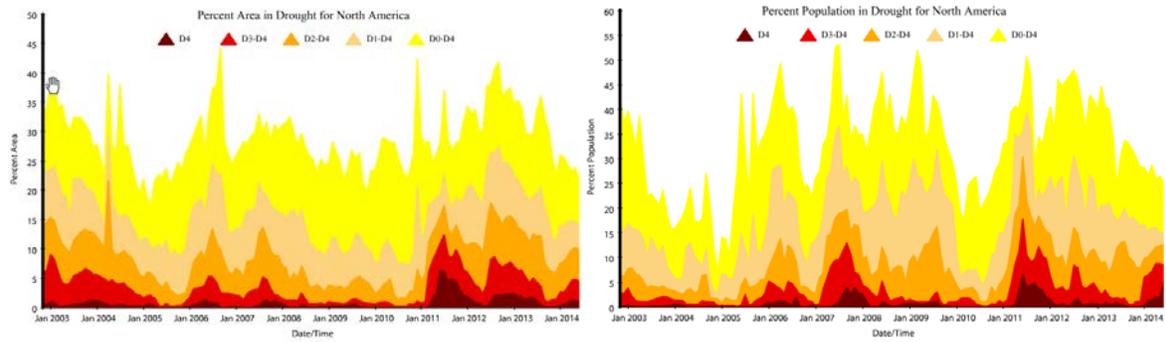


North American Drought Monitor – May 2014

At the end of May 2014, moderate to exceptional drought (D1-D4) affected approximately 14.6% of the area and 15.0% of the population of North America. These percentages are a decrease of 0.2% for area and 1.1% for population compared to the values for the end of April 2014.



CANADA: The beginning of May saw a continuation of April's cool, wet weather across Canada, followed by warmer temperatures towards the end of the month. These mild conditions allowed much of the winter's snowpack to thaw, producing sufficient spring runoff to recharge soil moisture in certain dry areas. Particularly wet conditions were experienced throughout much of Quebec, Ontario, Manitoba and northern Saskatchewan. These above average levels of precipitation relieved a number of areas that were Abnormally Dry (D0) through March and April. The improvement in conditions was particularly seen in northern Ontario, eastern Quebec and Northern Manitoba. The area surrounding Winnipeg, in southern Manitoba, also experienced some improvement, as its Abnormally Dry (D0) classification withdrew slightly. Despite this, the area of moderate drought which carried through March and April is still present. This lingering drought is due to accumulated dry conditions over the fall and winter months, as well as below average precipitation over Winnipeg this past month.

In contrast with the rest of eastern Canada, the Atlantic provinces experienced a relatively dry May. Precipitation in the region was as low as 40% of the the monthly average and temperatures were 2 to 3 degrees Celsius below normal. As a result of these adverse conditions, much of Newfoundland is classified as Abnormally Dry (D0); however, this will likely subside as spring progresses.

Western Canada also experienced drier conditions through May; precipitation levels across Alberta into central British Columbia were 20 to 60% below the monthly average. The Peace River area received particularly low levels of precipitation, with less than 40% of the monthly average. As a result of this dry spell, a new Abnormally Dry (D0) pocket emerged in the area. In south-eastern Alberta, the arid conditions exacerbated the Moderate Drought

(D1) which was formed by long-term accumulative dry conditions. As this area is the result of long-term conditions, it will take significant rainfall to alleviate the situation.

Precipitation was varied across British Columbia this past month, alternating between just below and just above normal. The Abnormally Dry (D0) region along the North Coast expanded, while the D0 areas in the Cariboo and Vancouver Island regions contracted slightly. These abnormally dry areas will likely recede as summer begins.

UNITED STATES: During May 2014, a strong westerly flow in the upper-level circulation sent several weather systems rippling across the contiguous U.S. (CONUS), some of which would stall in the upper-level trough/ridge pattern and amplify, then move slowly across a region. These systems brought heavy precipitation to parts of the country, especially the Gulf of Mexico coast. The haphazard character of the slow-moving upper-level systems split the storm track east of the Rockies, resulting in drier-than-normal weather from the Southern Appalachians to Central Plains, and contributing to the occurrence of large wildfires early in the month. Ridging in the upper atmosphere dominated in the West, bringing mostly below-normal precipitation and above-normal temperatures. Drought expanded in some areas, but beneficial rains from the upper-level lows and cold fronts contracted drought in others. The net change was contraction of moderate to exceptional drought in the Midwest, Central to Southern Plains, and West, but an increase in the *intensity* of drought (expanded extreme to exceptional drought) in the Central Plains and West. Upper-level ridging brought dry weather to much of Alaska, while Hawaii was generally wetter than normal in the northern islands and drier than normal in the south with statewide drought conditions continuing to improve.

On balance, the national drought footprint shrank when compared to last month, decreasing to about 31.2 percent of the U.S. as a whole, according to U.S. Drought Monitor (USDM) statistics. According to the Palmer Drought Index, which goes back to the beginning of the 20th century, about 34 percent of the CONUS was in moderate to extreme drought at the end of May, an increase of about 5 percent compared to last month.

