Danger Season 2025 microsite methodology

Updated May 2025

Description

The Danger Season 2025 web feature integrates daily National Weather Service alerts, population and social disadvantage data, Climate Central's Climate Shift Index (CSI), and EPA/AirNow´s Air Quality Index (AQI) into maps and a webpage (https://dangerseason.ucs.org/). Our intent is to provide the public with up-to-date information on how climate change has turned the months between May and October into "Danger Season"—a period when extreme weather events in the United States and its territories have not only become more common and damaging, but also are more likely to overlap. The Danger Season webpage is in both English and Spanish.

We show counties or county equivalents currently under extreme weather alerts or experiencing bad air quality. In addition, we provide four key indicators that are updated daily:

1. Total number of people facing alerts
2. Percent of disadvantaged people facing alerts since the start of Danger Season
3. Percent of people who have faced at least one alert since the start of Danger Season
4. Percentage of extreme heat alerts attributable to climate change since the start of Danger Season

Our maps and NWS alert data cover the contiguous United States, as well as Alaska, Hawai'i, Puerto Rico, and the United States Virgin Islands.

Data & Data Pre-processing

We pre-processed multiple datasets and aggregated all data to counties and *municipios* (the county equivalent in Puerto Rico). After doing this, we developed four Danger Season indicators.

National Weather Service (NWS) Alerts

We obtain NWS alerts as polygons in shapefile format from the Iowa State University's Iowa Environmental Mesonet (NWS 2023). Every day at 5:30AM Eastern Time, we download and process this shapefile to extract the following alerts based on the attribute table's PHENOM data column, which we refer to as "Danger Season alerts":

- CF (Coastal Flood)
- FA or FL (Flood)
- FF (Flash Flood)
- LS (Lakeshore Flood)
- HU (Hurricane)
- SR (Storm)
- SS (Storm Surge)
- TI (Inland Tropical Storm)
- EH (Excessive Heat)
- HT (Heat)

- XH (Extreme Heat)
- FW (Fire Weather)

NWS alerts are issued by Weather Forecasting Offices (WFOs) and often overlap multiple counties. To determine which alerts affect counties, we assign an alert to a county if that county's geographical center (i.e., centroid) is located within the polygon for that alert.

Population and social disadvantage data

We integrate county-level population data from the American Community Survey 5-Year Data for 2019 (US Census Bureau 2019). In addition, we integrate data from the Climate & Economic Justice Screening Tool, beta version (CEJST 2021). CEJST data contain a binary variable indicating a Census Tract's designation as a disadvantaged or non-disadvantaged community based on scores in "categories of burdens" comprised of multiple indicators covering climate change, energy burden, health, housing, pollution, transportation, water/wastewater, and workforce development. CEJST data include the contiguous United States (CONUS) as well as Alaska, Hawaii, Puerto Rico and the United States Virgin Islands.

Climate Central's Climate Shift Index (CSI)

We query Climate Central's CSI Application Programming Interface (Climate Central n.d.) process to obtain, daily, CSI values for daily maximum high temperatures between May 1, 2025 and the current day up until October 31, 2025 (the end of Danger Season). We subset only CSI values indicating a moderate, strong, very strong, extreme, or exceptional influence of climate change in making temperatures more likely (i.e., CSI values >=1). CSI data returned by this query are provided for NOAA climate divisions (NOAA 2023) covering CONUS and do not include Alaska, Hawaii, Puerto Rico or the United States Virgin Islands. We assign the CSI value to each county based on the climate division in which the county's geographical center is located.

Air Quality Index (AQI)

We integrate AirNow's NowCast AQI for small particulates (PM2.5, AirNow 2025). These data are provided in georefenced raster format. Every day at 5:30AM Eastern Time, we download the current raster file and calculate the mean AQI for all pixels in each county. We assign an indicator of unhealthy air quality to a county if that county's mean AQI equals or exceeds 100 (Unhealthy for Sensitive Groups), a value that corresponds to the National Ambient Air Quality Standards' (NAAQS) 24-hour standard of 35 $\mu g/m^3$. Thus, we consider counties with Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, or Hazardous AQIs as having dangerous air quality (see the categories at https://www.airnow.gov/aqi/aqi-basics/).

Due to gaps in AQI data, we are unable to provide air quality data for Alaska, Hawaii, Puerto Rico, the United States Virgin Islands, and 134 counties in the contiguous United States (see Appendix A for the full list of counties and county equivalents for which no AQI data are available).

Calculation of Danger Season indicators

Total number of people facing alerts

To estimate the total number of people in the United States currently facing NWS alerts, we subset all counties with current alerts and sum the total population in each county.

