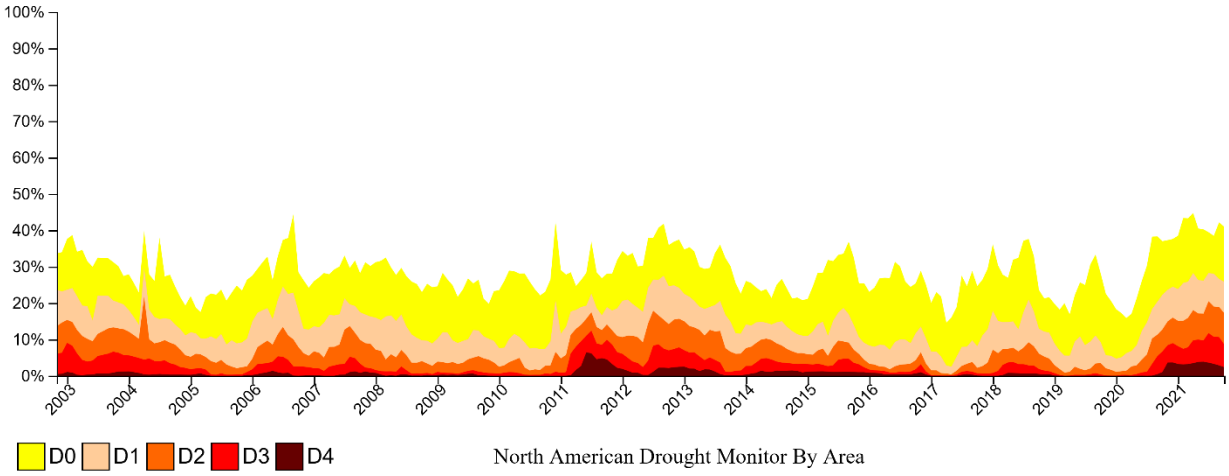
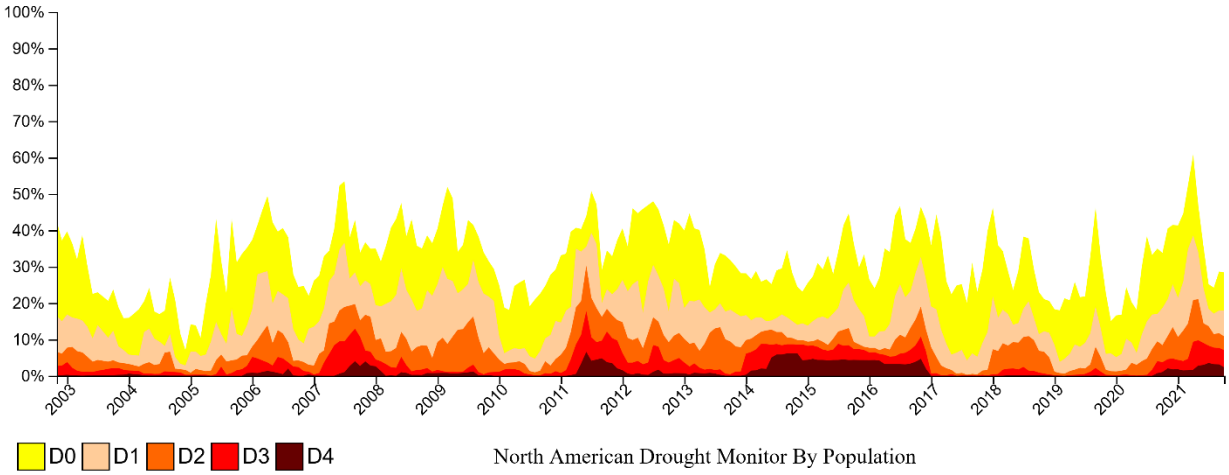
North American Drought Monitor – October 2021

At the end of October 2021, moderate to exceptional drought (D1-D4) affected 25.9% of the area and 17.9% of the population of North America. The percent area value was 0.7% less than the value for the end of September 2021. The percent population value was 0.1% less than the value for the end of September. At the end of October 2021, 94.2% of the Columbia River Basin and 56.3% of the Great Plains were in moderate to exceptional drought, and 35.9% of the Rio Grande/Bravo River Basin and 18.3% of the Great Lakes Basin were in moderate to extreme (D1-D3) drought. The North American Great Plains extends across the United States and into adjacent parts of northeast Mexico and the southern Prairies of Canada. The percent area values for the Great Lakes and Rio Grande/Bravo River Basins increased compared to the end of September 2021. The percent area values for the Columbia River Basin and Great Plains decreased compared to the end of September.