By the end of the month:

- moderate (D1) to severe (D2) drought covered a large area of the U.S. continuously from the West Coast to the Great Plains, connected across New Mexico;
- there were two epicenters of extreme (D3) to exceptional (D4) drought within this large drought area — one located in the California-Nevada region and the other in the Southern Plains centered in the Texas panhandle-western Oklahoma and extending outward into New Mexico, central Texas, central Oklahoma, southeast Colorado, and southern to western Kansas; and
- patches of moderate drought lingered in the Midwest and Hawaii, and developed in the Southeast.

Historical Perspective: According to preliminary information provided by the NOAA National Climatic Data Center, when integrated across the CONUS, May 2014 ranked as

the 48th driest May in the 1895-2014 record. Kansas had the sixth driest May on record, and Kansas had their third driest and Oklahoma their ninth driest spring (March-May). Thirteen states ranked in the driest third of the historical record, with three of them having the tenth driest, or drier, year-to-date: Kansas (second driest January-May), Oklahoma (third driest), and Arizona (fourth driest). Most of the West and Great Plains was drier than normal during December 2013-May 2014, with four states having the tenth driest, or drier, December-May in the 1895-2014 record — Kansas (second driest), Oklahoma (second driest), Arizona (fourth driest), and California (sixth driest). For the last twelve months (June 2013-May 2014), dryness dominated California, the Southern to Central Plains, and Midwest, with pockets of wetness in most of the dry areas. California was especially hard hit, having the hottest and third driest June-May on record, and Iowa ranked tenth driest. Seven other states ranked in the driest third of the historical record.

Parts of the West, especially the southern portions, have been in drought for the last several years, with the Palmer Hydrological Drought Index (PHDI) reaching record or near-record low values at times. The May 2014 PHDI has surpassed the lowest values reached during the 1976-77 drought of record for parts of California — the Central Coast Drainage (climate division 4), the San Joaquin Drainage (climate division 5), and the South Coast Drainage (climate division 6). Some of these analyses show a disturbing trend toward more extreme droughts over the last 40 years in California.

Agricultural and Hydrological Highlights: The May precipitation pattern for the Primary Hard Red Winter Wheat agricultural belt was drier than normal, with May 2014 ranking as the 27th driest and 44th warmest May region-wide. The growing season to date (October 1-present) ranked as the fifth driest October-May in the 1895-2014 record. Three of the last four growing seasons have been much drier than normal. The growing season for the Primary Corn and Soybean agricultural belt got off to a dry start during March, it was wet across much of the region during April 2014, and May saw a return to dry conditions region-wide. When these three months are aggregated together, spring 2014 ranked as the 49th driest and 36th coolest March-May on record. As noted by the U.S. Geological Survey, streamflow in some river basins in the West and Central Plains was much below normal at the end of May. The Arkansas-White-Red river basin had the 12th driest spring (March-May) and 14th driest water year to date (October-present) in the 1895-2014 record. The Rio Grande river basin had the 11th driest year to date (January-May) and 27th driest water year to date. The water year to date ranked as the 24th driest for the Pacific Northwest basin, 14th driest for the Lower Colorado River basin, and 33rd driest for the Tennessee River basin.

Drought conditions were reflected in numerous agricultural, hydrological, and other meteorological indicators, both observed and modeled. The cumulative impact of the persistent reduced precipitation (last one to eight months) in the nation's agricultural areas can be seen in dried soils and stressed vegetation in parts of the West and much of the Plains. According to June 2 U.S. Department of Agriculture (USDA) reports, more than 60 percent of the topsoil was short or very short of moisture in California (75%), Oklahoma (68%), New Mexico (66%), and Kansas (60%), and 50 percent or more was short or very short in Nevada (55%), Texas (53%), Utah (51%), and Washington (51%). Subsoil moisture conditions were worse, with more than 80 percent of the subsoil moisture short or

very short in California (85%), and Oklahoma (84%), and more than 70 percent in Kansas (75%) and Nevada (75%), reflecting the long-term (multi-year) nature of the drought. The wind, low humidities, and prolonged dryness contributed to the development of large wildfires in the Plains, Southwest, and Southern Appalachian regions throughout the month.

Precipitation in the Southern Plains improved soil moisture and crop conditions, but the continued dry conditions across the West and Central Plains ravaged crops and other vegetation. The modeled Soil Water Index indicated unsatisfactory soil moisture conditions across the southwestern third of the country, where impacts could be stress or wilting, and the Water Requirement Satisfaction Index indicated potential crop failure across much of the Southwest and Southern Plains. As of June 3rd, about 51 percent of winter wheat was in drought, down from 53 percent a month ago, 43 percent of the cattle inventory was in drought (down 1 percent), 29 percent of hay (down 1 percent), 22 percent of corn (down 4 percent), and 16 percent of soybeans (down 3 percent). June 2nd USDA reports indicated that 44 percent of the winter wheat crop was in poor to very poor condition, nationally (up 10 percent from a month ago), with state values of 78 percent in Oklahoma, 64 percent in Texas, 62 percent in Kansas, and 39 percent in Colorado. Nationally, 19 percent of the pasture and rangeland was in poor to very poor condition, with statewide values over 50 percent in California (70%), New Mexico (68%), and Arizona (55%), and 40 percent or more in Kansas (43%), Oklahoma (43%), and Nevada (40%). The Palmer Crop Moisture Index (CMI) showed abnormally to excessively dry conditions expanding northward in the West as the month progressed.

