Research Home
Current Publications
All Publications
WWA Reports
WWA Annual Reports
Intermountain West Climate Summary
Stakeholder Climate Needs

WWA Home È Research È Publications È Intermountain West Climate Summary

INTERMOUNTAIN WEST CLIMATE SUMMARY

A product of the Western Water Assessment

Issued March 23, 2010, Vol. 6, Issue 2

Brad Udall Ð WWA Director

Jeff Lukas, Christina Alvord, Kristen Averyt Ð Editors/Writers

Lucia Harrop Ð Graphic Designer

Klaus Wolter, Gary Bates Ð Asst. Editors

March 2010 Summary

Temperature & Precipitation — *February was another cold month across the region, with widespread temperature departures of 4Ð10¼F below average. Southerly storm tracks led to much-above-average precipitation in the southern tier of the Intermountain West, but left northern Utah, northwestern Colorado, and most of Wyoming drier than average.*

Hydrological Conditions — *The overall low state of the regional March 1 snowpack reflects the persistent southward shift in storm tracks this winter, with only far southern Utah and southern Colorado reporting above-average snowpacks. Likewise, the March 1 streamflow forecasts are much below average across most of the region, except in southern Utah and Colorado.*

ENSO — *The current El Ni–o event has likely peaked and is expected to continue weakening, although El Ni–o conditions are forecasted to persist through spring. The southward shift in the storm tracks linked to El Ni–o is expected to relent in the next few months, but this is unlikely to help the driest areas in the northern part of the region.*

Climate Forecasts — *For April and subsequent seasons, the CPC seasonal outlooks call for an enhanced risk of warmer-than-average temperatures for much of the western portion of the Intermountain region, and a slightly enhanced risk of above-average precipitation for southern and eastern portions of the region, centered on eastern Colorado.*

RETURN TO TOP

Announcements & News

NOAA Climate Service proposed; would include RISAs such as Western Water Assessment

In an announcement on February 8, the Department of Commerce and NOAA proposed establishing a NOAA Climate Service. NOAA is increasingly asked for information about climate variability and climate change from across diverse sectors and interests. To meet this demand, the proposed NOAA Climate Service would provide a single, reliable and authoritative source for climate data, information, and decision-support services, akin to the role of the NOAA National Weather Service with respect to weather data and services. The central Web presence for the Climate Service will be http://www.climate.gov (see this monthÕs Focus Article). Many of the NOAA branches that conduct climate research and deliver climate products, including the National Climatic Data Center and the Climate Program Office (home of RISA programs such as WWA) would be incorporated into the NOAA Climate Service. While details of the implementation are still being worked out, NOAA expects to have a functional

NOAA Climate Service up and running by late 2010 or early 2011.

At the Western Water Assessment, we donÕt expect that the implementation of the NOAA Climate Service will cause major changes to our programs and activities. We do anticipate that the Climate Service will provide improved access to national- and global-level climate data, and foster new collaborations within NOAA, and partnerships with other agencies, that will expand the delivery of regional-level climate services to WWAÕs partners and stakeholders. We will provide updates as the implementation of the NOAA Climate Service progresses.

RETURN TO TOP

Feature Article

What is the risk to Colorado River storage and deliveries under climate change scenarios? A review of several recent studies

by Joe Barsugli, CIRES, and Jeff Lukas, WWA

(download pdf)

RETURN TO TOP

Focus Article

The New NOAA Climate Web Portal (www.climate.gov)

by Christina Alvord, WWA

(download pdf)

RETURN TO TOP

Recent Climate Conditions

Average temperatures for February ranged from below 15¼F in the high-elevation mountain regions up to 50¼F in the far southeast corner of **Utah** (Figure RC-1). Across western **Utah**, much of **Colorado**, and the southeastern corner of **Wyoming**, departures of 4Đ10¼F below average were observed (Figure RC-2). Temperatures were warmer than average only in northwestern **Utah** and parts of western **Wyoming**.

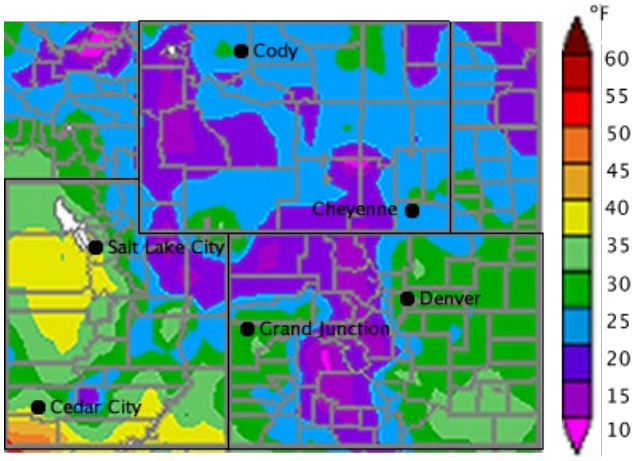

Figure RC-1. Average temperature for the month of February 2010 in iF. (Source: High Plains Regional Climate Center)

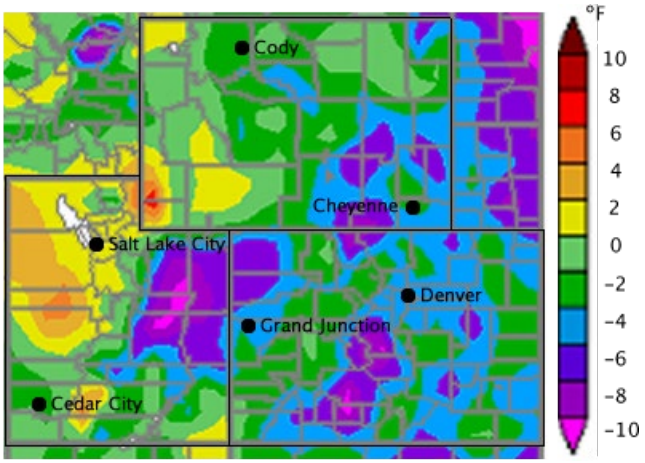

Figure RC-2. Departure from average temperature for the month of February 2010 in iF. (Source: High Plains Regional Climate Center)

	Record	New Record	Old Record	Year
February 6				
Randolph, UT	High Min Temperature	20	11	2000
February 15				
Casper, WY	Low Min Temperature	-14	-13	1978
February 19				
Lander, WY	Daily Max Snowfall	8.2	8.1	1953
February 20				
Cheyenne, WY	Daily Max Snowfall	4.6	4.3	1976
February 22				
Lander, WY	Daily Max Snowfall	1.5	0.6	1967
Capitol Reef National Park, UT	Low Max Temperature	35	37	1975
February 23				
Casper, WY	Low Min Temperature	-9	-8	1960

Table RC-1. Record temperature and precipitation events in the Intermountain West during February 2010. (Source: NOAA National Weather Service)

During February, storms persistently tracked along the southern edge of the Intermountain West, leading to a precipitation pattern consistent with El Ni–o expectations for late winter and early spring: dry in the north, and wet in the south. Above-average precipitation fell across southern **Utah** and southern and eastern **Colorado**, extending up into the southeastern corner of **Wyoming** (Figures RC-3 and RC-4). Much of this area experienced more than 200% of average February precipitation.

