



WATER SUMMARY UPDATE

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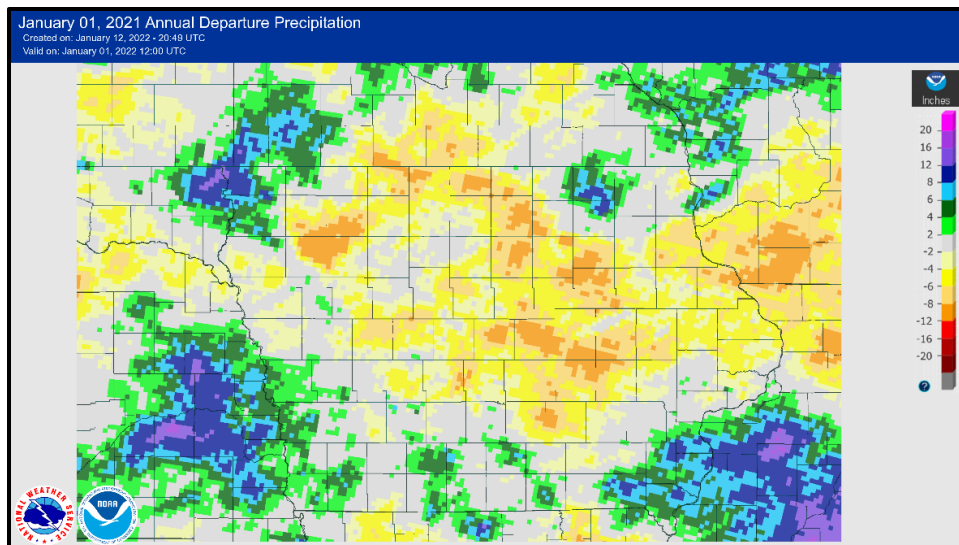
A review of water resource trends from 2021

2021 brought a second dry year in a row for Iowa, after the two wet years of 2018 and 2019. The northwest part of the state began the year in drought, which increased in severity over much of the year, reaching its peak in August. The month of October, which was the third wettest October on record, was very significant for Iowa, reversing the deterioration of conditions and providing much needed moisture going into the fall months. The state ended 2021 with just over 31 inches of rain for the year – almost 4.5 inches below normal. Iowa also ended the year with an average temperature of 50.0 degrees or 1.6 degrees above normal. Both streamflow and groundwater conditions were both concerning for much of the year, but 2021 ended with near normal streamflow and groundwater conditions across the state.

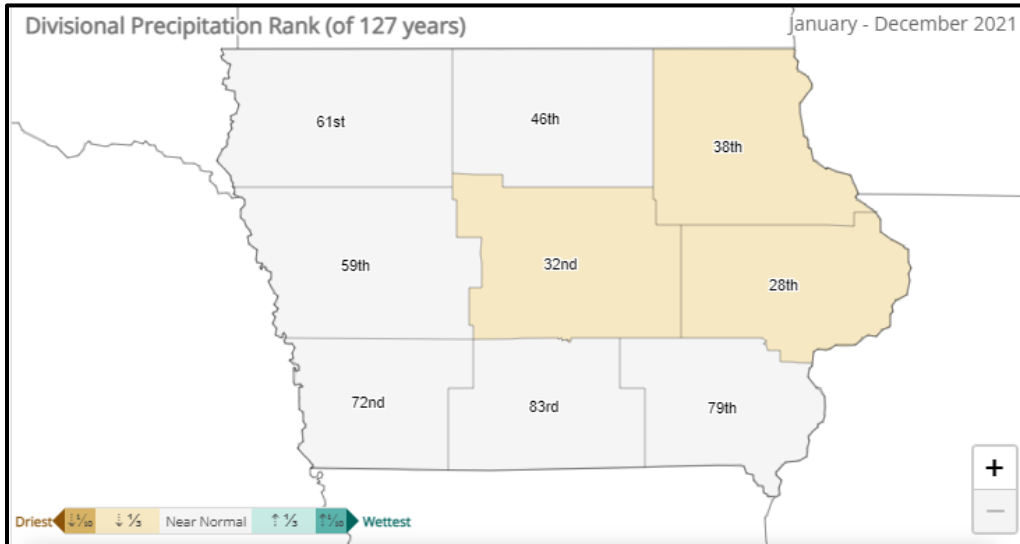
PRECIPITATION FOR 2020

Based on 149 years of statewide observations, Iowa experienced its 57th driest year on record in 2021 with a statewide average precipitation accumulation of 31.06 inches, 4.49 inches below normal. A drier year occurred just last year. In 2021 precipitation was below normal for 8 of the 12 months of the year and was significantly below normal during late spring and early summer. On the opposite side of the meteorological spectrum, October 2021 was the 3rd wettest October on record, with 2.88 inches of above average rainfall.