Percent area of North America in drought, November 2002-October 2021.



Percent of the population of North America in drought, November 2002-October 2021.

CANADA:

National Overview

Through October, drought conditions improved slightly, though substantial drought persisted across much of Western Canada. Moisture in the Pacific Region allowed for significant improvements in drought across Vancouver Island and onto the mainland in the southern region of British Columbia. In much of the Prairie Region, extremely dry conditions continued to linger with only a few select areas receiving moisture. Some small improvements were seen in southern Manitoba. In the Central Region, many areas across southern Ontario and Quebec received normal to above-normal precipitation in October, allowing the region to remain drought free or see some improvement. The only area of the central region that continued to receive below-normal precipitation was southeastern Quebec, which led to the formation of Severe Drought (D2). Eastern and Northern Regions of Canada remained relatively unchanged, with dry conditions added along the northern coast of Nova Scotia. More than thirty-eight percent of the country was considered Abnormally Dry (D0) or in Moderate to Exceptional Drought (D1 to D4), which includes nearly eighty percent of the national agricultural landscape.

Pacific Region (BC)

In the month of October, significant rains allowed for continued improvement to drought conditions on Vancouver Island and along the western coast. Over the past 60 days, Vancouver Island received 150 to 600 mm of precipitation, amounts that were moderately to exceptionally high for the season. This accumulation of precipitation allowed for the improvement of Moderate Drought (D1) across the Island and onto the mainland, including the Vancouver area, where a considerable amount of precipitation eased long-term deficits and improved soil moisture. Abnormally Dry (D0) conditions remained on the eastern coast of the Island where longer term, dry conditions existed as well as around Victoria where the area received below-normal precipitation over the past 365 days.

The central region of British Columbia received near- to above-normal precipitation through the month of October allowing for small improvements to pre-existing Severe to Exceptional Drought (D2 to D4), most notably through the Okanagan where Extreme (D3) and Exceptional Drought (D4) conditions were improved. Although this precipitation had minimal impact on forage production, ground water and well levels that were low during the growing season reportedly returned to normal. Severe Drought (D2) conditions also improved along the western edge of the Canadian Rockies as the area saw increased moisture from late-month storm systems passing through. A pocket of Severe Drought (D2) remained given that the area received below-normal precipitation in the long-term. Sixty-two percent of the province was classified as Abnormally Dry (D0) or in Moderate to Exceptional Drought (D1 to D4); this includes approximately ninety-one percent of the agricultural landscape.

Prairie Region (AB, SK, MB)

Overall, the precipitation received through the month of October did little to improve long-term drought conditions across much of the Prairie Region. The majority of the western Prairies received near-normal to below-normal precipitation which worsened drought conditions, particularly across eastern Alberta and western Saskatchewan, where 40 to 60 percent of normal precipitation fell. Although any precipitation was welcome, it did not accumulate enough moisture to completely alleviate impacts of the significantly dry growing season. Given both longer-term conditions and less than 40 percent of expected precipitation falling in October, an area of Exceptional Drought (D4) developed east of Edmonton, Alberta and along the Alberta-Saskatchewan border. Extreme to Exceptional Drought (D3 to D4) also remained in place across much of central Alberta and Saskatchewan as well as southern Manitoba as these areas have not yet recovered from the significant moisture deficits of the past 1 to 2 years. These areas reported a deficit of 140 mm of precipitation within the last year, with some as low as 220 mm below-normal. As the 2021 growing season came to a close, many farmers across the Prairies reported some of the worst crop conditions they've ever seen, such as in southern Alberta, where they expect only one third of their normal crop yields. Agricultural producers also experienced poor seed harvests which could lead to seed shortages for the next growing season. Zero sub-surface soil moisture was also reported across many parts of the region, as concern continues to grow for next year's growing season; many are hoping for heavy snowpack and moisture throughout the winter and spring.

