

North American Drought – Perspectives from the United States

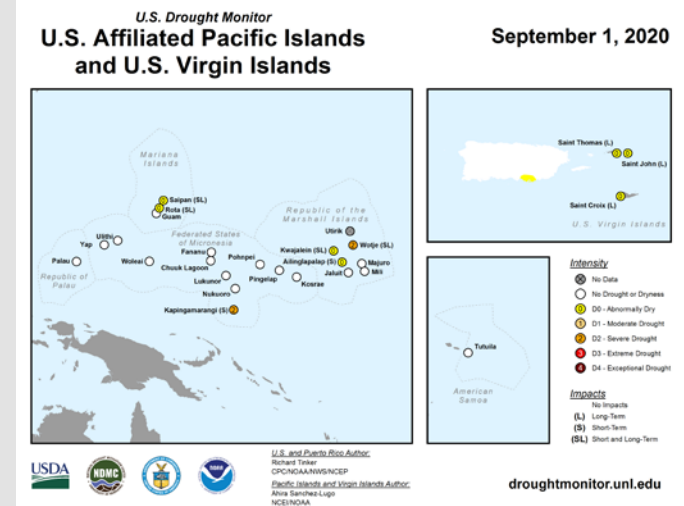
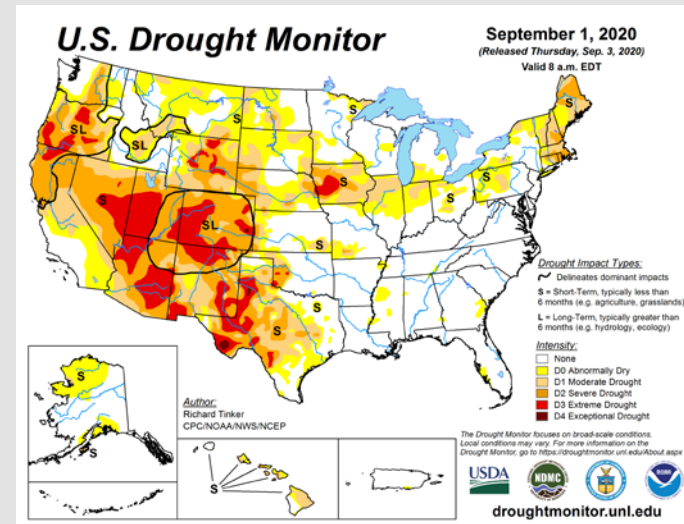
Richard R. Heim Jr. / Meteorologist, NOAA/NESDIS/NCEI

Improving the Effectiveness of Early Warning Systems for Drought:
2020 Virtual Drought Summit
29 September-October 1, 2020



U.S. Drought Monitor (USDM)

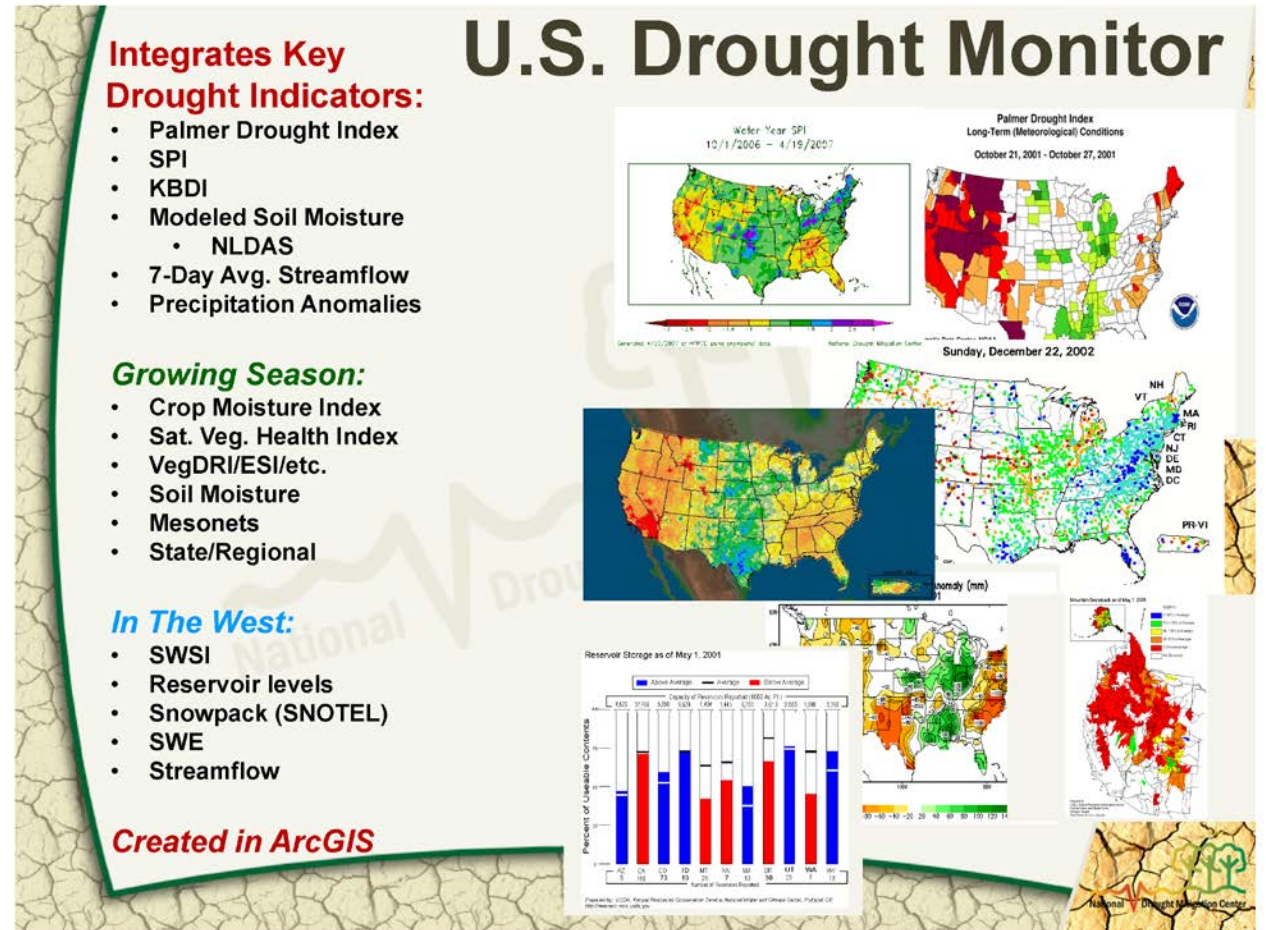
- Operational 2000, collaborative effort
 - NOAA, USDA, NDMC; 400+ academic & state partners provide local info & recommendations
- Page 1 (50 States + PR), Page 2 (USAPI & USVI)
- ArcGIS environment
- Biennial workshops, user engagement