The distribution of precipitation was not uniform across Iowa in 2021. There were pockets of near to above-average precipitation totals around the four corners of the state. Much of Iowa's interior experienced precipitation deficits of four to six inches; pockets of eight to twelve inch precipitation deficits were found in central, north-central and northwestern Iowa.



The figure below shows the historical ranking of Iowa's nine climate divisions based on 127 years of record kept at the National Center for Environmental Information. The northern six climate divisions experienced drier than normal conditions while the southern three climate divisions were wetter than the 1981-2010 climatological normal.

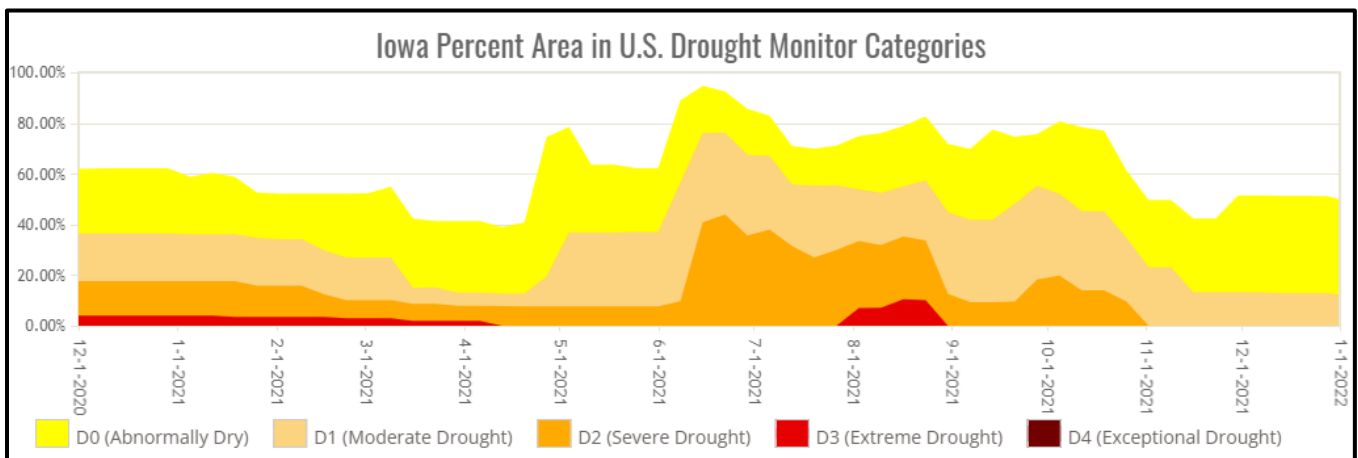


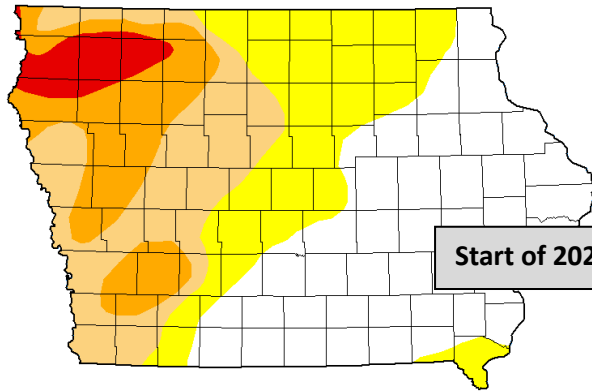
TEMPERATURE FOR 2021

Iowa temperatures averaged 50.0 degrees or 1.6 degree above normal ranking as the 16th warmest year on record. A warmer year was last reported in 2016.

