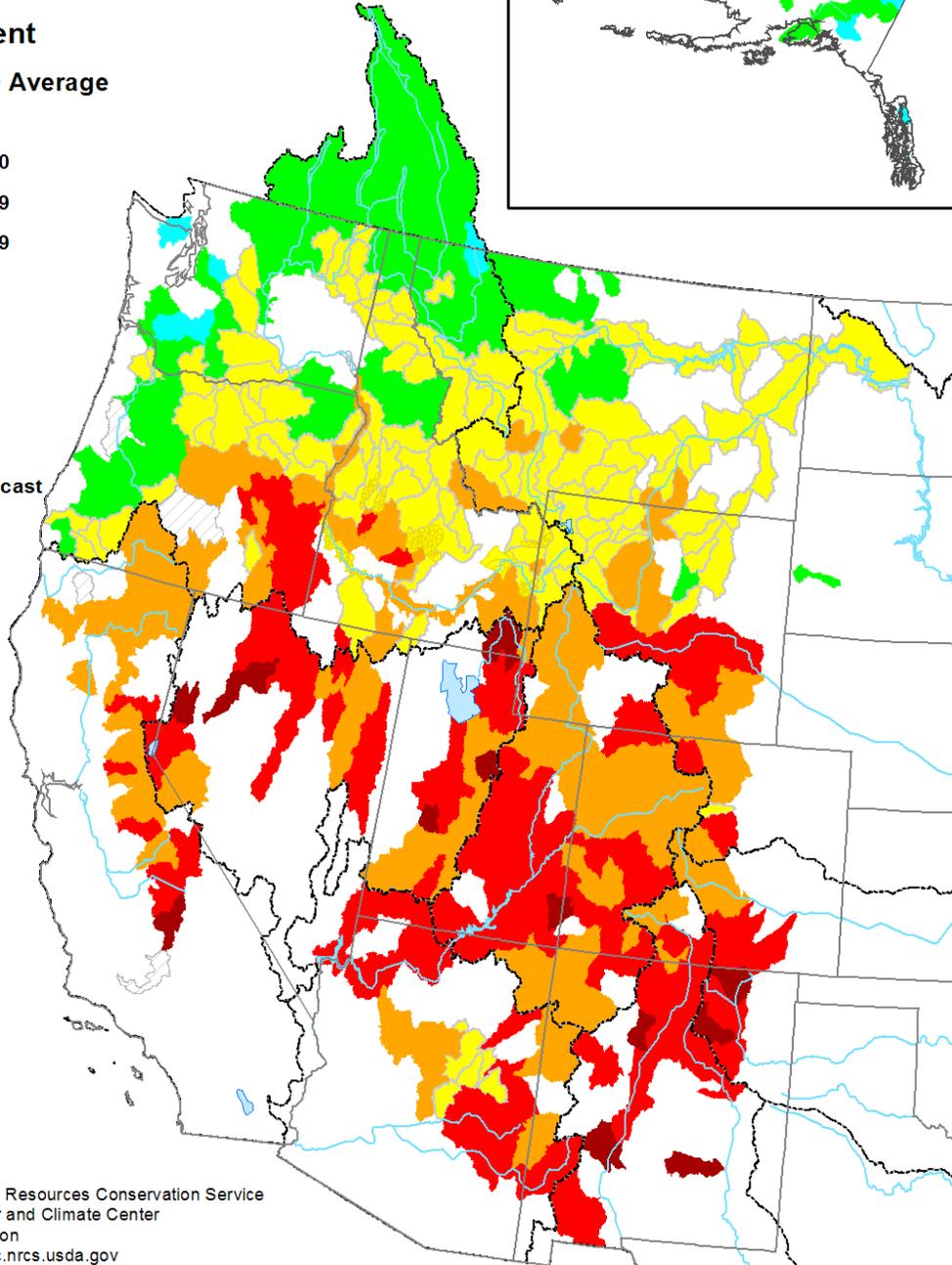
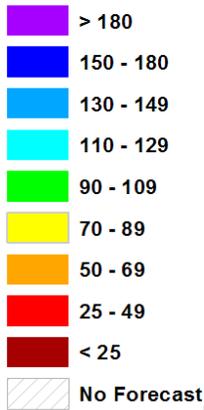