Although most areas in the Prairies remained in significant drought, some select locations received above-normal monthly precipitation, leading to small areas of improvement. Much of the precipitation fell in western Alberta, southern Saskatchewan and along the Manitoba-U.S. border; this much-needed moisture helped to improve the drought situation in these areas. Upwards of 25 mm above-normal precipitation fell along the Foothills and towards Lethbridge, which roughly accounted for more than 200 percent of normal precipitation for the month of October. As a result, small improvements were made to Severe to Extreme Drought (D2 to D3) in the area. Similar precipitation fell across parts of southern Saskatchewan and Manitoba; this led to a reduction in Severe Drought (D2) around Regina and Extreme to Exceptional Drought (D3 to D4) across southern Manitoba. Although southern Manitoba previously struggled with adequate moisture levels, this area has received 30 to 60 mm above-normal precipitation since August. Emerson, Manitoba reported their wettest October on record with more than 400 percent of normal precipitation falling.

Altogether, the Prairie provinces have committed to paying $317 million as a part of the AgriRecovery program, with the most committed in Alberta and Saskatchewan. Thus far: 8,500, 7,500 and 118 claims have been made in Alberta, Saskatchewan and Manitoba, respectively. At the end of the month, seventy-six percent of the Prairie Region was classified as being Abnormally Dry (D0) or in Moderate to Exceptional Drought (D1 to D4), including nearly one-hundred percent of the region's agricultural landscape.

Central Region (ON, QC)

Much of southern Ontario received significant precipitation in the month of October, while portions of northwestern Ontario and southeastern Quebec remained dry. Conditions across the most northwestern portions of Ontario improved as the area received between 115 to 200 percent of normal precipitation, while areas from Thunder Bay to Timmins missed out on significant moisture; as a result, Moderate to Extreme Drought (D1 to D3) remained in place. Southern regions received more than 200 percent of normal precipitation in October, providing ample moisture for the region and staving off any Abnormally Dry (D0) conditions. This extends to 350 to 450 mm of precipitation in the past 3 months, corresponding to very high to exceptionally high precipitation values. Some of the October moisture pushed into parts of southern Quebec, where Moderate Drought (D1) was improved. However, the St-Georges area in southeastern Quebec received roughly 45 to 55 mm less precipitation than what is expected in October, which led to the formation of a Severe Drought (D2) pocket. Northern Quebec remained relatively unchanged in Abnormally Dry (D0) conditions. By the end of the month, thirty percent of the Central Region was classified as Abnormally Dry (D0) or in Moderate to Severe Drought (D1 to D2), including thirty-four percent of the agricultural landscape.

Atlantic Region (NS, NB, PE, NL)

Through the month of October, the majority of the Atlantic Region received near- to slightly below-normal precipitation which allowed the area to remain unchanged in terms of dry or drought conditions. Soil moisture across New Brunswick and Prince Edward Island was reported at capacity and there were no lingering deficits. Still, a pocket of Abnormally Dry (D0) conditions was added to the northern coast of Nova Scotia as the area received below-normal precipitation in the past 90 days. Moderate Drought (D1) improved across Newfoundland, but Abnormally Dry (D0) conditions remained in place. Minimal changes occurred across Labrador, though small improvements took place along the southwestern corner. By the end of the month, twelve percent of the Atlantic Region was classified as Abnormally Dry (D0), including nine percent of the agricultural landscape. No drought was reported in the region this month.

Northern Region (YT, NT)

The Northern Region saw minimal changes to Abnormally Dry (D0) conditions through the month of October. Although much of the region remained slightly dry in October, many areas reported above-normal precipitation since August; this led to slight reductions in Abnormally Dry (D0) conditions around Old Crow, Yukon and Great Bear Lake in the Northwest Territories. However, southern portions of both Territories received below-normal precipitation in the past 30 and 60 days, especially along the B.C.-Yukon border, causing the expansion of Abnormally Dry (D0) conditions along the border and north towards Watson Lake. This region reported only 30 percent of average precipitation since September and 19 percent of normal precipitation in October alone. Seven percent of the Northern Region was classified as Abnormally Dry (D0).