DROUGHT MONITOR FOR 2021

Iowa began the year already in drought conditions, especially in the northwest part of the state. As shown in the figure below, those early 2021 drought conditions held mostly steady through the winter months and into the spring. By the middle of April D3 – Extreme Drought had disappeared from the state, and drought conditions continued to improve until the middle of June, when drought coverages began to expand. Extreme Drought reappeared in early August, and was present in the state until the end of that month. After the rains of October, D2 – Severe Drought disappeared from the state in early November, and conditions remained generally steady for the remainder of the year. Iowa ended 2021 with roughly half of the state free from any dryness or drought, and about 12 percent of the state with D1-Moderate Drought conditions.



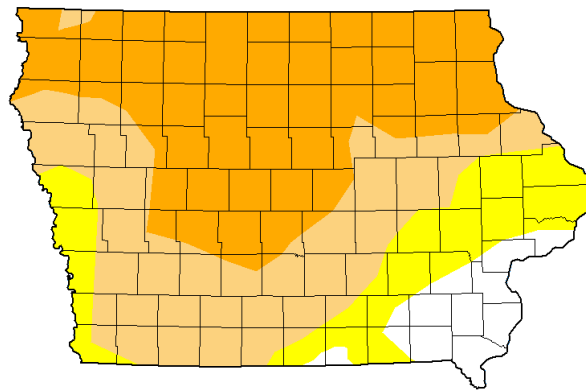


Start of 2021 Conditions

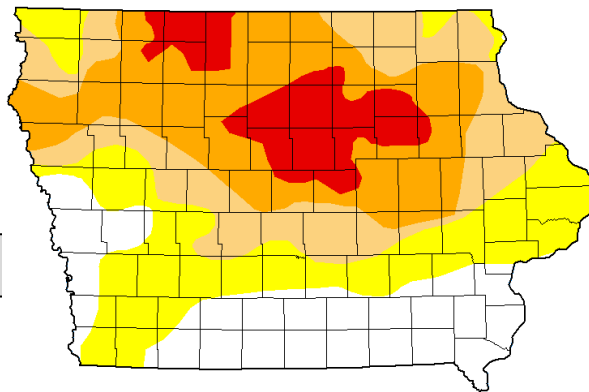
Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

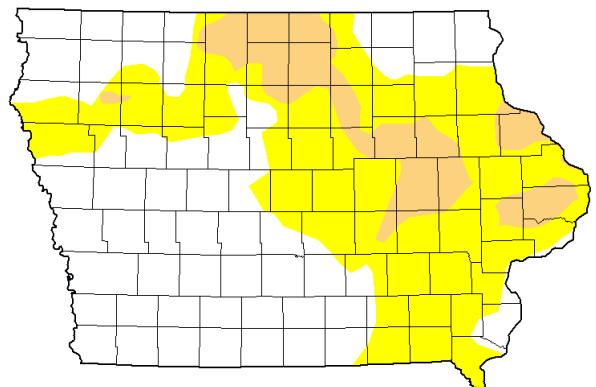
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