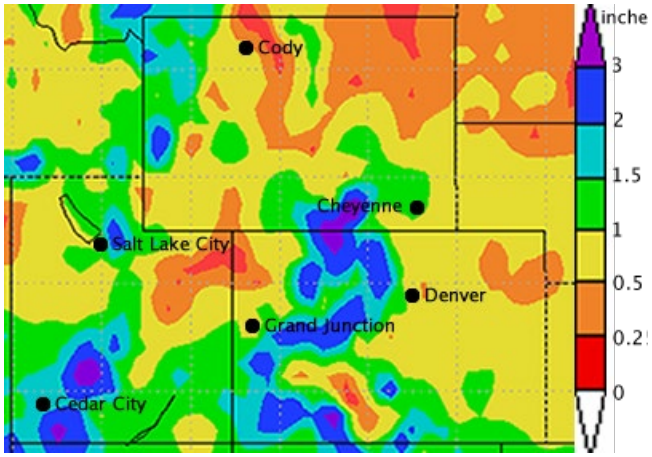

Figure RC-3. Precipitation for the month of February 2010 (inches). (Source: NOAA ESRL Physical Science Division)

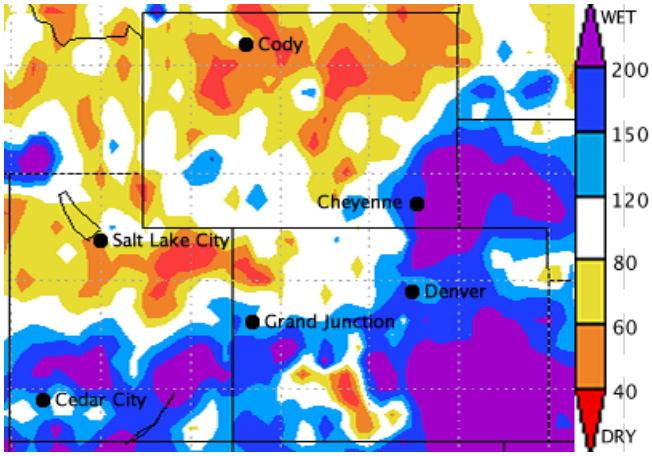

Figure RC-4. Precipitation for the month of February 2010 as percent of average precipitation for February. (Source: NOAA ESRL Physical Science Division)

The north-south precipitation pattern is also observed in the 3-month SPI (Figure RC-5), reflecting the general southward shift in storm tracks throughout this winter (DecemberÐFebruary). The 36-month SPI (Figure RC-6) shows the persistence of dry conditions in the western areas of **Wyoming** and very dry conditions in eastern **Utah.**

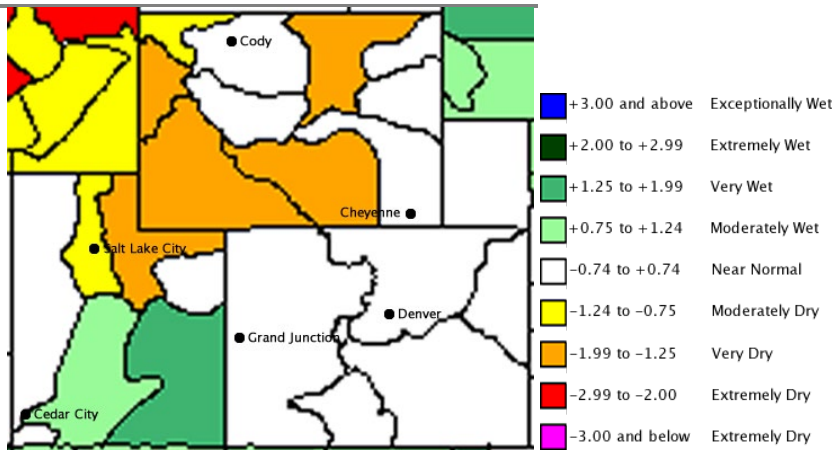

Figure RC-5. 3-month Intermountain West regional Standardized Precipitation Index as of the end of February 2010 (data from 12/01/09Ð2/28/10). (Source: Western Regional Climate Center)

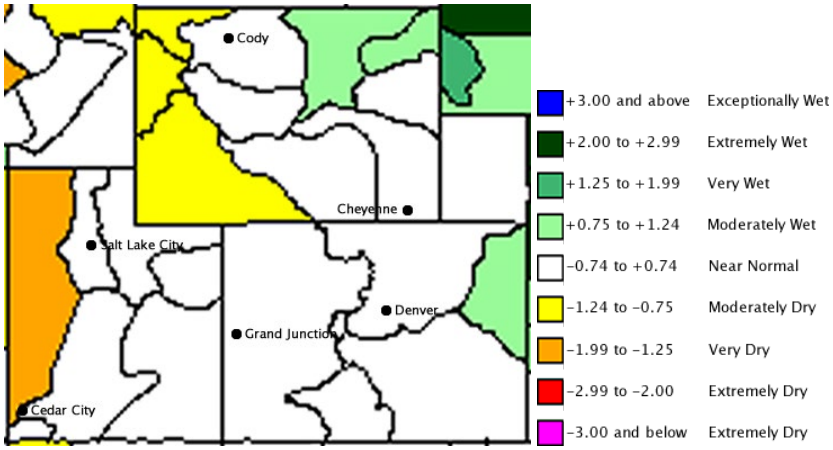

Figure RC-6. 36-month Intermountain West regional Standardized Precipitation Index as of the end of February 2010 (data from 3/01/07Ð2/28/10). (Source: Western Regional Climate Center)

The U.S. Drought Monitor for early March indicates that above-average precipitation has relieved abnormally dry conditions in southwestern **Colorado**, while conditions have worsened to severe drought (D2) in a portion of western **Wyoming,** and to moderate drought (D1) in a small area of northwest **Colorado** (Figure RC-7).