USDM "Convergence of Evidence" Approach

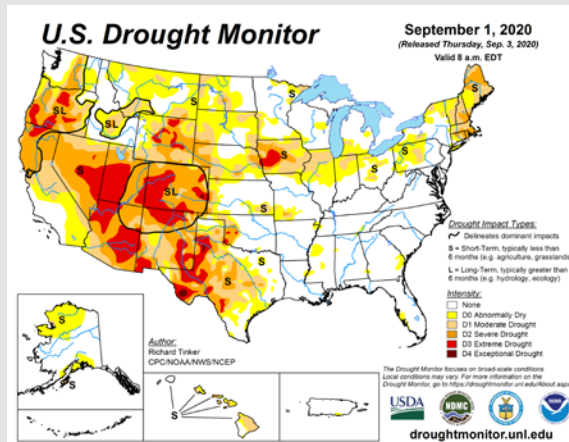
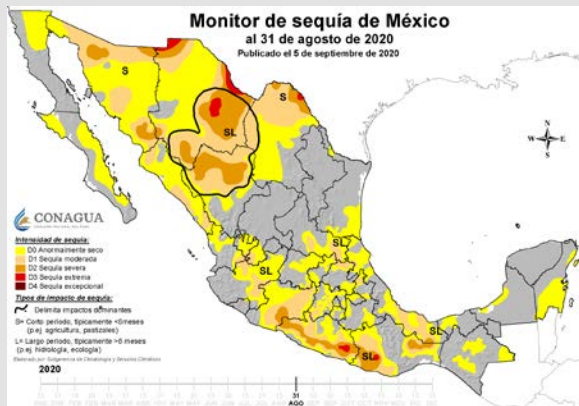
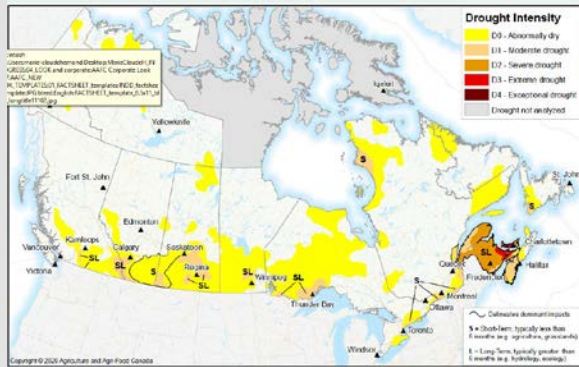
- Integrates multiple objective drought indices
- Incorporates drought impacts from local field experts
- Percentile-based drought intensities

Description	Category	Percentile
Abnormally Dry	D0	0.21-0.30
Moderate Drought	D1	0.11-0.20
Severe Drought	D2	0.06-0.10
Extreme Drought	D3	0.03-0.05
Exceptional Drought	D4	0.00-0.02



North American Drought Monitor (NADM)

Canadian Drought Monitor
Conditions as of August 31, 2020

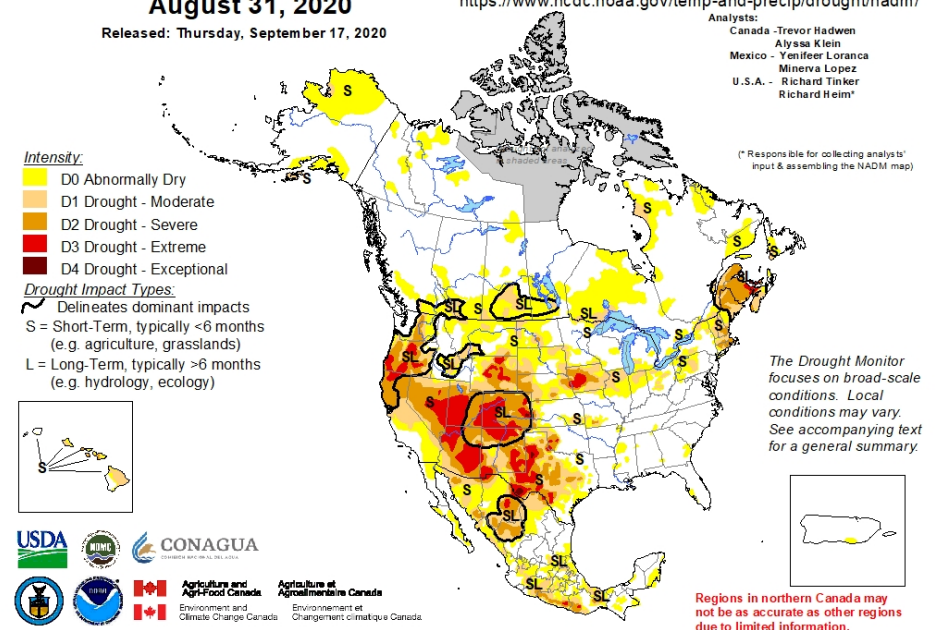


- Extends the USDM concept continent-wide
 - National DMs merged into NADM
 - ArcGIS, Convergence of Evidence

North American Drought Monitor

August 31, 2020
Released: Thursday, September 17, 2020
<https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/>

Analysts:
Canada - Trevor Hadwen
Alyssa Klein
Mexico - Yenifer Loranca
Minerva Lopez
U.S.A. - Richard Tinker
Richard Heim*



* Responsible for collecting analysts' input & assembling the NADM map

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

Regions in northern Canada may not be as accurate as other regions due to limited information.