UNITED STATES:

National Overview:

The upper-level circulation during October 2021 was very active with several shortwave troughs and closed lows moving through the jet stream flow. During the first two-thirds of the month they mostly kept to the western portions of the contiguous U.S. (CONUS) while a ridge dominated the East, but after mid-month they migrated across the entire country. The frontal systems that accompanied the troughs were mostly of Pacific origin. The troughs, fronts, and lows spread above-normal precipitation across much of California and the Great Basin into the Pacific Northwest and central Rockies. Once they crossed the Rockies, they tapped Gulf of Mexico moisture to produce above-normal precipitation across much of the northern Plains and parts of the central Plains, Midwest, Southeast, and Northeast. Some areas missed out on the precipitation. These included parts of the Southwest and central to southern Plains, much of Montana and the Lower Mississippi Valley, the western Great Lakes, northern New England, and Mid-Atlantic coast to Florida. When averaged across the month, the migratory troughs and closed lows flattened the upper-level flow over the CONUS, with the greatest trough/ridge anomalies occurring over Alaska and Canada. The monthly temperature anomaly pattern reflected the dominant flow of the first three weeks, with cooler-than-normal temperatures in the West associated with the troughs and closed lows, and warmer-than-normal temperatures east of the Rockies beneath the dominance of upper-level ridging. Record-warm monthly temperatures occurred from the Ohio Valley to Northeast.

As a result of these conditions, drought or abnormal dryness expanded or intensified in the southern Plains to central High Plains, western Great Lakes, and parts of Montana and the coastal Carolinas. Beneficial precipitation caused drought or abnormal dryness to contract or decrease in intensity in parts of the West, Plains, and Mid- to Upper Mississippi Valley. Drought expansion generally equaled contraction, with the U.S. Drought Monitor (USDM)-based national moderate-to-exceptional drought footprint (total area) the same as last month for the CONUS (47.8 percent at the end of September and 47.8 percent at the end of October) and slightly smaller for the 50 States and Puerto Rico (40.1 percent for September and 40.0 percent for October). According to the Palmer Drought Index, which goes back to the beginning of the 20th century, about 35.8 percent of the CONUS was in moderate to extreme drought at the end of October, a decrease when compared to the end of September. The percent area of the CONUS in moderate to extreme drought has hovered between 35 and 49 percent for the last 14 months (since September 2020).

For October 2021, the temperature averaged across the CONUS was 57.0 °F (13.9 °C), or 2.9 °F (1.6 °C) above the 20th century average. This ranked sixth warmest in the 127-year record. The October precipitation total for the CONUS was 3.11 inches (79.0 mm), 0.95 inch (24.1 mm) above average, ranking ninth wettest in the 1895-2021 period of record.

Historical Perspective:

Summer monsoon rains brought above-normal precipitation to southern and central portions of the western CONUS, while Pacific fronts and an “atmospheric river” event brought above-normal precipitation to western and northern portions. This year’s precipitation improved short-term

conditions, but long-term dryness continued. Drought in California to the Pacific Northwest resulted from precipitation deficits that have built up over the last two years, while the Southwest (Nevada and the "Four Corner" states of Arizona, Utah, Colorado, and New Mexico) have suffered from precipitation deficits dating back five to six years. Precipitation integrated across the West (from the Rockies to the West Coast) over the last two years (November-October periods) ranked November 2020-October 2021 as the 13th driest such 12-month period in the 1895-2021 record and November 2019-October 2021 as the third driest such 24-month period. Earlier in the year, the West was experiencing the driest 24-month period on record. Temperatures were still in the top ten warmest category, with November 2020-October 2021 ranking as the seventh warmest such 12-month period and November 2019-October 2021 ranking as the fourth warmest such 24-month period. Temperatures have been much warmer than normal in the West for much of the last one to eight years, and have undergone a pronounced warming trend for the last 40 years.

On a state-by-state basis, Montana had the fourth driest January-October and November-October periods in 2021, while California ranked eighth driest for November 2020-October 2021.

The Standardized Precipitation Evapotranspiration Index (SPEI) integrates both water supply (precipitation) and water demand (evapotranspiration). In spite of the recent beneficial precipitation, the SPEI was still record dry for longer time scales for some states, including Arizona (18-month period ending in October), California (15-month and 18-month periods), and Nevada (18-month and 24-month periods).