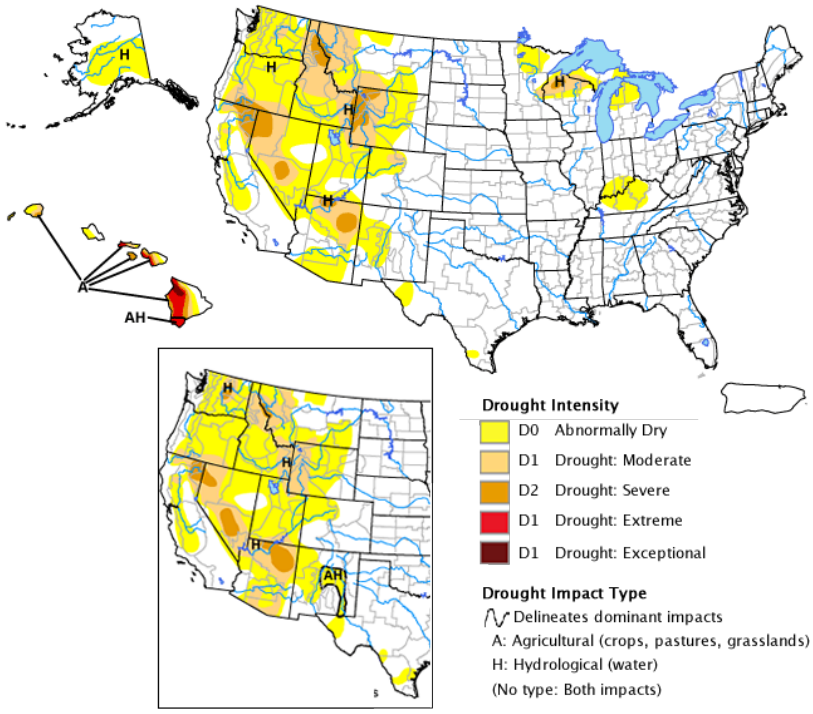

Figure RC-7. U.S. Drought Monitor from March 16, 2010 (full size) and February 16, 2010 (inset, lower left) for comparison. (Source: National Drought Mitigation Center)

Notes & Weblinks

(provides explanations of graphics and additional information sources)

RETURN TO TOP

Intermountain West Snowpack

The pattern of precipitation across the Intermountain West during February only reinforced the winter-long north-south gradient in snowpack status. As of March 1, snowpacks were well below average across Wyoming and the northern half of **Utah** and **Colorado**, and above average in areas to the south (Figure SP-1).

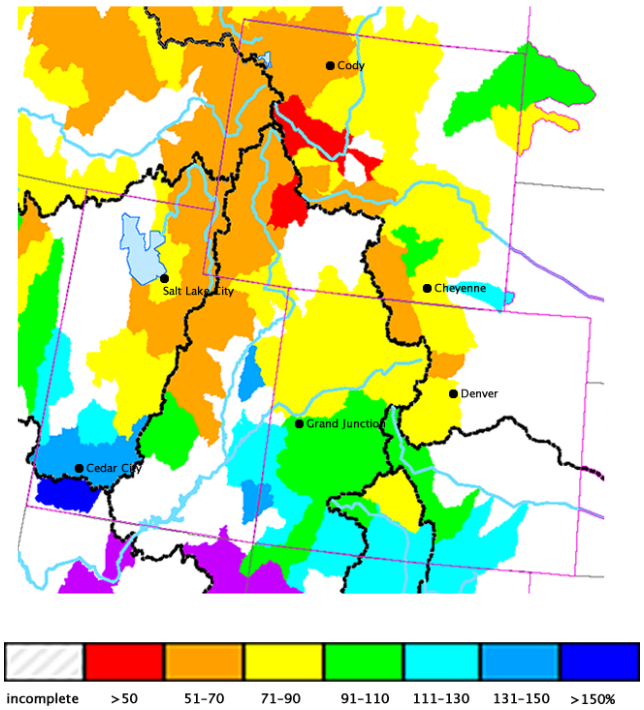

Figure SP-1. Snow water equivalent (SWE) as a percent of average for available SNOTEL and snow course sites, averaged across each basin, in the Intermountain West as of March 1, 2010. (Source: Natural Resources Conservation Service)

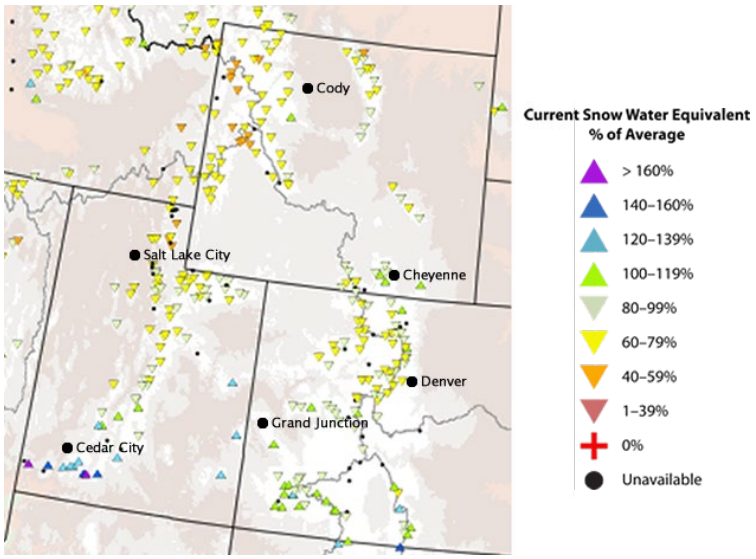

Figure SP-2. Current snow water equivalent (SWE) as a percent of average for individual SNOTEL sites as of March 5, 2010. (Source: Natural Resources Conservation Service)

In **Colorado**, the first half of February was dry throughout much of the state, but storms towards the end of the month increased snowpack percentages to near- or above-average in all but the northwestern basins. Precipitation was below average for the fourth consecutive month in the Colorado, Yampa, White and North Platte Basins. March 1 basinwide snowpack percentages ranged from a low of 76% in the combined Yampa, White, North Platte and Laramie basinsÑthe second lowest percentage since 1987 in these basinsÑto a high of 109% in the Rio Grande basin.

In **Utah,** the northern basins report below-average snowpacks (<90% of average) and the southwestern basins report average or above-average snowpacks. Below-average February precipitation in northern **Utah** now leaves little chance for snowpacks and consequently streamflows to reach near-average levels. March 1 snowpack in the Bear River basin is the lowest since 1992, at 59% of average. Meanwhile, February precipitation in southern **Utah**

was near or above average (83Ð105%), helping maintain snowpacks there.