Percent of disadvantaged people facing alerts since the start of Danger Season

We aggregated Census Tract-level CEJST data by subsetting Census Tracts identified as disadvantaged in counties with active alerts and summing the total 2019 population. We then calculate the percent that this population represents out of the total US population.

Percent of people who have faced at least one alert since the start of Danger Season

To estimate this indicator, we subset all counties in the US with a current NWS alert of any and a CSI value indicating a moderate, strong, very strong, extreme, or exceptional influence of climate change in making temperatures more likely (i.e., CSI values >=1). We then calculate the percent that this number of counties represents out of all counties in CONUS.

Percentage of extreme heat alerts attributable to climate change since the start of Danger Season

To estimate this indicator, we subset all counties in CONUS with a current heat alert and a CSI value indicating a moderate, strong, very strong, extreme, or exceptional influence of climate change in making temperatures more likely (i.e., CSI values >=1). We then calculate the percent that this number of counties represents out of all counties in CONUS.

References

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Iowa Environmental Mesonet, 2025. Archived NWS Watch, Warnings, Advisories. https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml

National Oceanographic & Atmospheric Administration.n.d. U.S. Climate Divisions. nClimDiv Dataset. https://www.ncei.noaa.gov/access/monitoring/dyk/us-climate-divisions

US Census Bureau. 2019. American Community Survey 5-Year Data (2017-2021). https://www.census.gov/data/developers/data-sets/acs-5year.2019.html#list-tab-1036221584

White House Council on Environmental Quality. 2022. Climate and Economic Justice Screening Tool beta version. https://edgi-govdata-archiving.github.io/j40-cejst-2/en/#3/33.47/-97.5

In addition, we used the following R libraries for data processing:

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———. *Stringr: Simple, Consistent Wrappers for Common String Operations*, 2023. https://CRAN.R-project.org/package=stringr.

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Wickham, Hadley, and Lionel Henry. *Purrr: Functional Programming Tools*, 2023. https://CRAN.R-project.org/package=purrr.

Wickham, Hadley, Davis Vaughan, and Maximilian Girlich. *Tidyr: Tidy Messy Data*, 2023. https://CRAN.R-project.org/package=tidyr.

Appendix A: Counties and county equivalents without available AQI data

Aleutians East Borough, AK
Aleutians West Census Area, AK
Anchorage Municipality, AK
Bethel Census Area, AK
Bristol Bay Borough, AK
Denali Borough, AK
Dillingham Census Area, AK
Fairbanks North Star Borough, AK
Haines Borough, AK
Hoonah-Angoon Census Area, AK
Juneau City and Borough, AK
Kenai Peninsula Borough, AK
Ketchikan Gateway Borough, AK
Kodiak Island Borough, AK
Kusilvak Census Area, AK
Lake and Peninsula Borough, AK
Matanuska-Susitna Borough, AK
Nome Census Area, AK
North Slope Borough, AK
Northwest Arctic Borough, AK
Petersburg Borough, AK
Prince of Wales-Hyder Census Area, AK
Sitka City and Borough, AK
Skagway Municipality, AK
Southeast Fairbanks Census Area, AK
Valdez-Cordova Census Area, AK
Wrangell City and Borough, AK
Yakutat City and Borough, AK
Yukon-Koyukuk Census Area, AK
Apache County, AZ
Cochise County, AZ
Coconino County, AZ
Gila County, AZ
Graham County, AZ
Greenlee County, AZ
Navajo County, AZ
Sedgwick County, CO
Hawaii County, HI
Honolulu County, HI
Kalawao County, HI
Kauai County, HI
Maui County, HI
Owyhee County, ID

Kittson County, MN
Lake of the Woods County, MN
Marshall County, MN
Roseau County, MN
Arthur County, NE
Blaine County, NE
Boyd County, NE
Brown County, NE
Cherry County, NE
Custer County, NE
Dawson County, NE
Deuel County, NE
Frontier County, NE
Garden County, NE
Garfield County, NE
Grant County, NE
Hayes County, NE
Holt County, NE
Hooker County, NE
Keith County, NE
Keya Paha County, NE
Lincoln County, NE
Logan County, NE
Loup County, NE
McPherson County, NE
Perkins County, NE
Rock County, NE
Thomas County, NE
Churchill County, NV
Elko County, NV
Eureka County, NV
Humboldt County, NV
Lander County, NV
Lincoln County, NV
Mineral County, NV
Nye County, NV
Pershing County, NV
White Pine County, NV
Catron County, NM
Chaves County, NM
Cibola County, NM
Curry County, NM
De Baca County, NM
Eddy County, NM
Grant County, NM