The subnormal precipitation was reflected in below-normal monthly precipitation totals as well as lack of rain days and long runs of consecutive dry days, especially in the Southwest. Streamflow and modeled runoff averaged below normal in parts of the West, Plains, and Southern Appalachians, with some basins averaging much below normal and some stream gauges measuring record low monthly values for May. Precipitation for the water year-to-date has generally been near to above normal for the Northern to Central Rockies. On a basinwide basis, the northern basins in the Pacific Northwest had near average precipitation for the water year-to-date, but on an individual station-by-station basis, many stations were drier than normal. Of the western basins, the Central Rockies basins have had the wettest water year, based on percent of normal. Stations and basins in the Southern Rockies and Southwest, especially California, predominantly have had a drier-than-normal water year. The persistent dryness — for the water year-to-date and longer — was reflected in below-normal groundwater and springwater observations, and — for Texas (especially the western counties), California, and most of the western states — below-normal reservoir levels. Some wells in the western and central states, and some springs in the western states, had record low levels, with some of the wells having the lowest groundwater levels in at least 50 years.

MEXICO: Three frontal systems, two trough lines (one of them associated with a cold front), and the entry of moisture from the Gulf of Mexico in the second part of the month provided the main precipitation in the northeast, the slope of the Gulf of Mexico and the southeast. At the end of the month, Hurricane Amanda (Category 4 on the Saffir-Simpson

scale) and her remnants, located in the Pacific, caused heavy rains in the western states and in the central part of the country. This rainfall in general led to a decline in the percentage of abnormally dry regions (D0) in Nuevo Leon, Tamaulipas, San Luis Potosi and Veracruz, helped to eliminate drought areas in Tabasco and the Yucatan Peninsula, and reduced extreme (D3) and exceptional drought (D4) in Coahuila.

Due to the combination of the above systems, May 2014 ended as the second wettest May in the 1941-present record. Monthly rainfall of 67.9 mm was 70% above average, just below May 2000 (the wettest May) when 68.9 mm fell at the national level. On the state level, Colima, Guerrero, Michoacan, Yucatan, and Morelos all together experienced their second wettest May, while Aguascalientes ranked third; Baja California Sur, Chiapas, Jalisco, and Tabasco had the fourth wettest May; and Campeche and Puebla ranked fifth wettest for May. The rains were distributed in almost two thirds of the country with the highest accumulations in the south and southeast; however, the northwestern states were very warm with no rains or much below normal precipitation.

The May rains allowed an important recovery for fourteen states; these states were close to normal for the February-April 2014 period and reached the wettest zone for the new 3-month period (March-May 2014). The most prominent were Jalisco which moved from the 13th driest to 10th wettest, Veracruz from 11th driest to 18th wettest, and Coahuila and Oaxaca which moved from 8th driest to near normal. In the last three months, the wettest states were Morelos (2nd wettest March-May), Campeche, Colima, Guerrero and Tabasco (3rd), Chiapas (4th) and Puebla (5th). Of all of the states, Baja California is the only state to rank in the driest zone for the second consecutive quarter. From December 2013 to May 2014 (6-month period), there were significant deficits for Baja California (3rd driest), Sonora (23rd driest) and Coahuila (24th driest); these states have drought areas from moderate (D1) up to extreme drought (D3). At the end-of-May, the country's percent area in abnormally dry (D0) to exceptional drought (D4) categories fell just 0.4%; the abnormally dry area (D0) fell in the south, but increased along Chihuahua and Durango.

The high pressure system in the western United States extended to northwest Mexico, causing clear skies and dry air over Baja California, Sonora, Sinaloa and Chihuahua; this helped to increase drought in the northwest. A dry line (a line that separates a dry air mass from a wet one and causes low relative humidity and high temperatures) was located from Oklahoma to northern Coahuila, raising maximum temperatures and promoting exceptional drought (D4). The high pressure also helped Baja California and Baja California Sur reach their warmest May since 1971, Nayarit and Sinaloa reach their second warmest May, and Sonora the ninth warmest May. On the other hand, the start of the rainy season helped Veracruz and Tabasco to reach their third coldest and coldest May, respectively. The mean temperature at the national level of 24.3 °C was 1.0 °C above the 1971-2000 normal, resulting in the ninth warmest May since 1971.

The National Forestry Commission (CONAFOR) reported 86,634 hectares burned by fires from January 1 to May 29, 2014, with the largest number of fires reported in Mexico State, the Federal District, Michoacán, Chihuahua, Puebla, Jalisco, Oaxaca, Tlaxcala, Veracruz and Chiapas. This is the third season with fewer forest fires since 1998, and it represents

fifteen percent of the area burned in 2011 (the largest in area burned) when 86% of the country was affected by moderate (D1) to exceptional drought (D4).