North American Drought Monitor (NADM)

- Collaboration – USDM agencies, AAFC*, SMN**
- Biennial Workshops, User Engagements
- CEC Survey

<https://survey.zohopublic.com/zs/ePCsdL>

* AAFC: Agriculture and AgriFood Canada
 ** SMN: National Meteorological Service of Mexico
 CEC: Commission for Environmental Cooperation

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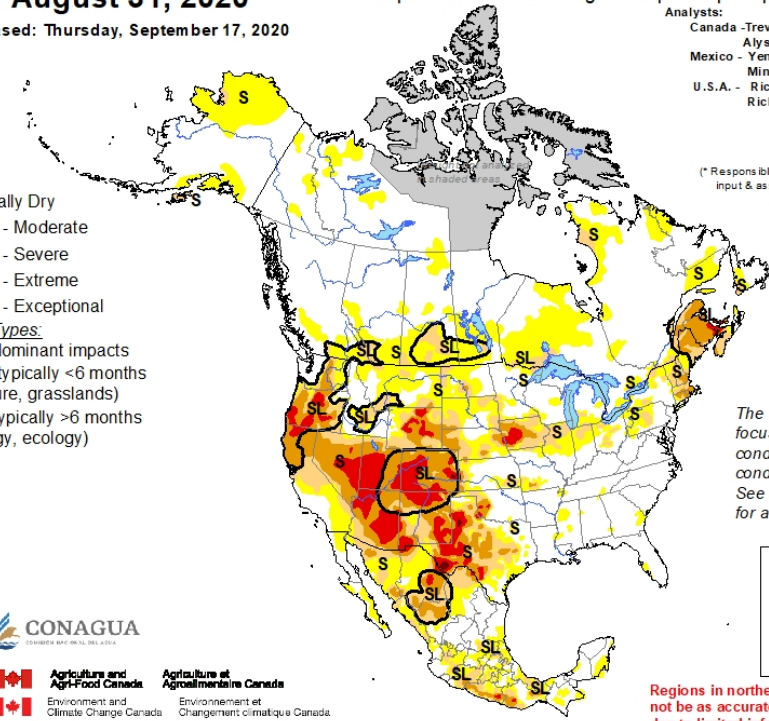
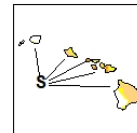
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Intensity:

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

Drought Impact Types:

- Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)



(* Responsible for collecting analysts' input & assembling the NADM map)

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



Regions in northern Canada may not be as accurate as other regions due to limited information.

Las regiones en el norte de Canadá podrían no ser tan precisas como el resto, debido a limitaciones en la información.

Les régions situées dans le nord du Canada ne sont pas aussi précises que les autres régions en raison du peu d'information disponible.

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3 NADM Websites

NOAA / NCEI

<https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/>

The screenshot shows the NOAA website header with the logo and navigation menu. The main content area is titled "North American Drought Monitor" and includes an "Overview" section. The overview text states: "The North American Drought Monitor (NADM) is a cooperative effort between drought experts in Canada, Mexico and the United States to monitor drought across the continent on an ongoing basis. The program was initiated at a three-day workshop in late April 2002 and is part of a larger effort to improve the monitoring of climate extremes on the continent. The NADM (Lawrimore et al. 2002) is based on the highly successful U.S. Drought Monitor (USDM), and as such, is being developed to provide an ongoing comprehensive and integrated assessment of drought throughout all three countries. Since its inception in 1999, the US Drought Monitor (Svoboda et al. 2002) has been extremely successful in assessing and communicating the state of drought in the US on a weekly basis. As with the US Drought Monitor, the North American Drought Monitor blends..." To the right of the text is a map of North America with the flags of Canada, the United States, and Mexico overlaid.

NCEI: National Centers for Environmental Information
NIDIS: National Integrated Drought Information System
NDMC: National Drought Mitigation Center

<https://droughtmonitor.unl.edu/nadm/Home.aspx>
NDMC

The screenshot shows the NIDIS website header with the logo and navigation menu. The main content area is titled "North American Drought Portal" and includes a "Welcome!" section. The welcome text states: "The North America Drought Monitor (NADM) is a cooperative effort between drought experts in Canada, Mexico and the United States to monitor drought across the continent on an ongoing basis. The NADM is based on the highly successful U.S. Drought Monitor (USDM), and provides an ongoing comprehensive and integrated assessment of drought throughout all three countries." Below the text is a map of North America showing drought conditions. At the bottom of the screenshot is a line graph titled "N.A. % Area in Drought" showing the percentage of the North American area in drought from 1945 to 2020. The graph shows a significant increase in drought area starting around 2000, peaking around 2012-2013, and then declining.

NIDIS Portal

<https://www.drought.gov/nadm/>

The screenshot shows the North American Drought Monitor website header with the logo and navigation menu. The main content area is titled "North American Drought Monitor" and includes a "Map for August 31, 2020" section. The map shows drought conditions across North America, with a legend indicating different levels of drought severity. Below the map is a "Welcome to the North American Drought Monitor (NADM) supplemental website. This website provides additional maps and statistics for the NADM." section. The text states: "The NADM is a cooperative effort between drought experts in Canada, Mexico and the United States to monitor drought across the continent on an ongoing basis." Below this is a "Note:" section that says: "This is a supplemental website for the North American Drought Monitor. Please visit the official North American Drought Monitor website." At the bottom of the screenshot is an "Author(s):" section.