February was a very dry month across most of **Wyoming**, with the driest conditions in the central and western basins. As a result, snowpacks across the state are still below average, with the majority of basins reporting 58Ð 74% of average March 1 SWE (Figure SP-2). The only basins to receive near-average February precipitation (91% of average) were the Belle Fourche and Cheyenne basins. March snowpacks in these basins are highest in the state, ranging from 87Ð93% of average.

Update: As of March 19, NRCS is reporting little change in SWE conditions since the March 1 reports. A few more SNOTEL sites in northwest **Wyoming** and northern **Colorado** along the Continental Divide are reporting well below-average SWE conditions (<75% of average). Drier conditions in the first half of March in northwest **Wyoming** are also reflected in the US Drought Monitor (Figure RC-7).

[Much of the text in this section comes from the NRCS State Basin Outlook Reports: http://www.wcc.nrcs.usda.gov/cgibin/bor.pl.]

Notes & Weblinks
(provides explanations of graphics and additional information sources)

RETURN TO TOP

Spring and Summer Streamflow Forecasts for the 2010 Runoff Season

Spring and summer streamflow forecasts issued March 1 call for near- or above-average runoff for southeastern **Wyoming,** southern **Colorado,** and southwestern **Utah**. For the rest of the region, significantly below-average flows are forecasted with the lowest flows (<50% of average) in western and central **Wyoming**, and northeastern **Utah** (Figure STRM-1). Since the initial WY 2010 streamflow forecasts were released in January, the streamflow outlook has worsened in **Wyoming** and northern half of **Utah**, remained the same across **Colorado**, and improved in southern **Utah**.

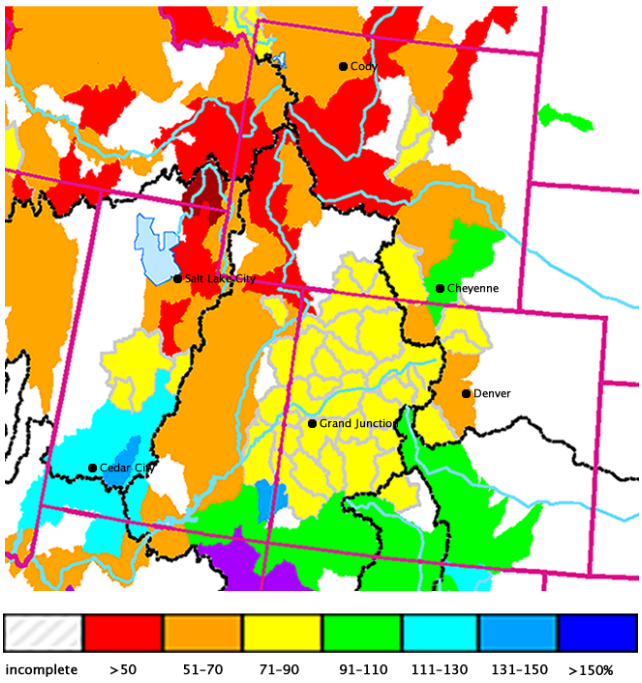

Figure STRM-1. NRCS outlook for natural streamflows for spring and summer in the Intermountain West region as a percent of average streamflows (data through March 1, 2010). (Source: Natural Resource Conservation Service)

In **Colorado**, streamflow forecasts in most basins call for below-average flows, with the low snowpack exacerbated by dry antecedent moisture conditions last fall. March 1 forecasted streamflows are highest (90Ð 109% of average) for the Rio Grande and San Juan, and Arkansas basins. The lowest streamflow forecasts (50Ð 60% of average) are for the North Platte basins and headwaters of the Colorado and Yampa Rivers.

In **Utah,** the forecasted streamflows are below average across most of the state (50Ð69% of average).

Streamflows are expected to range from a low of 15% of average in the Bear River basins to a high of 115% of average in the Sevier River basin.

In **Wyoming**, streamflow forecasts call for below-average flows with the exception of the Cheyenne and Belle Fourche River basins (104% of average). Forecasted streamflows across most of the state range from 45Ð70% of average. The lowest forecasted flows are for the Big Horn and Wind River Basins (31% of average). Expected AprilÐJuly inflows to Flaming Gorge Reservoir are 43% of average.

Because of the unusually low snowpack in the Colorado headwaters, Yampa, White, and Green River basins, the March 1 expected inflows for **Lake Powell** for AprilÐJuly have declined to 68% of average.

Notes & Weblinks
(provides explanations of graphics and additional information sources)

RETURN TO TOP

Reservoir Supply

March is typically the last full month for snowpacks to receive a boost in accumulation before warmer temperatures commence the spring runoff, and reservoirs begin to fill. As of the end of February, reservoir levels are generally near-average or above-average in **Wyoming** and **Colorado**, and below-average in **Utah** (Figure RES-1).

In **Colorado**, overall reservoir storage on March 1 is above average and will help offset projected below-average spring and summer streamflows across most of the state. Current statewide storage is 102% of last yearÕs, equivalent to an additional 84,000 acre-feet of storage above last yearÕs levels. Basin-wide reservoir storage is lowest in the combined San Juan, Animas, Dolores, and San Miguel basins at 88% of average, and highest in the Yampa River basin at 115% of average.

In **Utah,** combined storage in 41 major reservoirs throughout the state is 7% higher than last yearÕs, at 69% of average. Basin-wide reservoir storage ranges from a low of 36% of average in the Bear River basin to a high of 90% of average in Provo River basin. Bear Lake is at 48% of average capacity, which, combined with very low projected streamflows for that basin (15Ð58% of average), suggests severe water shortages unless conditions dramatically improve.

In **Wyoming,** reservoir storage is average or above average in many basins, and is at 109% of average for the entire state. This reflects above-average snowpack and streamflows in WY 2009, replenishing depleted water supplies from subpar water supplies in WY 2006ÐWY 2008. Water managers will likely rely on storage to meet demands this year due to well-below-average streamflows forecasted across most of the state.

	RESERVOIR	current storage (af)	capacity (af)	% full	% of average for 2/28
COLORADO	Dillon Reservoir	244,117	257,304	95%	112%
	Turquiose Lake	65,729	129,390	51%	83%
	Lake Granby	379,277	539,758	70%	127%
	Blue Mesa	544,867	829,500	100%	122%
	Pueblo	257,500	354,000	73%	153%
UTAH	Strawberry	974,400	1,106,500	88%	153%
	Utah Lake	862,900	870,900	99%	105%
	Bear Lake	434,500	1,302,000	33%	48%
	Lake Powell	13,786,000	24,322,000	57%	79%
WYOMING	Fontenelle	123,105	344,800	36%	79%
	Flaming Gorge	3,181,000	3,749,000	85%	109%
	Seminoe	676,796	1,017,273	67%	150%
	Boysen	590,072	741,594	80%	103%

	Buffalo Bill	431,907	644,126	67%	107%

Figure RES-1. Table of several large reservoirs in the Intermountain West Region. All reservoir content data are from February 28, 2010. Reservoir data are shaded according to the "% of Average" value as follows: green: >80% of average; light green: 60Ð79%; yellow: 40Ð59%; orange: 20Ð39%; red: 0Ð19%

RETURN TO TOP

ENSO Status and Forecast

While sea-surface temperature warm anomalies across the tropical Pacific decreased from late December to mid-February, as of mid-March they remained at values which indicate a moderate El Ni–o event (Figure EN-1).