Peak Overall Coverage in 2021 – June 22



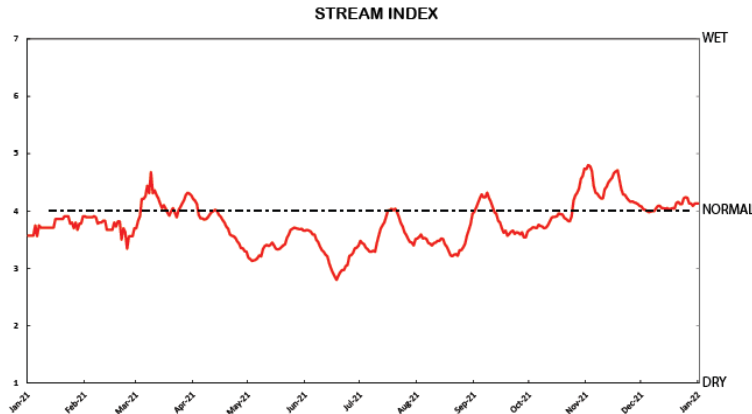
Peak D3 Coverage in 2021 – August 17



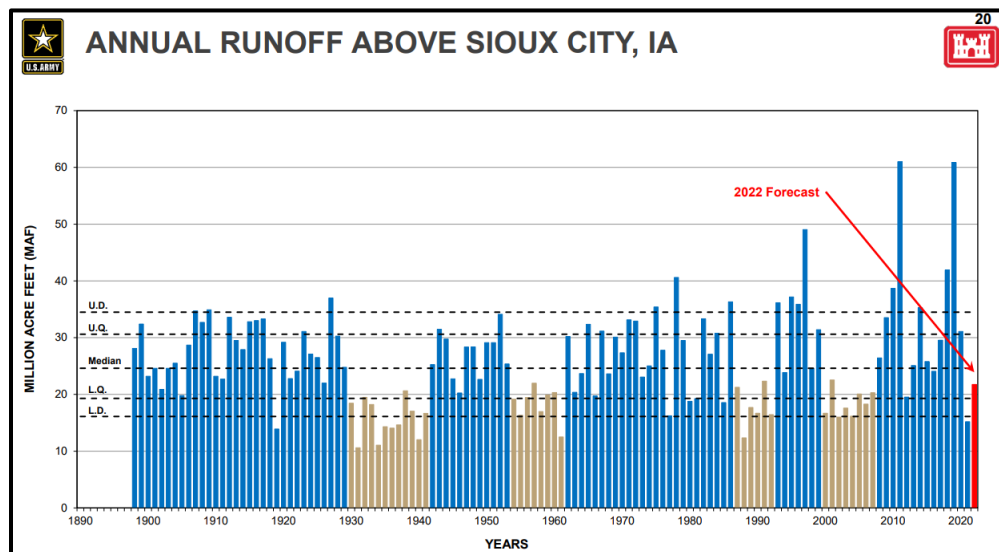
End of 2021 Conditions

2021 RUNOFF AND STREAMFLOW

Stream Index is a measure of the average streamflow at any time when compared to normal flow for that same time. This allows for a snapshot of the overall streamflow conditions over the year. The Stream Index for 2021 reflects the slightly below normal conditions at the end of 2020 carrying forward into the start of 2021, and then slight increase for spring runoff followed by a dry summer and wet fall. Toward the end of 2021 average streamflows in Iowa were slightly above normal – reflecting the very wet month of October.



The concern for major flooding on the Missouri River a year ago gave way to concern for drought, as much of the Missouri River basin was very dry this past year. Annual runoff in the Missouri River basin above Sioux City, Iowa was 15.2 million acre-feet, 59 percent of average. The ongoing drought shows no relief in sight and the U.S. Army Corps of Engineers (USACE) is predicting runoff into the mainstem reservoir system will remain below normal. 2021 had the 10th lowest annual runoff for the Missouri River Basin in 123 years of record-keeping. The runoff in 2021 was less than one fourth the volume of water that the river carried during the flooding of 2019. USACE has forecast the runoff for 2022 to be 84 percent of normal, at 21.7 MAF.



2021 SHALLOW GROUNDWATER

The year began with shallow aquifer conditions under slight drought stress across most of the western half of the state and moderate to severe drought stress in northwest Iowa. By late spring the slight stress area had expanded to include most of the western two thirds of the state but the moderate to severe conditions

remained limited to northwest Iowa. As late-spring progressed into early summer the moderate to severe conditions expanded into central Iowa, but by mid to late summer the stress had diminished to slight to moderate drought conditions over central and north-central Iowa. During fall into winter drought conditions lessened even more to include only slight stress over a several-county area in north central and northeast Iowa. As 2021 ended the shallow groundwater levels across the state appeared mostly stabilized with no known issues of significant decline heading into 2022.

Monthly Conditions: December 2021

DROUGHT MONITOR FOR DECEMBER 2021

Drought and abnormally dry conditions remained largely unchanged through the month. Soil temperatures did not drop below 32 degrees until the end of the month, so much of the rain that fell in the month was able to infiltrate into soil profiles, keep holding drought conditions steady. As of the first week of January, portions of eastern Iowa saw a one-category improvement with D1 conditions decreasing by one percent, where a heavier snowpack was present after a New Year's Day winter storm.