Agricultural Impacts:

During October 2021, the Primary Hard Red Winter Wheat agricultural belt generally was warmer than average with drier-than-normal conditions in the west and wetter-than-average conditions in the east. The month ranked as the 46th wettest and 14th warmest October, regionwide, in the 1895-2021 record. As of November 2, drought affected approximately 89 percent of barley production, 87 percent of spring wheat production, 54 percent of the sheep inventory, 43 percent of winter wheat production, 42 percent of the milk cow inventory, 37 percent of hay acreage, 35 percent of the cattle inventory, 23 percent of cotton production, 20 percent of rice production, 19 percent of sorghum production, 19 percent of corn production, and 15 percent of soybean production.

October 31 USDA reports indicated that topsoil moisture was short or very short (dry or very dry) across 29 percent of the CONUS and subsoil moisture was short or very short across 36 percent of the CONUS. These values are less than a month ago. Forty-two percent of the pasture and rangeland was in poor to very poor condition, nationwide, while 21 percent of the winter wheat crop was in poor to very poor condition. States having 30 percent or more of the topsoil moisture short or very short include Colorado (66%), Idaho (32%), Kansas (34%), Montana (96%), Nebraska (33%), New Mexico (76%), North Carolina (30%), North Dakota (42%), Oklahoma (46%), Oregon (54%), South Dakota (32%), Texas (54%), Washington (71%), and Wyoming (52%). States having 30 percent or more of the subsoil moisture short or very short include Arkansas (30%), Colorado (60%), Delaware (30%), Idaho (59%), Iowa (35%), Kansas (39%), Minnesota (36%), Montana (94%), Nebraska (48%), Nevada (55%), New Mexico (79%), North Carolina (36%), North Dakota (64%), Oklahoma (45%), Oregon (69%), South Dakota (47%), Texas (60%), Utah (36%), Washington (75%), and Wyoming (74%). States having 30 percent or

more of pasture and rangeland in poor to very poor condition include Arkansas (32%), California (60%), Colorado (36%), Idaho (39%), Minnesota (39%), Montana (95%), Nebraska (34%), Nevada (55%), New Mexico (33%), North Dakota (77%), Oregon (77%), South Dakota (66%), Texas (30%), Utah (52%), Washington (77%), and Wyoming (62%). States having 30 percent or more of the winter wheat in poor to very poor condition include California (30%), Montana (44%), Oregon (64%), South Dakota (31%), and Texas (46%).

Abnormally dry conditions (D0) developed in the citrus growing region of Florida by the end of the month, forcing farmers to irrigate in several areas. The drier conditions in South Carolina helped many farmers complete cotton and peanut harvesting. Drought stress caused some pine trees in Maine to drop more needles than usual.

West:

Moderate (D1) to extreme (D3) drought extended from the West Coast to Rocky Mountains and into the adjacent northern Plains, with a large areas of exceptional (D4) drought. The atmospheric river event near the end of the month brought several inches of heavy precipitation across northern California and adjacent parts of the Great Basin and Pacific Northwest, which improved monthly streamflow and end-of-month soil moisture and vegetation indicators in these areas. But long-term drought indicators such as reservoir levels continued low. For example, in northern California, the reservoir level for Shasta Lake was 24% of capacity at the end of September, had fallen to 21% of capacity by October 19 (before the atmospheric river event), but rose to only 22% of capacity by the end of October (after the atmospheric river event). This was only a 1% increase from the October 19 minimum and still below the value from a month earlier. Lake Trinity was 29% of capacity at the end of September, 26% on October 19, and 27% at the end of October. The values for Lake Oroville were 22%, 22%, and 28%, respectively. The values for Folsom Lake (a smaller reservoir than the other three) were 23%, 22%, and 32%, respectively.

Elsewhere in the West, the severity and expanse of the drought was reflected in low streamflow, groundwater, spring water, and reservoir levels; dry soils; parched vegetation; and high evapotranspiration. Rain from the Pacific fronts and atmospheric river helped reduce the number of large wildfires, especially near the end of the month. According to the National Interagency Coordination Center, 48,366 wildfires had burned in the U.S. for the year to date as of October 29, 2021, scorching a total area of 6,523,989 acres. The number of wildfires in 2021 is below the ten-year average for year-to-date through October 29 (49,868) and the area burned is below the ten-year average of 6,914,978 (about 94% of the ten-year average).

