Current Drought Conditions and Scenarios for this Winter

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Overview:

Drought conditions continue to plague much of the western United States. As of January 22, 2004, severe to exceptional drought conditions were reported over 90 percent of the Rocky Mountain States according to the National Drought Monitor. In addition, much of the western half of Nebraska and Kansas reported severe drought conditions, with a pocket of extreme conditions reported across the western 1/3 of Nebraska, northwestern 1/4 of Kansas, and eastern 1/4 of Colorado.

The lack of strong snow storm activity during the last 4 years has led to significant problems within the Republican and Platte river valleys. Without significant snowfall this winter, projections for these regions continue to point to below normal to record low flows during the spring runoff season. Even with normal precipitation during the next 5 months, many reservoirs within this region will not have enough stored water to deliver full irrigation needs during the 2004 production season.

Forecasts:

The latest Climate Prediction Center (CPC) outlook for the upcoming 18 months (issued in mid-January) calls for above normal temperatures across most of the southern half of the Rocky Mountain states through the remainder of the winter season. There are equal chances for above normal, normal, or below normal temperatures across the central Plains region through February. The models project a tendency toward below normal temperatures during the March - June period for a small pocket of the central Plains that includes Nebraska, northern Kansas, along with eastern Colorado and Wyoming. There is a weak chance for above normal temperatures across the southwestern 1/3 of the United States during the July through October period, which includes Colorado, Kansas, and the southern half of Nebraska. There are no significant precipitation trends in the outlooks for the central Plains until the September through December period, where a weak tendency for above normal precipitation is indicated.

During last winter, a weak El Nino event led to above normal precipitation across much of the southern United States in a region from eastern Oklahoma and Texas through the southeastern United States. This area generally has a positive response to above normal precipitation during El Nino events. However, the typical response to above normal precipitation in the desert southwest failed to materialize. This in part allowed the semi-permanent high pressure system that

occurs during the summer in the middle layers of the atmosphere to strengthen and expand toward the northeast. The resulting pattern during the second half of last summer was a large pocket of drier than normal conditions from New Mexico northeastward into the upper Great Lakes region.

This region of high pressure weakened during the late fall and early winter period. Strong low pressure systems were to enter the Pacific northwest and carve out occasional upper air troughs across the central and northern Rocky mountains. Several strong storms developed across the central and northern High Plains region, but precipitation coverage was disappointing. In many locations where rain and snow did fall, precipitation totals in excess of two inches per storm event were not uncommon. However, most locations of western Nebraska and Kansas, as well as eastern Colorado and Wyoming missed out on major moisture during the critical fall soil moisture recharge period. In fact, many of these areas have received less than one inch of liquid equivalent moisture since October 1, which is less than 25 percent of normal.

Snow pack accumulations in the Rocky Mountains have been above normal during the first half of the winter. As of January 1, 2004, snow packs across most major river basins were above long term normals and 20-40 percent higher than January 1, 2003. Unfortunately, the Platte river basins failed to receive as much moisture with average basin snow pack percentages between 70 and 90 percent of normal.

A dry pattern developed during the last 3 weeks of January and the cumulative snow pack dropped an average of 14 percent compared to long term normals. The snow hasn't disappeared, but has lost ground since snow should be accumulating depth until the middle of April. For each week that there is no precipitation in Colorado and Wyoming, the cumulative snow pack is declining an average of five percent.

There was a strong low pressure system that developed out of the southwestern United States during the January 24-29 period. It was able to merge with a clipper system moving out of south-central Canada and drop a significant swath of snow, ice, and rain from eastern Nebraska through the mid-Atlantic region. This may be a one-shot deal or a sign that snow activity may be taking on a more positive trend.

Under normal conditions, we would expect these upper air lows to get stronger as they develop across the central and southern Rocky mountains. The clash of early spring warmth across Texas, coupled with arctic air over the northern Plains states is the perfect ingredient for major snow storm activity. If this trend continues for the remainder of the winter, there is a fairly good chance that much of the central High Plains will experience several major precipitation events. However, if the high pressure dominates the central Rockies for the remainder of

the winter, then expectations would be for below normal precipitation through the remainder of the winter.

Snowpack impacts on Drought:

As we move into this spring, a crucial component that I concentrate on in reference to drought susceptibility is the mountain snow pack. It is essentially critical that an above normal snow pack is maintained from New Mexico northward through Wyoming. Above normal snowpack in northern Colorado through central Wyoming increases the likelihood of some recovery in the depleted reservoir system within the Platte watershed. Below normal snowpack in this region would mean that most of the reservoirs in Wyoming and Nebraska will set or be near record low pools by the end of the 2004 production season. In some locations, significant water delivery restrictions will materialize.

Above normal snowpack across the southern half of the Rockies would serve three significant purposes. First, melting snow would provide above normal streamflow rates for reservoir recharge. Second, the longer the snowpack remains during the summer, the less likely that the southwestern high pressure will strengthen and expand northeastward. Third, the evaporative effects of the melting snow provides moisture and cold air aloft for thunderstorm development along the front range of the Rockies. It is these thunderstorms during the growing season that provide a substantial portion of the moisture required to complement irrigation deliveries in the semi-arid cropping environment of the western High Plains region. Without normal thunderstorm activity, most regions of the central Plains would be hard pressed to meet crop demands solely by irrigation.

El Nino and La Nina Impacts:

At present, slightly warmer than normal sea surface temperatures are being reported in the western Pacific Ocean along the equator. Although temperatures are above normal, no major El Nino event is projected to materialize during the remainder of the winter. Typically, La Nina or El Nino events begin to materialize during the late summer and reach there statistical peak around December 25th. However, their peak strength can vary between December 1 and January 31. La Nina events are the opposite of El Nino and occur when sea surface temperatures remain colder than normal along the Equatorial Pacific region. Depending on the strength of the event, impacts can be felt in the United States through the late spring months.

El Nino and La Nina events occur on a frequent basis, with a general return period of 2-5 years. It is useful to understand their implications on weather patterns over the central United States. El Nino events do show a slightly positive influence on precipitation across the region during the October-March period. The best responses come from the strongest events. During this period, temperatures

are typically on the warmer than normal side. During an unusually strong event, above normal precipitation tendencies do occur in the April-June period across southwestern Kansas.

La Nina events generally result in below normal temperatures during the October-December period for areas north of the Kansas-Nebraska border, with above normal temperatures likely during the January-March period across the entire central High Plains region. During strong events, there is a tendency for below normal temperatures to materialize across southeastern Nebraska and eastern Kansas. Precipitation patterns during La Nina events are less dramatic across the central High Plains. There are weak tendencies for above normal precipitation across northeast Colorado, eastern Wyoming, and the Nebraska Panhandle during the October-December period. Only northeastern Colorado shows an above normal precipitation response during the January-March period. For strong La Nina events, above normal precipitation tendencies occur across southeastern Nebraska and eastern Kansas during the April-June period.

Outside of the defined response areas stated above for the La Nina and El Nino cases, there is an equal distribution of temperatures and precipitation. This means that there are equal chances of receiving above normal, normal, or below normal precipitation and/or temperatures during the October-December, January-March, or April-June periods.