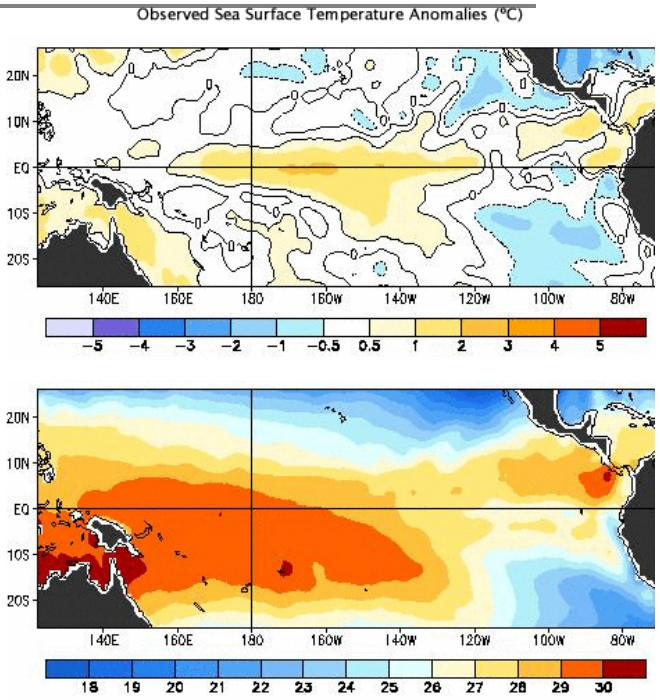

Figure EN-1. Observed SST (upper) and the observed SST anomalies (lower) in the Pacific Ocean. The Ni–o 3.4 region encompasses the area between 120iWÐ170iW and 5iNÐ5iS. The graphics represent the 7-day average centered on March 1, 2010. (Source: NOAA Climate Prediction Center)

Across a broad set of dynamical and statistical ENSO forecast models, nearly all indicate that the current El Ni–o will continue to weaken, although weak to moderate El Ni–o conditions will be maintained during the MarchÐMay season currently in progress (Figure EN-2). By the summer season (JuneÐAugust) and beyond, most of the models forecast a return to neutral ENSO conditions, although a few models either maintain or re-develop weak or moderate El Ni–o conditions by late summer, while an equal number develop a La Ni–a event.

The NOAA ENSO Diagnostic Discussion will be updated on the first Thursday of April 2009.

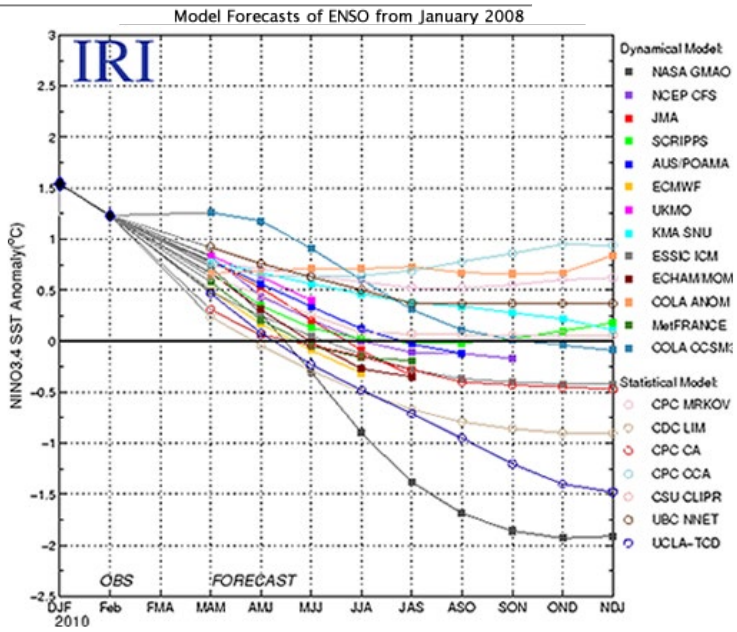

Figure EN-2. Forecasts made by dynamical and statistical models for sea surface temperatures (SST) in the Ni–o 3.4 region for nine overlapping 3-month periods from MarchÐMay 2010 to November 2010ÐJanuary 2011 (released March 16, 2010). (Source: International Research Institute (IRI) for Climate and Society)

Notes & Weblinks
(provides explanations of graphics and additional information sources)

RETURN TO TOP

Temperature Outlook
April–August 2010 (Released March 18, 2010)

The latest temperature outlooks from the NOAA Climate Prediction Center indicate an enhanced risk of above-average temperatures for the northwest and far western US, in April 2010 and subsequent seasons (Figures TEMP-1 to TEMP-4). This region of likely warmer-than-average temperatures extends into the western portions of the Intermountain West, with the most enhanced risk of warming seen for southeastern **Utah** for the MayÐJune and JuneÐAugust seasons. A slightly enhanced risk of cooler-than-average temperatures is shown for eastern **Colorado** for April.

Note: These climate outlooks are intended for use prior to the start of their valid period (in this case, prior to the beginning of April). Within any given valid period, observations and NWS short- and medium-range forecasts should be consulted. The April 2010 temperature forecast will be updated on March 31st on the CPC web page. This Òzero-leadÓ monthly update will incorporate information from the short range numerical weather prediction models and the latest monthly predictions from the Climate Forecast System models. The Seasonal Outlooks are updated on the third Thursday of the month, and the next one will be issued on April 15th.