Guadalupe County, NM
Harding County, NM
Hidalgo County, NM
Lincoln County, NM
Luna County, NM
McKinley County, NM
Otero County, NM
Quay County, NM
Roosevelt County, NM
San Juan County, NM
San Miguel County, NM
Sierra County, NM
Socorro County, NM
Torrance County, NM
Union County, NM
Dare County, NC
Hyde County, NC
Benson County, ND
Cavalier County, ND
Eddy County, ND
Foster County, ND
Grand Forks County, ND
Griggs County, ND
Nelson County, ND
Pembina County, ND
Ramsey County, ND
Stutsman County, ND
Towner County, ND
Walsh County, ND
Wells County, ND
Harney County, OR
Malheur County, OR
Charles Mix County, SD
Gregory County, SD
Tripp County, SD
Baylor County, TX
Brown County, TX
Callahan County, TX
Coke County, TX
Coleman County, TX
Concho County, TX
Cottle County, TX
Crockett County, TX
Culberson County, TX
Eastland County, TX

Edwards County, TX
Fisher County, TX
Foard County, TX
Haskell County, TX
Hudspeth County, TX
Irion County, TX
Jeff Davis County, TX
Jones County, TX
Kimble County, TX
King County, TX
Knox County, TX
McCulloch County, TX
Menard County, TX
Mitchell County, TX
Nolan County, TX
Presidio County, TX
Reeves County, TX
Runnels County, TX
Schleicher County, TX
Scurry County, TX
Shackelford County, TX
Stephens County, TX
Sterling County, TX
Stonewall County, TX
Sutton County, TX
Taylor County, TX
Throckmorton County, TX
Tom Green County, TX
Val Verde County, TX
Garfield County, UT
Juab County, UT
Kane County, UT
Millard County, UT
San Juan County, UT
Tooele County, UT
Adjuntas Municipio, PR
Aguada Municipio, PR
Aguadilla Municipio, PR
Aguas Buenas Municipio, PR
Aibonito Municipio, PR
Añasco Municipio, PR
Arecibo Municipio, PR
Arroyo Municipio, PR
Barceloneta Municipio, PR
Barranquitas Municipio, PR

Bayamón Municipio, PR
Cabo Rojo Municipio, PR
Caguas Municipio, PR
Camuy Municipio, PR
Canóvanas Municipio, PR
Carolina Municipio, PR
Cataño Municipio, PR
Cayey Municipio, PR
Ceiba Municipio, PR
Ciales Municipio, PR
Cidra Municipio, PR
Coamo Municipio, PR
Comerío Municipio, PR
Corozal Municipio, PR
Culebra Municipio, PR
Dorado Municipio, PR
Fajardo Municipio, PR
Florida Municipio, PR
Guánica Municipio, PR
Guayama Municipio, PR
Guayanilla Municipio, PR
Guaynabo Municipio, PR
Gurabo Municipio, PR
Hatillo Municipio, PR
Hormigueros Municipio, PR
Humacao Municipio, PR
Isabela Municipio, PR
Jayuya Municipio, PR
Juana Díaz Municipio, PR
Juncos Municipio, PR
Lajas Municipio, PR
Lares Municipio, PR
Las Marías Municipio, PR
Las Piedras Municipio, PR
Loíza Municipio, PR
Luquillo Municipio, PR
Manatí Municipio, PR
Maricao Municipio, PR
Maunabo Municipio, PR
Mayagüez Municipio, PR
Moca Municipio, PR
Morovis Municipio, PR
Naguabo Municipio, PR
Naranjito Municipio, PR
Orocovis Municipio, PR

Patillas Municipio, PR
Peñuelas Municipio, PR
Ponce Municipio, PR
Quebradillas Municipio, PR
Rincón Municipio, PR
Río Grande Municipio, PR
Sabana Grande Municipio, PR
Salinas Municipio, PR
San Germán Municipio, PR
San Juan Municipio, PR
San Lorenzo Municipio, PR
San Sebastián Municipio, PR
Santa Isabel Municipio, PR
Toa Alta Municipio, PR
Toa Baja Municipio, PR
Trujillo Alto Municipio, PR
Utuado Municipio, PR
Vega Alta Municipio, PR
Vega Baja Municipio, PR
Vieques Municipio, PR
Villalba Municipio, PR
Yabucoa Municipio, PR
Yauco Municipio, PR
St. Croix Island, VI
St. John Island, VI
St. Thomas Island, VI