Author(s):

NOAA / NCEI NADM Website

<https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/>



NADM Maps – 3 languages

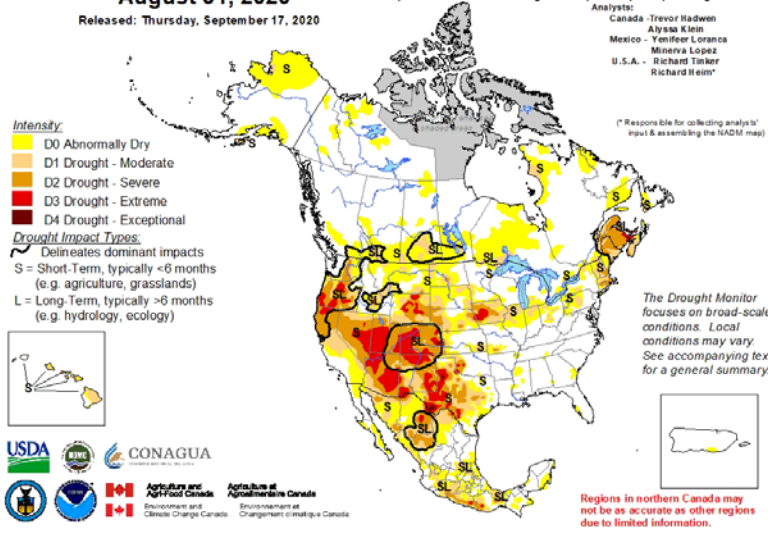
Narrative – 3 languages

North American Drought Monitor

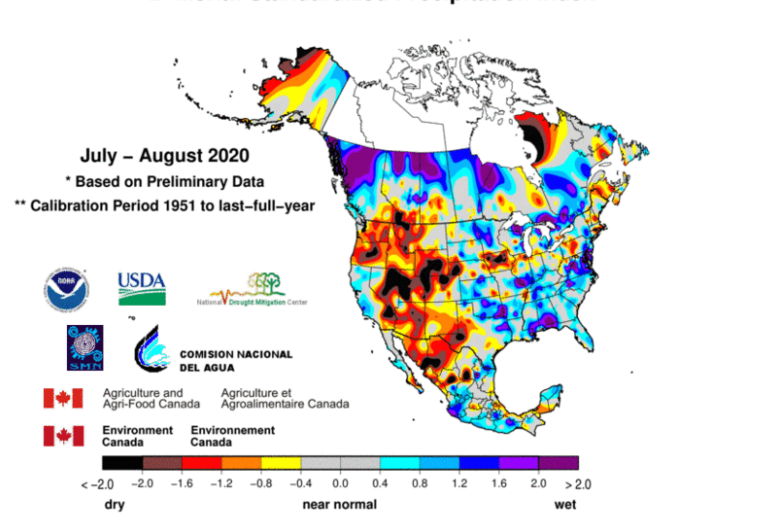
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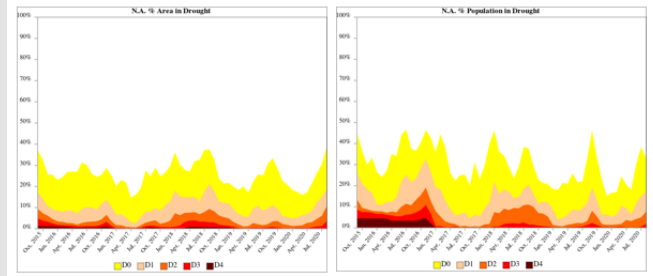
2-Month Standardized Precipitation Index



Drought Indicators – SPI,
Palmer Drought Index,
Percent of Average Precip

North American Drought Monitor – August 2020

At the end of August 2020, moderate to exceptional drought (D1-D4) affected 18.4% of the area and 16.9% of the population of North America. The percent area value was 3.7% more than the value for the end of July 2020. The percent population value was 1.9% more than the value for the end of July. At the end of August, 72.6% of the Rio Grande/Bravo River Basin and 37.9% of the Great Plains were in moderate to exceptional drought, 28.7% of the Columbia River Basin was in moderate to extreme drought (D1-D3), and 5.8% of the Great Lakes Basin was in moderate 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 Plains and the Columbia and Rio Grande/Bravo River Basins increased this month, while the value for the Great Lakes Basin decreased compared to the end of July.



CANADA:
National Overview
Dry conditions across Canada expanded significantly in the month of August. More than twenty-five percent of the country was considered Abnormally Dry (D0) or in drought; this represents a nearly ten percent increase since the end of July. The Atlantic region continues to be the hardest hit area where agricultural crops yields and water supplies have been

Geographical Reference Maps
Climatology Maps

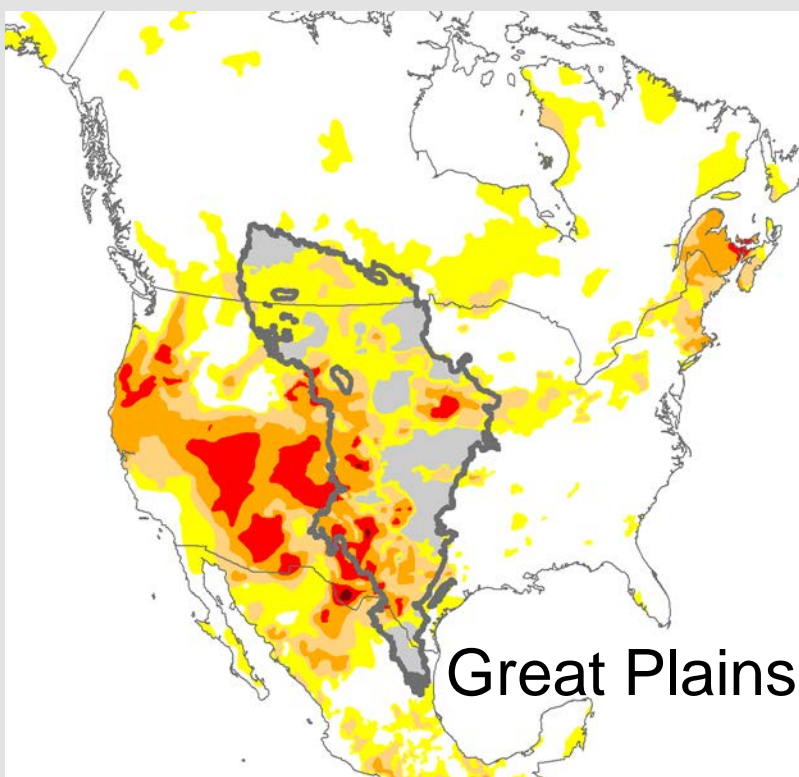
NADM Survey – <https://survey.zohopublic.com/zs/ePCsdL>