The percent area of the West experiencing moderate to exceptional drought, according to USDM statistics, hovered around 90 percent, increasing slightly from 89.6 percent at the end of September to 90.4 percent at the end of October. The percent area of the West (from the Rockies to the West Coast) in moderate to extreme drought, based on the Palmer Drought Index, fell sharply in response to the atmospheric river precipitation, with a value of 64.9 percent at the end of October 2021. The Palmer Hydrological Drought Index (PHDI), based on data integrated across the West, reached near-record dry levels in July 2021, exceeded only by the drought of 1976-77. The Western U.S. PHDI improved in 2021 as summer monsoon rains and October precipitation entered into the equation.

Northern and Central Great Plains (High Plains region):

Drought contracted or reduced in intensity in northern and eastern parts of the central to northern Plains, but expanded or increased in intensity in western and southern parts. The moderate to exceptional drought area contracted from 63.6 percent of the central and northern Plains at the end of September to 59.0 percent at the end of October, with exceptional drought ending; most of the expansion occurred in the high plains of Colorado. The drought conditions were reflected in low streamflow and groundwater levels, dry soils, high evapotranspiration, and stressed vegetation.

Southern Great Plains and Lower Mississippi Valley (South region):

Drought contracted or reduced in intensity in parts of the southern Plains, but expanded or increased in intensity in western and southern parts. The moderate to extreme drought area grew from 26.5 percent of the Southern Plains at the end of September to 35.4 percent at the end of October. Most of the expansion occurred in Texas while most of the contraction occurred in eastern Oklahoma. Some of the expansion and contraction spread into the Lower Mississippi Valley states (Arkansas and Louisiana). The drought conditions were reflected in low streamflow and groundwater levels, dry soils, high evapotranspiration, and stressed vegetation.

Midwest:

Drought expanded in some parts of the Midwest and contracted in others. Overall, the moderate to extreme drought area contracted from 23.4 percent at the end of September to 19.4 percent at the end of October. The worst drought areas were in the western Great Lakes and Upper Mississippi Valley.

Northeast:

Moderate to severe drought contracted in the Northeast, shrinking from 3.1 percent at the end of September to 2.0 percent at the end of October. What little drought remained was in northern Maine and New Hampshire.

Southeast:

In the Southeast, moderate drought redeveloped in the Carolinas and adjacent Virginia, and abnormal dryness expanded. The drought and abnormal dryness area increased from 2.5 percent (abnormally dry) at the end of September to 20.9 percent (moderate drought and abnormally dry) at the end of October.

Alaska, Hawaii, and Puerto Rico:

Alaska remained free of drought and abnormal dryness. In Hawaii, exceptional drought developed on Maui but the overall drought footprint continued at 38.5 percent at the end of October. In the Caribbean, moderate drought shrank from 11.8 percent of Puerto Rico at the end of September to 1.8 percent at the end of October. In the U.S. Virgin Islands (USVI), moderate drought continued

in the south on St. Croix, while St. John improved compared to last month, becoming free of drought and abnormal dryness, and abnormal dryness developed on St. Thomas.

MEXICO:

National Overview:

Precipitation decreased across much of the country compared to September, due to the transition from summer to fall season. Above-average rain fell along the states of the Gulf of Mexico, in addition to Michoacan, Guerrero, northern Oaxaca, regions of Tamaulipas and Nuevo Leon, northern San Luis Potosi, Durango and Sinaloa, as well as in southern Baja California Sur, northern Sinaloa, Campeche and Yucatan. These rains resulted from trough lines, the passage of two cold fronts and five tropical waves, as well as the development of Hurricanes Pamela and Rick in the Pacific basin. Although above-average precipitation fell in specific areas, the national rainfall in October 2021 was 67.4 mm, which ranked in the top 30 driest category for October, based on the historical record.