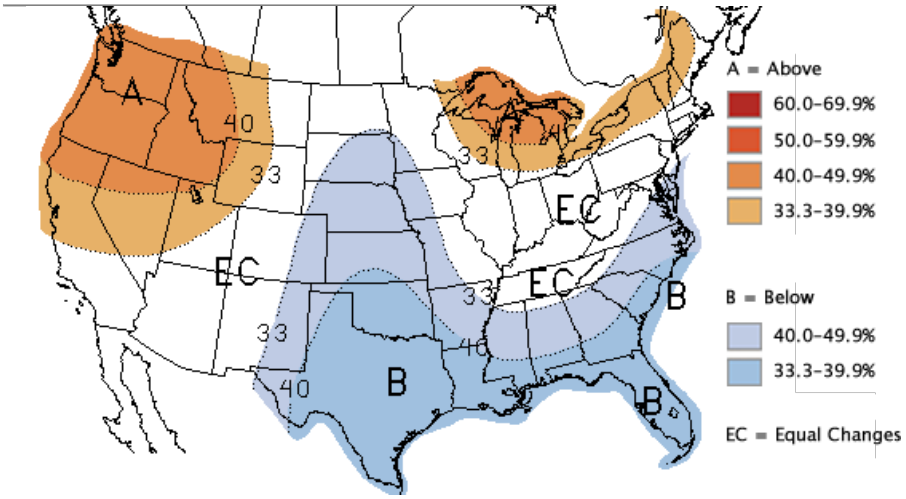

Figure TEMP-1. Long-lead national temperature forecast for April 2010. (Source: NOAA Climate Prediction Center)

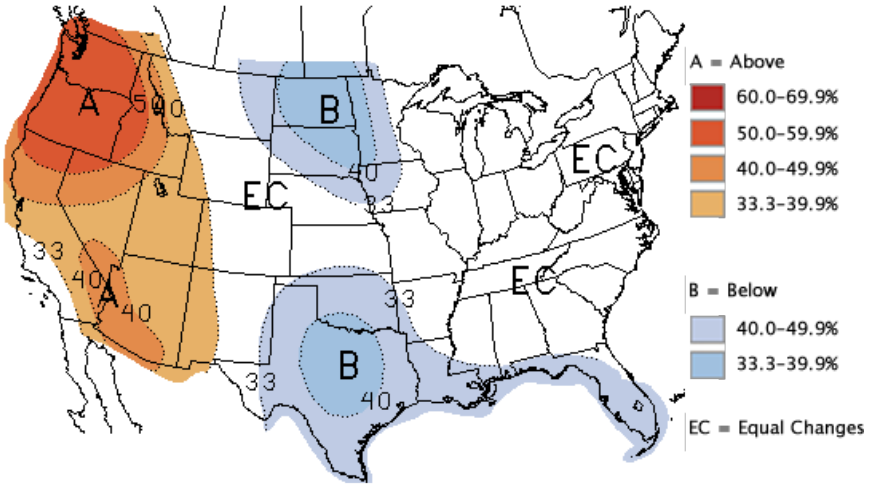

Figure TEMP-2. Long-lead national temperature forecast for AprilÐJune 2010. (Source: NOAA Climate Prediction Center)

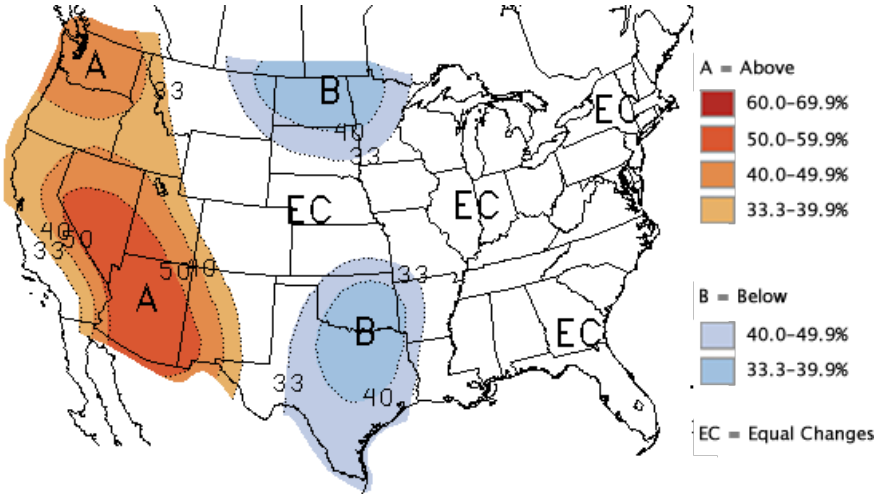

Figure TEMP-3. Long-lead national temperature forecast for MayÐJuly 2010. (Source: NOAA Climate Prediction Center)

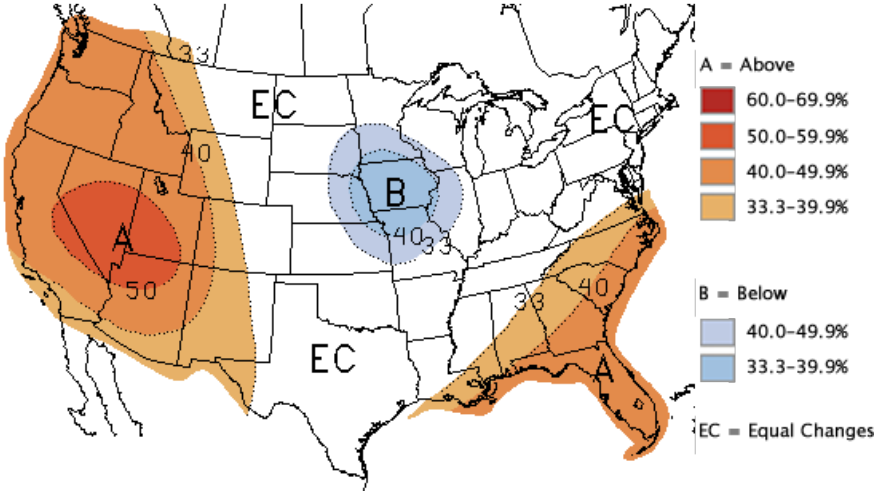

Figure TEMP-4. Long-lead national temperature forecast for JuneÐAugust 2010. (Source: NOAA Climate Prediction Center)

Notes & Weblinks

(provides explanations of graphics and additional information sources)

RETURN TO TOP

Precipitation Outlook
April–August 2010 (Released on March 18, 2010)

The CPC precipitation outlook for April 2010 (Figure PPT-1) shows a slightly enhanced risk of above-average precipitation for much of the Intermountain West, with the most enhanced risk in southeastern **Colorado**. For the AprilÐJune season, the area of enhanced risk of wetter-than-average conditions shifts to the north and west, covering all of **Colorado** and **Utah**, and southern **Wyoming** (Figure PPT-2). For the summer seasons, this area contracts so that only eastern **Colorado** is included (Figures PPT-3 and PPT-4).

Areas of above- or below-average precipitation are largely due to expected El Ni–o impacts on climate, including the typical El Ni–o-influenced tilt of the odds towards above-average precipitation for some areas of the southern tier, and towards dry conditions for the Pacific Northwest and Ohio Valley.