NOAA / NCEI NADM Website

<https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/>



Transboundary Regions and River Basins – Percent Area in Drought (in Narrative)



Great Plains

Percent Area - Aug 2020

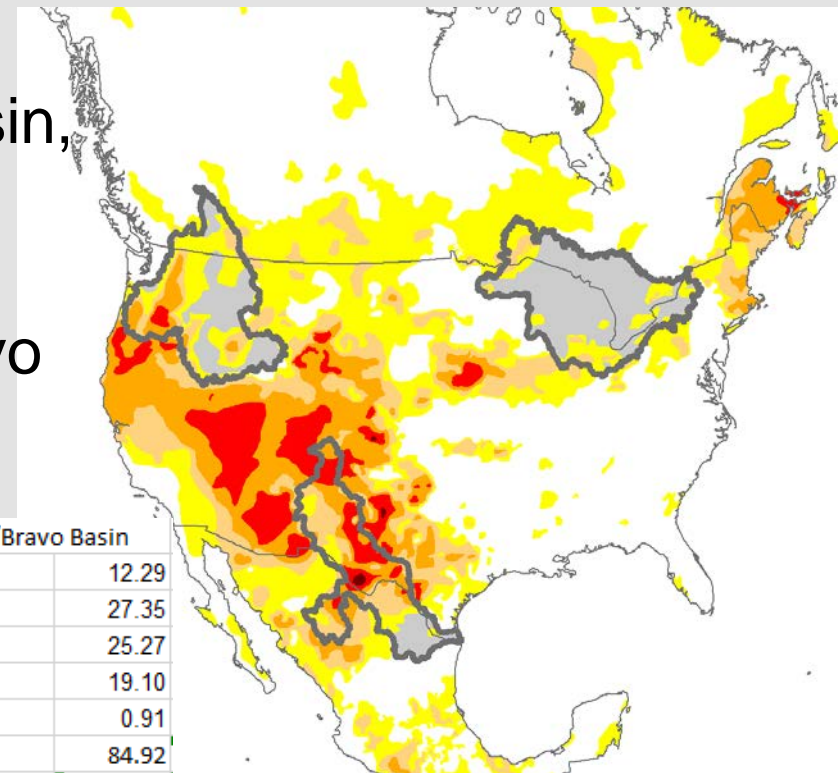
Great Plains	
D0	33.14
D1	19.05
D2	14.20
D3	4.52
D4	0.10
D0-D4	71.01
D1-D4	37.86

Great Lakes Basin,
Columbia River
Basin,
Rio Grande/Bravo
River Basin

Columbia River Basin	
D0	33.12
D1	15.20
D2	11.62
D3	1.92
D4	
D0-D4	61.87
D1-D4	28.74

Great Lakes Basin	
D0	20.42
D1	5.77
D2	
D3	
D4	
D0-D4	26.19
D1-D4	5.77

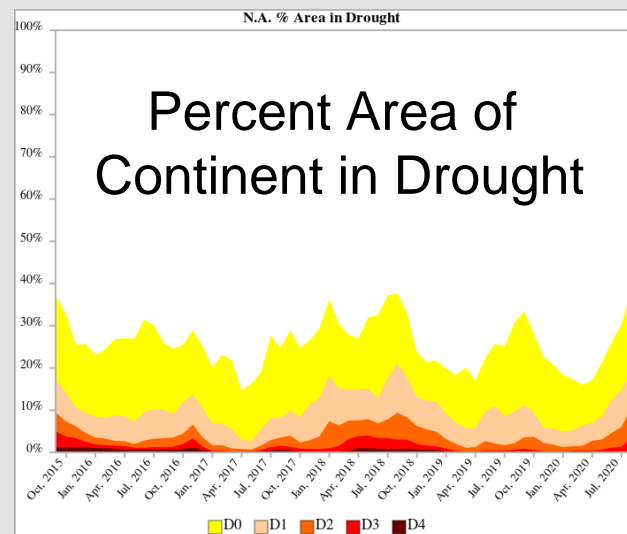
Rio Grande/Bravo Basin	
D0	12.29
D1	27.35
D2	25.27
D3	19.10
D4	0.91
D0-D4	84.92
D1-D4	72.63



NADM Survey – <https://survey.zohopublic.com/zs/ePCsdL>

NIDIS Portal Website

<https://www.drought.gov/nadm/>



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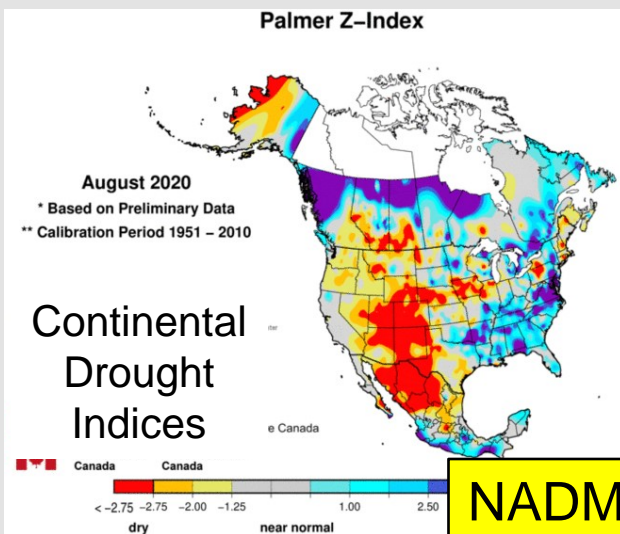
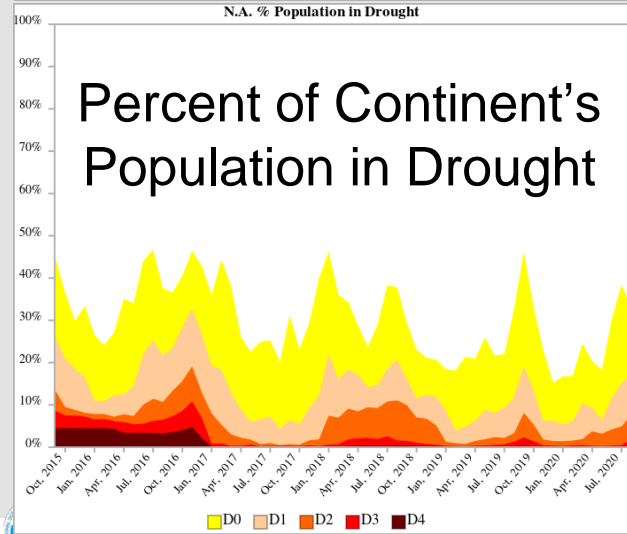
<https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/>