Fig. 5: Seasonal Water Supply Forecasts - [April 1, 2013](#). While about one-third of the Northern Tier of the West is expected to have near normal spring and summer streamflow, the opposite conditions are expected over the Southern Tier with the majority of drainages at significantly below average values. California and Alaska data are updated in this report.

Change in Spring and Summer Streamflow Forecasts from March 1 to April 1, 2013

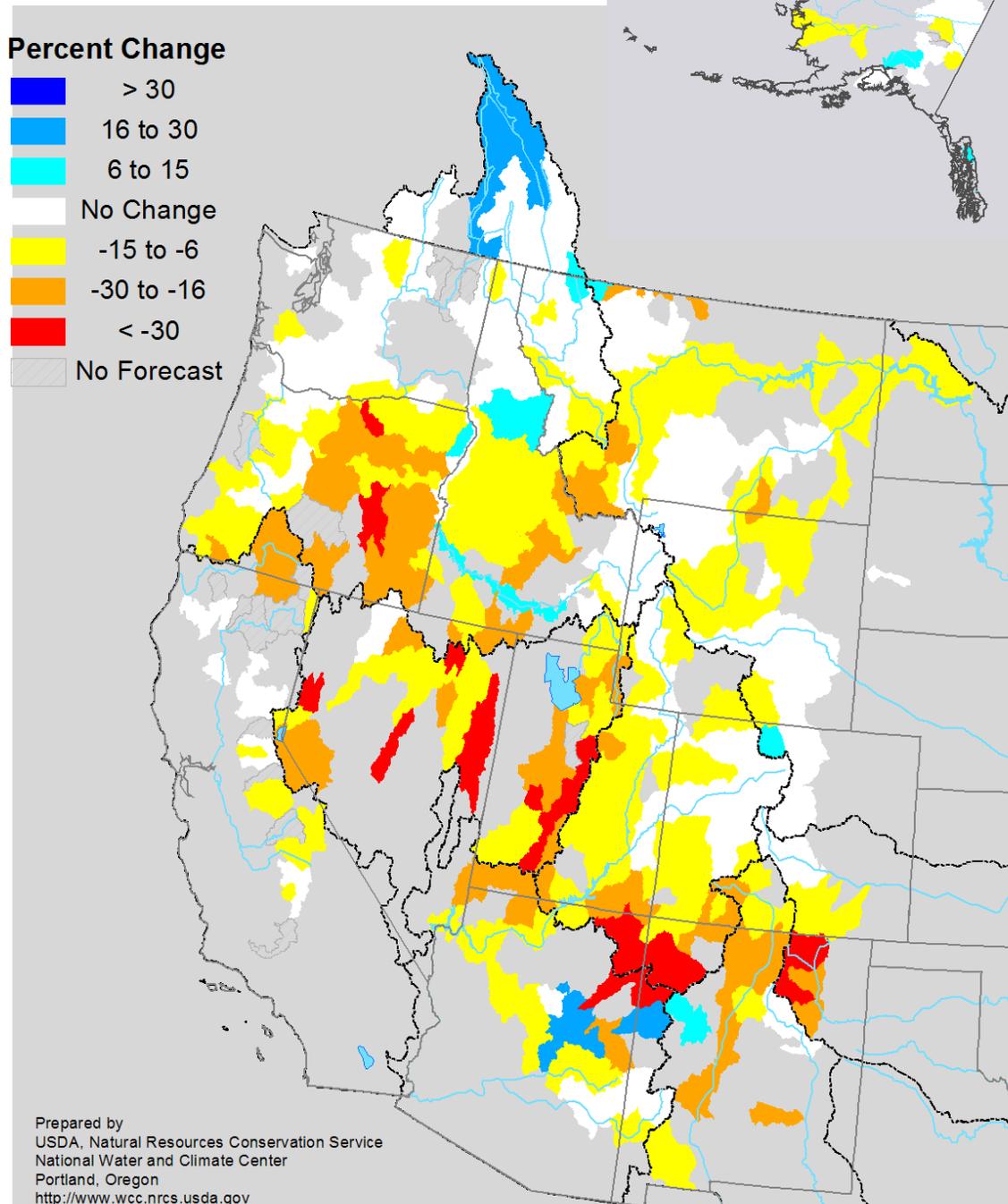
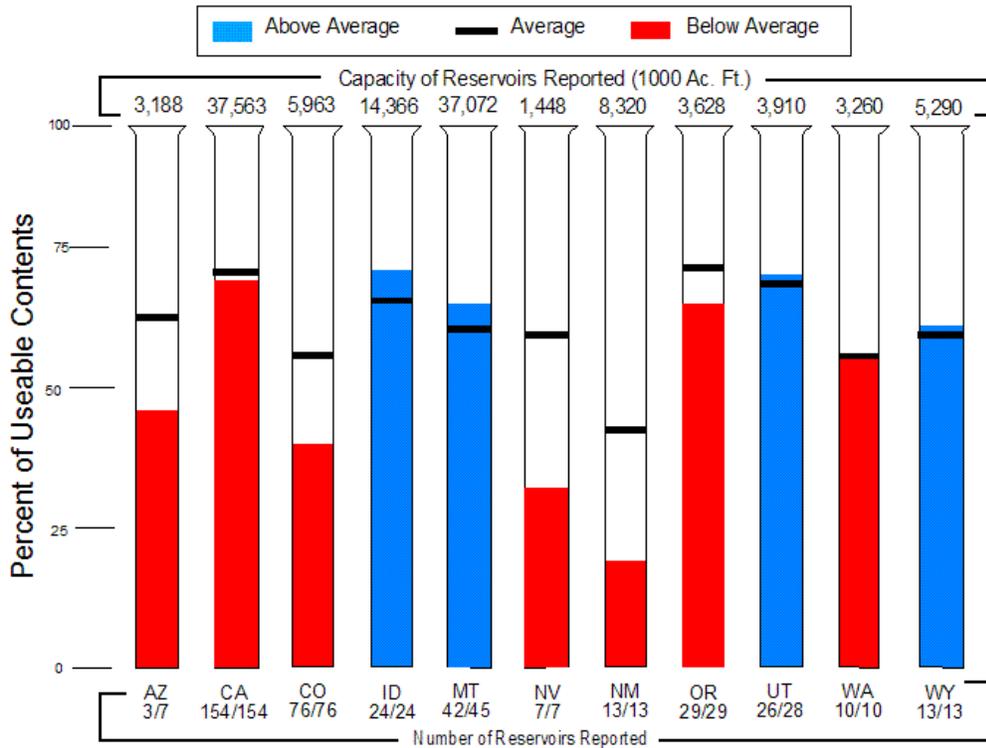


Fig. 6: Change in streamflow forecast between March 1 and April 1, 2013. Most basins continue to show a decline in their streamflow forecasts. The exceptions noted in blue shading are increases, but in most cases they will not be enough to reach the long-term average. The Upper Columbia River benefited with adequate moisture in March to have their water supply forecast improve to near normal. California and Alaska data are updated in this report.

Reservoir Storage as of April 1, 2013



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

Fig. 7: Reservoir Storage - [April 1, 2013](#). No significant changes since last month with the exception of a moderate decrease in Arizona's level. California, Idaho, Montana, Utah, and Wyoming are near normal. The remainder of the western states are below normal, especially Nevada and New Mexico. California data is updated in this report.