The lack of precipitation was mainly concentrated in the northern, northwestern and southeastern parts of the country, mainly in the states of Sonora, Chihuahua, Baja California, Baja California Sur, Coahuila, northern Sinaloa, southern Oaxaca, Quintana Roo, Yucatan and parts of Campeche. The scarce precipitation in the Yucatan Peninsula was more noticeable during the first week of October, due to the absence of cyclonic activity in the Atlantic basin; during this first fortnight a lack of precipitation was also observed in the northwest. On the other hand, during the second week of October, rainfall along the Sierra Madre Occidental remained low, while in southern parts of the country conditions were wetter than normal, thanks to cyclonic activity as well as passage of cold fronts. Although there was a difference in the pattern of precipitation between these two fortnights, the values of the accumulated rainfall of each do not differ significantly – during the first fortnight the national rainfall had a value of 36.5 mm while in the second one it was 30.9 mm.

Despite the passage of cold fronts and cyclonic activity, the national average temperature was 23.1 °C, making it the fourth warmest October on record (since 1953). The national maximum temperature record was recorded in Chihuahua with a value of 44.7 °C on October 8. In general, a pattern with temperatures above the 1981-2010 average was observed in most of the country, mainly in the states of Coahuila and Chihuahua. Sonora was the only state that had temperatures similar to or below average.

At the national level, as of 31 October 2021, 7.89% of the country is in conditions from moderate to extreme drought (D1-D3). Above-average rainfall helped to decrease areas with drought (D1-D3) in Durango, while moderate drought (D1) was erased in Michoacán and abnormally dry conditions (D0) were eliminated in Jalisco and the State of Mexico. On the other hand, precipitation deficits increased the moderate to severe drought (D1-D2) coverage in northeastern areas, while moderate drought (D1) emerged in southern regions and abnormally dry conditions increased in the northwest and eastern parts of the country.

From January 1 to October 28, a total of 6,777 forest fires have been recorded throughout the country, of which 22 occurred in October, according to the National Forestry Commission (CONAFOR). The fires throughout the year have affected an area of 617,142 hectares. Of this area, 93% corresponded to herbaceous and shrub vegetation and 7% to arboreal strata.

The National Water Commission reported 65 of the 201 main reservoirs near or at 100% capacity on October 26.

Northwestern or Pacific Norte (Baja California, Baja California Sur, Sonora, Sinaloa, Nayarit): In this region, southern Sinaloa and Nayarit recorded well above-average rainfall due to Hurricane Pamela arriving on the coasts of Sinaloa during the first half of the month; thanks to these rains Sinaloa recorded its fifth rainiest quarter (August-October) since 1941 and Nayarit had its tenth rainiest quarter. Both states remain free of drought, with only a D0 patch in northern Sinaloa. In the peninsula of Baja California, moderate to severe drought (D1-D2) remains with minimal changes; local rains in northern Baja California helped to decrease severe drought (D2) slightly. On the other hand, the state with the lowest rainfall received was Sonora, which recorded its fifth driest October since 1941, so abnormally dry conditions (D0) increased in the south and east parts of the state. As of October 31, 2021, moderate to severe drought (D1-D2) covers 23.1% of the region, similar to that reported one month ago (23.2%); however, abnormally dry (D0) was at 26.5% in October, 11.8% higher than compared to the value in September (14.7%).

Northern (Chihuahua, Coahuila, Durango, Zacatecas and San Luis Potosí): Above-average rainfall was recorded in Durango, Zacatecas and San Luis Potosí, as well as in southern Chihuahua and Coahuila, mainly associated with moisture from the passage of Hurricane Pamela and development of trough lines. These rains allowed recovery of areas with moderate to extreme drought (D1-D3) in northern Durango; this state had its seventeenth wettest October. Zacatecas remained drought-free, while abnormally dry conditions (D0) were reduced in San Luis Potosí. In contrast, Coahuila and Chihuahua observed their sixteenth driest October, and their first and fourth warmest October since 1953, respectively, which favored the increase of areas with moderate to severe drought (D1-D2) in the north of those states and the increase of abnormally dry conditions (D0) in western and eastern Chihuahua and in central Coahuila. The area with moderate to extreme drought (D1-D3) was 7.5% as of October 31, 1.6% lower than reported at the end of September (9.1%).