NADM Maps & Narrative
-- 3 languages

Area Drought

N.A. % Area in Drought

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Aug, 2020	38.26%	38.26%	18.37%	10.28%	3.27%	0.04%
Jul, 2020	30.27%	30.27%	14.68%	5.86%	1.1%	0%
Jun, 2020	26.11%	26.11%	12.37%	4.45%	0.92%	0.03%
May, 2020	21.24%	21.24%	8.39%	2.86%	0.47%	0%



Population Drought

N.A. % Population in Drought

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Aug, 2020	33.2%	33.2%	16.85%	7.38%	1.71%	0%
Jul, 2020	38.35%	38.35%	14.93%	4.73%	0.26%	0%
Jun, 2020	30.03%	30.03%	11.41%	4.02%	0.17%	0%
May, 2020	18.13%	18.13%	6.3%	2.01%	0.07%	0%

Data Tables

- Climatology Maps
- Shapefiles
- Interactive Map Viewer

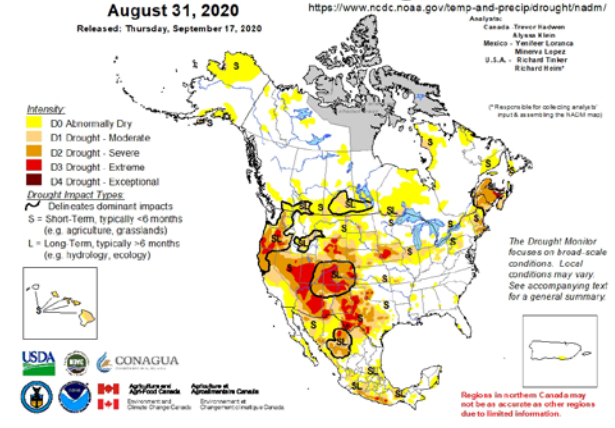
NADM Survey – <https://survey.zohopublic.com/zs/ePCsdL>

NDMC's NADM Website

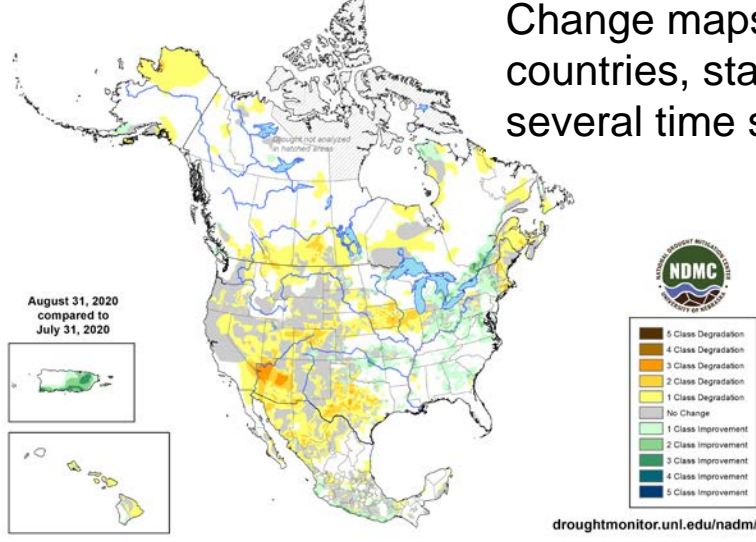
<https://droughtmonitor.unl.edu/nadm/Home.aspx>



North American Drought Monitor

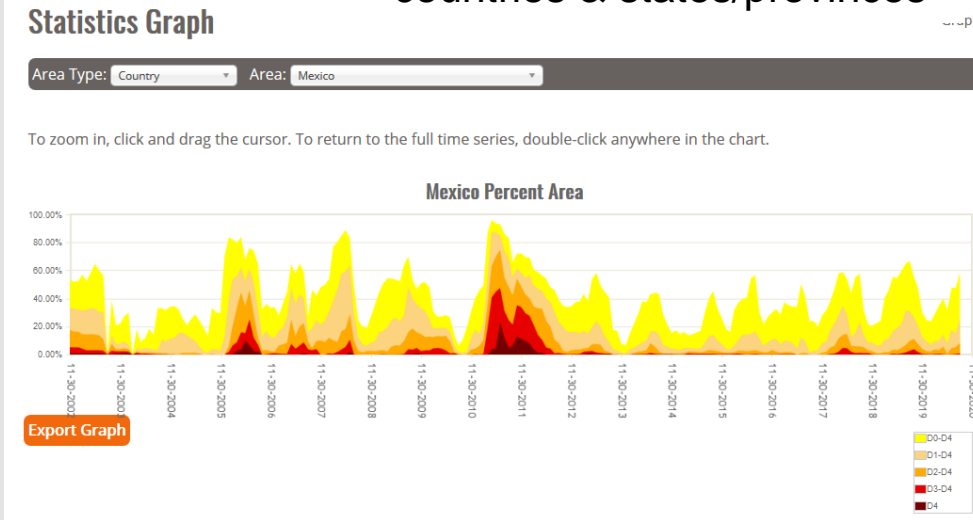


North American Drought Monitor Class Change 1 Month



Change maps for the continent, countries, states/provinces at several time scales

Percent area graphs for countries & states/provinces



NADM maps for the continent, countries, states/provinces

Statistics Table

Area Type: Country Area: Mexico Statistics type: Traditional Percent Area

Percent Area in North American Drought Monitor Categories

Show 25 entries Search:

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
2020-08-31	41.33	58.67	25.71	8.27	0.83	0.00
2020-07-31	52.22	47.78	15.14	5.39	0.42	0.00
2020-06-30	52.52	47.48	17.87	4.57	0.17	0.00
2020-05-31	67.90	32.10	8.01	0.61	0.00	0.00

Percent area tables for countries & states/provinces

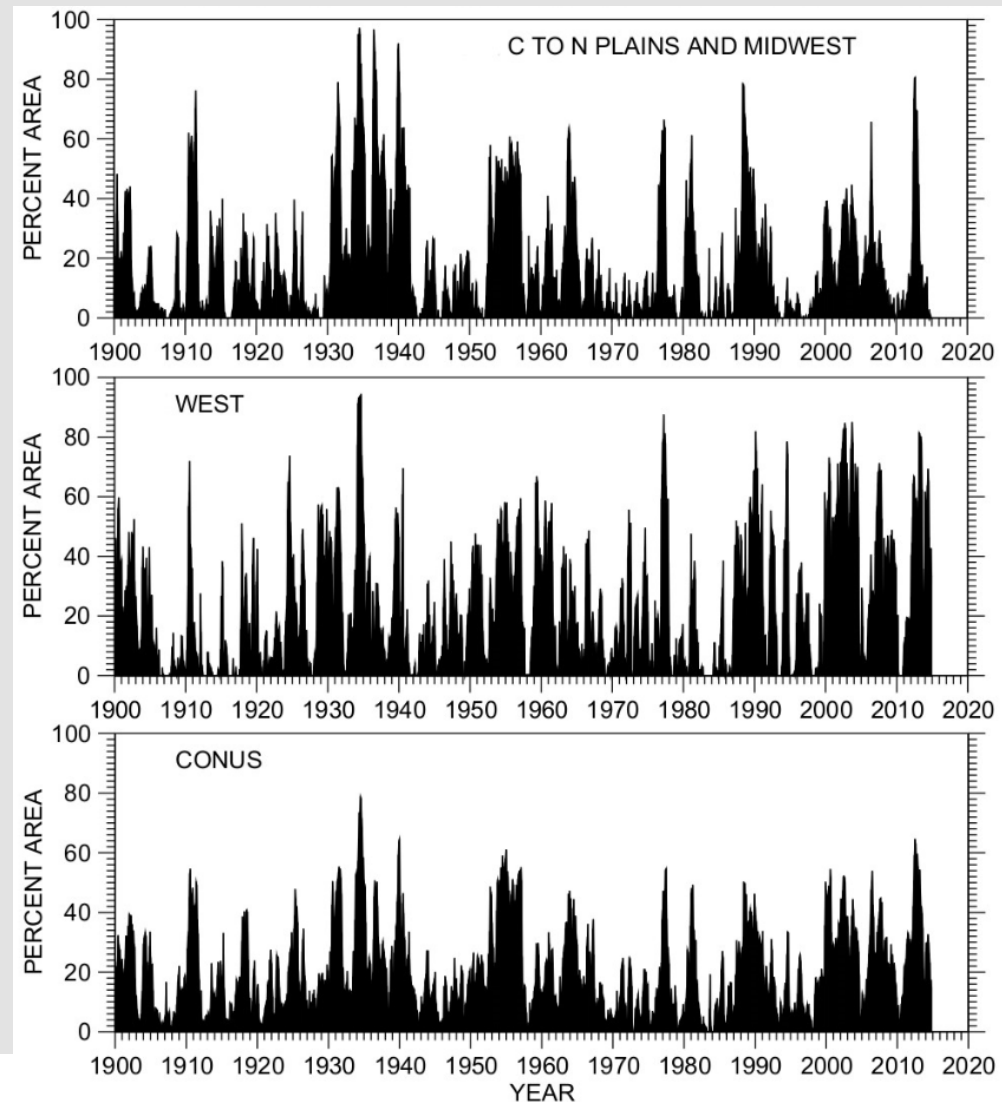
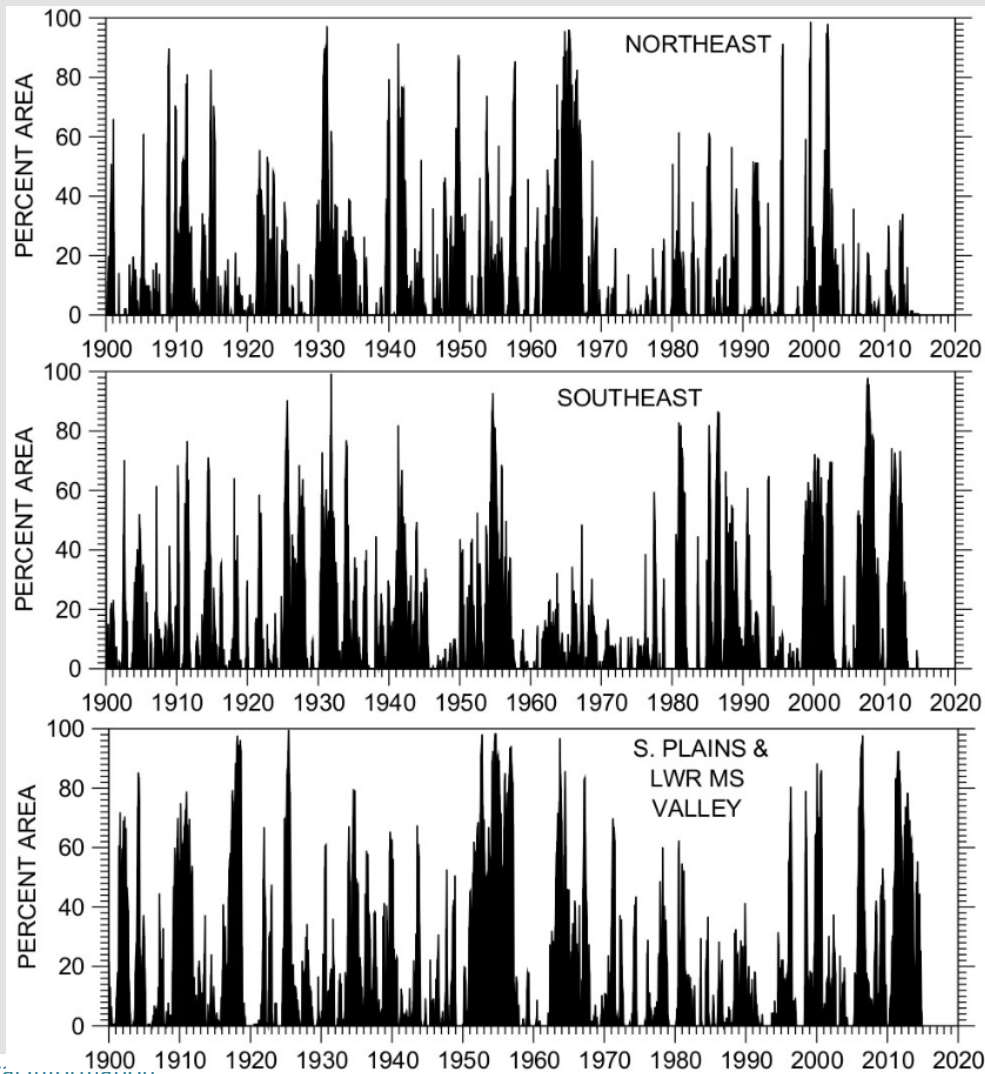
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U.S. Drought Episodes, 1900-2014