Note: these climate outlooks are intended for use prior to the start of their valid period (in this case, prior to the beginning of April). Within any given valid period, observations and NWS short- and medium-range forecasts should be consulted. The April 2010 precipitation forecast will be updated on March 31st on the CPC web page. This Òzero-leadÓ monthly update will incorporate information from the short range numerical weather prediction models and the latest monthly predictions from the Climate Forecast System models. The Seasonal Outlooks are updated on the third Thursday of the month, and the next one will be issued on April 15th.

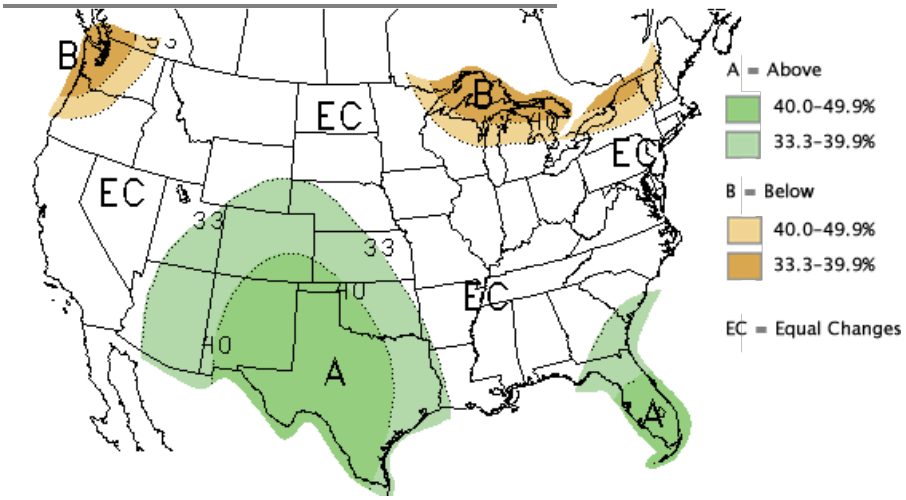

Figure PPT-1. Long-lead national precipitation forecast for April 2010. (Source: NOAA Climate Prediction Center)

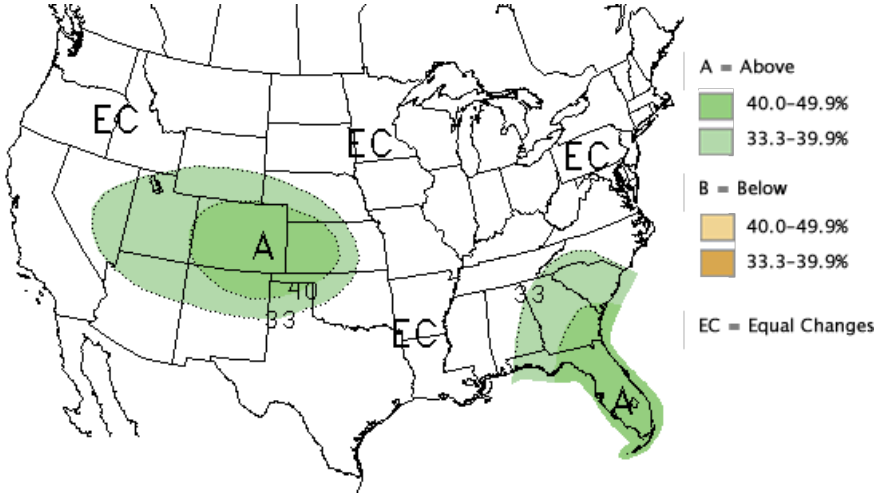

Figure PPT-2. Long-lead national precipitation forecast for AprilÐJune 2010. (Source: NOAA Climate Prediction Center)

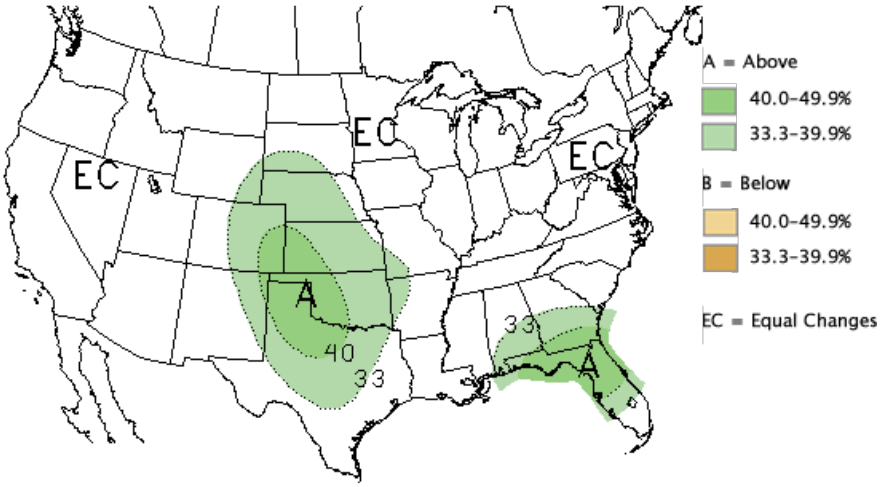

Figure PPT-3. Long-lead national precipitation forecast for MayÐJuly 2010. (Source: NOAA Climate Prediction Center)

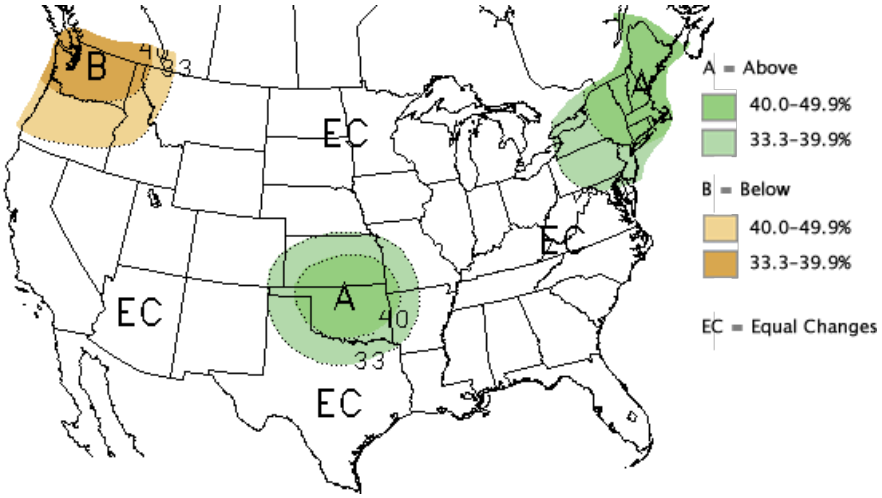

Figure PPT-4. Long-lead national precipitation forecast for JuneÐAugust 2010. (Source: NOAA Climate Prediction Center)

According to the experimental SWcast discussion, while the El Ni–o event of 2009-10 appears to have peaked recently, its effects should linger well into the spring season. The experimental forecast guidance for the late spring season (AprilÐJune) is favorable for a wet spring from northern **Utah** across northwestern **Colorado** into the high plains of eastern **Colorado** and New Mexico, much of this consistent with El Ni–o effects (Figure PPT-5). The dry forecast for southwestern **Colorado** contradicts typical El Ni–o outcomes.