PRECIPITATION AND TEMPERATURE FOR DECEMBER 2021

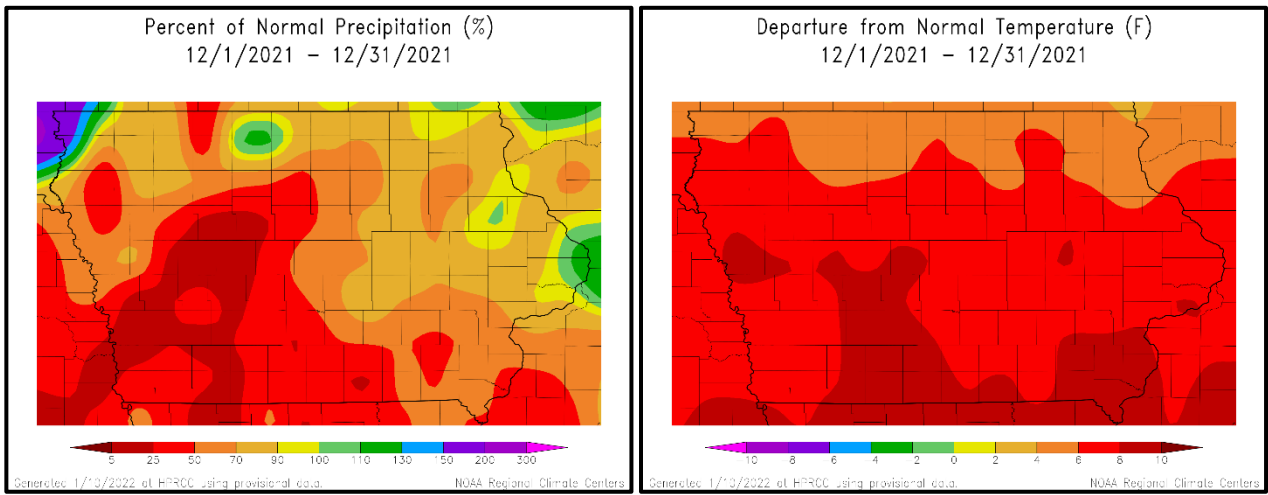
December 2021 was warmer and drier than normal. Temperatures averaged almost seven degrees above normal, ranking this past December as the 13th warmest December on record. Meanwhile, precipitation averaged 0.82 inch or 0.55 inch less than normal, ranking it as the 47th driest on record. With the exception of stations in extreme northwest and eastern Iowa, below-average precipitation was reported over a majority of Iowa. Precipitation deficits of over an inch were observed in west-central and southern Iowa while lesser totals were reported farther north.

The first winter storm of the season moved through the northwestern two-thirds of Iowa on the 10th and 11th. Heavier snow, on the order of four to eight inches, fell across northwestern Iowa with amounts tapering off farther southeast. Larchwood (Lyon County) measured 8.3 inches with central and eastern stations reporting a dusting. A mix of rain, freezing rain and snow fell along the system's southerly track with a gauge near Camanche (Clinton County) reporting 2.02 inches of rain.

A spring-like low pressure system brought a line of severe thunderstorms through Iowa on the 15th. The line was relatively narrow but packed a punch as it raced northeast at over 70 mph. Heavier rain fell over Iowa's northwest corner as well as in central Iowa. Larchwood observed 0.97 inch of rainfall while Adel measured 0.78 inch.

December's second and final winter system to impact Iowa moved through the state's northwest one-third on the 28th, leaving behind snow totals in the four to five-inch range. Rain and freezing rain fell over southern Iowa where temperatures remained above freezing. Liquid totals were generally a few tenths of inch or less with Muscatine reporting 0.53 inch.

Monthly precipitation totals ranged from 0.10 inch in Pacific Junction (Mills County) to 2.78 inches at a rain gauge in Camanche. The statewide average snowfall was 2.0 inches, which is 5.9 inches below normal.



SHALLOW GROUNDWATER FOR DECEMBER 2021

In December 2021 shallow groundwater levels across the state remained mostly normal, with no known issues of significant decline heading into January 2022.

STREAMFLOW CONDITIONS FOR DECEMBER 2021

Monthly average streamflow conditions for December were near normal across most of Iowa. Two areas of slightly above normal flow exist in central and northeast Iowa, while two areas of slightly below normal flow exist in west-central and southwest Iowa. Normal December streamflow levels are low, so even normal streamflow levels appear to be very low when observed in the field.

ADDITIONAL INFORMATION

For additional information on the information in this Water Summary Update please contact any of the following:

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