Percent Area in Drought Based on the Palmer Drought Index

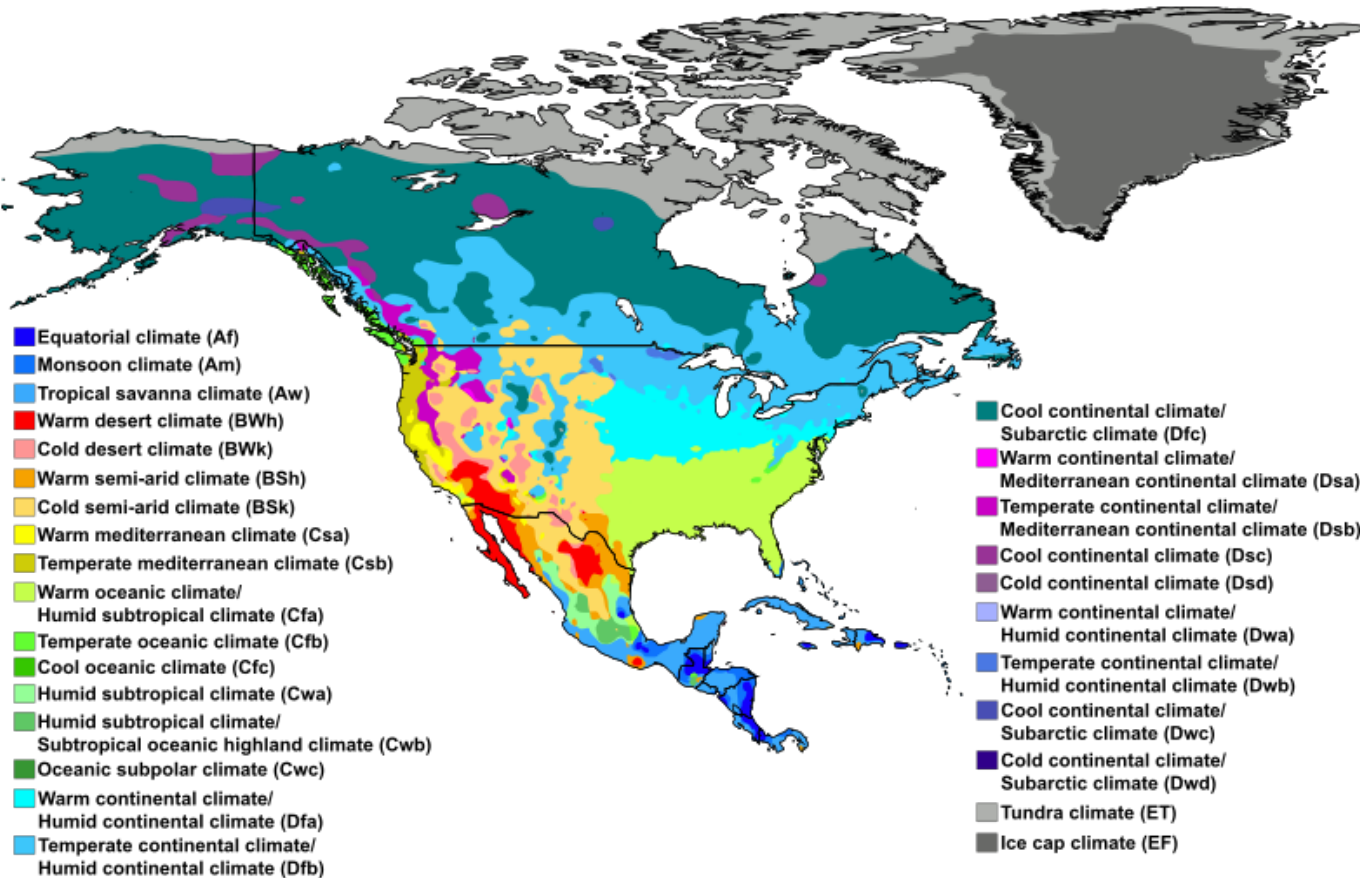
Heim, Jr., R.R., 2017: A Comparison of the Early 21st Century Drought in the USA to the 1930s and 1950s Drought Episodes. *BAMS.*, **98**, 2579–2592.

<http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-16-0080.1>



Are Drought Indices Appropriate Across All Climate Types?

North America map of Köppen climate classification



Factors to be considered:

- Hydrology (Streamflow & Groundwater)
- Soil Moisture Climatology & State (Frozen) of Soil
- Evapotranspiration
- Precipitation Amount, Type, & Seasonality

CEC Project Objective 1 engaged users on what indices they use across different climate types.



Thank You!

- Richard Heim
 - Richard.Heim@noaa.gov

NADM Survey – <https://survey.zohopublic.com/zs/ePCsdL>