Northeast (Nuevo Leon and Tamaulipas): Areas with precipitation surpluses were observed in the extreme northeast and south of Tamaulipas, and central portion of Nuevo Leon; the precipitation surpluses were associated with the development of trough lines and the passage of two cold fronts of the 2021-2022 season. The rest of the region received below-average rainfall, resulting in the emergence of moderate to severe drought (D1-D2) in northwestern Tamaulipas and northern Nuevo Leon. In terms of temperatures, Tamaulipas and Nuevo Leon recorded their fourth and third warmest October. At the end of October, areas with moderate to severe drought (D1-D2) covered 3.2% of the region.

Central-West (Aguascalientes, Jalisco, Guanajuato, Colima and Michoacán): Rainfall was mainly related to trough lines and the passage of Hurricane Rick. The state that most benefited from these rains was Michoacán, since moderate drought (D1) and abnormally dry conditions (D0)

previously located to the east of the state were eliminated; likewise in Jalisco where abnormally dry conditions (D0) disappeared. The rest of the states in the region remained unaffected by drought or dryness. Michoacán and Colima recorded their tenth and fifteenth wettest October, Colima and Jalisco had their second wettest quarter (August-October), and Aguascalientes and Guanajuato observed their fourth and sixth wettest August-October, respectively. As of October 31, 2021, the region is free of abnormally dry and drought conditions.

Central-South (Queretaro, Hidalgo, State of Mexico, Tlaxcala, Puebla, Morelos and Mexico City): Above-average rainfall was recorded in specific areas of all states that make up this region. The rain was mainly associated with the development of trough lines and the descent of two cold fronts. Since September 2021, the region remains free of drought, with only abnormally dry conditions (D0) remaining in the east and north of the region. Thanks to beneficial rains of this month, the portion of dryness (D0) in the east of the region was eliminated, but D0 areas in northern states of Queretaro and Hidalgo remained and even increased slightly; these states had their fourteenth and twentieth driest October, respectively. In terms of temperatures, Mexico City and Morelos had their second warmest October, Hidalgo and Queretaro their third, Tlaxcala their fourth, Puebla their seventh and finally the State of Mexico had its eleventh warmest October. Although temperatures were warmer than normal, wetness from previous months still remains. For example, in the three-month period from August to October 2021, Morelos recorded its third wettest quarter and Queretaro its ninth, while Tlaxcala and the State of Mexico had its fifteenth and nineteenth wettest quarter. Regionally, as of October 31, areas with abnormally dry conditions (D0) covered 7.4% of its territory, 3.2% higher than recorded at the end of September 2021.

Gulf of Mexico (Veracruz and Tabasco): This region had above-average rainfall in southern Veracruz and western Tabasco, due to the passage of two cold fronts. Veracruz recorded its twentieth rainiest October, while Tabasco stood out in temperature records by having its second warmest October since 1953; also, Veracruz had its sixteenth warmest October. Overall, rains over the region helped reduce abnormally dry conditions (D0) in central and southern Veracruz and western Tabasco. At the end of October, the Gulf of Mexico region recorded abnormally dry conditions (D0) in 40.1% of the territory, 9.9% less than figures on September 30, 2021.

South Pacific (Guerrero, Oaxaca and Chiapas): In southern parts of the country, rainfall was associated with the evolution and landfall of Hurricane Rick on the coasts of Guerrero and the passage of tropical waves. The above-average rainfall recorded by this tropical cyclone helped abnormally dry conditions (D0) to decrease on the coasts of Guerrero and Oaxaca; however, it did not stop the emergence of moderate drought (D1) in the central part of both states. Above-average rainfall was observed in Chiapas, reducing abnormally dry conditions (D0), although moderate drought (D1) also emerged in the west and east of the state. Guerrero and Chiapas had their seventh warmest October since 1953, while Oaxaca its thirteenth. As of October 31, 2021, 2.4% of the region's surface area has moderate drought (D1).

Yucatan Peninsula (Campeche, Quintana Roo and Yucatan): Even though some precipitation was observed in the states of Campeche and Yucatan, it was not enough to improve the abnormally dry conditions (D0) observed in the region. In terms of temperatures, Campeche recorded its warmest October since 1953, Yucatan its second warmest and Quintana Roo had its fourth warmest

October. These conditions led to an increase in abnormally dry conditions (D0), from 27.4% on September 30, 2021 to 50.6% on October 31.