As expected, the El Ni–o shifted the main storm track southwards this past winter, suppressing snowfall amounts over northern **Colorado** and northern **Utah**. Over the next couple of months, this storm track is expected to move northwards, bringing more moisture to some, but not all, of the drier areas from this winter.

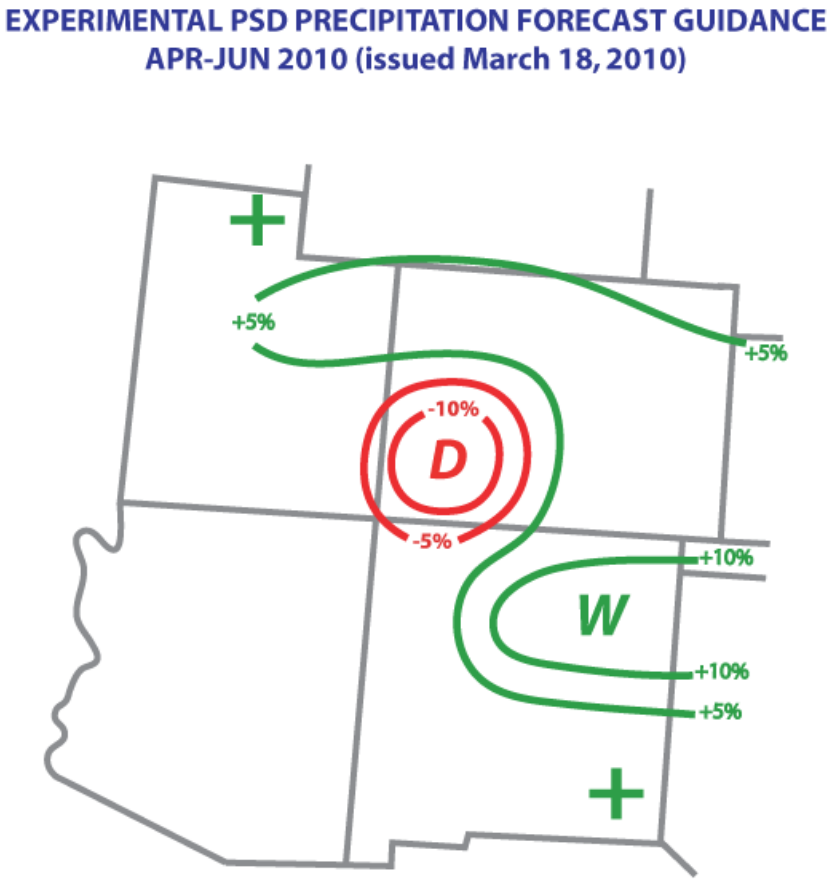

Figure PPT-5. Experimental precipitation forecast guidance. Forecasted shifts in tercile probabilities for AprilÐJune 2010. (Source: NOAA ESRL Physical Science Division)

Notes & Weblinks
(provides explanations of graphics and additional information sources)

RETURN TO TOP

Seasonal Drought Outlook
through June 2010 (Released March 18, 2010)

The U.S. Seasonal Drought Outlook (DO) builds on the Drought Monitor categories to project how these drought areas might change or where new drought areas might develop. The area of moderate (D1) and severe drought (D2) in western **Wyoming** and extreme northeastern **Utah** is expected to persist and expand in coverage over the next few months, linking up to the area of moderate drought in northwest **Colorado** (Figure DO-1). Improvement is forecasted for the area of abnormally dry conditions (D0) in far southern **Utah**.

Readers interested in the next 5 and 6Ð10 days can consult the ÒLooking AheadÓ section of each weekÕs Drought Monitor for near-term drought outlook conditions. The next Seasonal Drought Outlook will be issued April 1st.

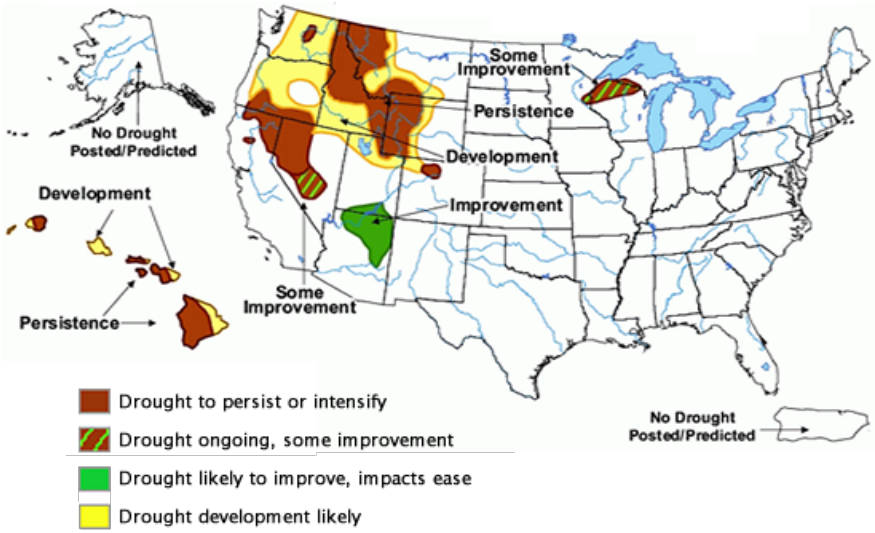

Figure DO-1. Seasonal Drought Outlook for March 18ÐJune 2010. (Source: NOAA Climate Prediction Center)

Notes & Weblinks

(provides explanations of graphics and additional information sources)

RETURN TO TOP

The Intermountain West Climate Summary is published periodically by Western Water Assessment (WWA), a joint project of the University of Colorado Cooperative Institute for Research in Environmental Sciences (CIRES) and the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL), researching water, climate, and societal interaction.

Cooperative Institute for Research in Environmental Sciences ■ University of Colorado Boulder ■ 216 UCB ■ Boulder, CO 80309-0216 ■ Phone: 303-735-8173