Climate-Related Hazards Damage SHELDUS data

Data Source:

SPATIAL HAZARD EVENTS AND LOSSES DATABASE FOR THE UNITED STATES (SHELDUS) Version 23.0

https://sheldus.asu.edu/

Downloaded: July 3, 2025

Key Variables:

- cropdmg: Direct damage to crops in nominal U.S. dollars.
- cropdmg_adj: Direct damage to crops in adjusted 2023 U.S. dollars.
- CropDmgPerCapita: Crop damage per capita, adjusted to the most recent SHELDUS inflation base year.
- propertydmg: Direct damage to property in nominal U.S. dollars (no decimals).
- propertydmg_adj: Direct damage to property in adjusted 2023 U.S. dollars (two decimal places).
- PropertyDmgPerCapita: Property damage per capita, adjusted to the most recent SHELDUS inflation base year.
- duration_days: Duration of the event in days (integer).

Hazard Categories (18 total):

1. Avalanche
2. Coastal
3. Drought
4. Earthquake
5. Flood
6. Fog
7. Hail
8. Heat
9. Hurricane/Tropical Storm
10. Landslide
11. Lightning
12. Severe Thunderstorm
13. Tornado
14. Tsunami/Seiche
15. Volcano
16. Wildfire
17. Wind
18. Winter Weather Load Libraries and Data

```
library(tidyverse)
library(here)
library(gt)
library(scales)

# Load and clean SHELDUS data
sheldus <- read_csv(here("data", "direct_loss_aggregated_output_5008.csv"))
names(sheldus) <- tolower(names(sheldus))

sheldus_clean <- sheldus %>%
  rename(
    state = statename,
    cropdmg_adj = `cropdmg(adj 2023)`,
    propertydmg_adj = `propertydmg(adj 2023)`
  ) %>%
  select(state, year, hazard, cropdmg = cropdmg_adj, propertydmg = propertydmg_adj)
```

Summary Statistics

Annual Damage Summary

```
summary_by_year <- sheldus_clean %>%
  group_by(year) %>%
  summarize(
    total_property_dmg = sum(propertydmg, na.rm = TRUE),
    total_crop_dmg = sum(cropdmg, na.rm = TRUE),
    .groups = "drop"
  )

summary_by_year |>
  mutate(
    total_property_dmg = total_property_dmg / 1e6,
    total_crop_dmg = total_crop_dmg / 1e6
  ) |>
  gt() |>
  tab_header(title = "Annual Direct Damage Summary (Adjusted to 2023 Dollars)") |>
  fmt_currency(columns = starts_with("total"), currency = "USD") |>
  cols_label(
    total_property_dmg = "Total Property Damage (million)",
    total_crop_dmg = "Total Crop Damage (million)"
  )
```

Damage by State

```
summary_by_state <- sheldus_clean %>%
  group_by(state) %>%
  summarize(
    total_property_dmg = sum(propertydmg, na.rm = TRUE),
    total_crop_dmg = sum(cropdmg, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  arrange(desc(total_property_dmg))

summary_by_state |>
  mutate(
    total_property_dmg = total_property_dmg / 1e6,
```

Annual Direct Damage Summary (Adjusted to 2023 Dollars)

year	Total Property Damage (million)	Total Crop Damage (million)
2000	$9,919.50	$5,817.19
2001	$22,510.80	$2,755.44
2002	$6,781.59	$2,094.61
2003	$17,354.38	$1,866.75
2004	$40,425.09	$2,189.22
2005	$149,046.27	$6,164.08
2006	$10,656.68	$5,124.74
2007	$10,689.08	$7,090.95
2008	$37,893.56	$4,813.12
2009	$8,093.02	$934.26
2010	$13,921.90	$3,384.90
2011	$31,204.97	$4,405.15
2012	$43,014.49	$8,070.91
2013	$11,876.21	$5,661.41
2014	$7,998.84	$4,670.56
2015	$5,606.35	$800.62
2016	$22,632.70	$299.36
2017	$100,313.59	$2,309.18
2018	$39,106.44	$6,158.66
2019	$19,529.16	$1,632.49
2020	$31,023.41	$583.50
2021	$19,921.82	$915.90
2022	$22,284.20	$1,085.60
2023	$16,631.10	$1,092.73

```
    total_crop_dmg = total_crop_dmg / 1e6
  ) |>
  gt() |>
  tab_header(title = "Total Damage by State (Adjusted to 2023 Dollars)") |>
  fmt_currency(columns = starts_with("total"), currency = "USD") |>
  cols_label(
    total_property_dmg = "Total Property Damage (million)",
    total_crop_dmg = "Total Crop Damage (million)"
  )
```

Damage by Hazard Type

```
summary_by_hazard <- sheldus_clean %>%
  group_by(hazard) %>%
  summarize(
    total_property_dmg = sum(propertydmg, na.rm = TRUE),
    total_crop_dmg = sum(cropdmg, na.rm = TRUE),
    .groups = "drop"
  ) %>%
  arrange(desc(total_property_dmg))

summary_by_hazard |>
  mutate(
    total_property_dmg = total_property_dmg / 1e6,
    total_crop_dmg = total_crop_dmg / 1e6
  ) |>
  gt() |>
  tab_header(title = "Total Damage by Hazard Type (Adjusted to 2023 Dollars)") |>
  fmt_currency(columns = starts_with("total"), currency = "USD") |>
  cols_label(
    total_property_dmg = "Total Property Damage (million)",
    total_crop_dmg = "Total Crop Damage (million)"
  )
```

Climate-Related Hazard Focus

Damage Trends: Most Climate-Related Hazards, including “Drought”, “Flood”, “Heat”, “Hurricane/Tropical Storm”, “Wildfire”, “Coastal”

Total Damage by State (Adjusted to 2023 Dollars)

state	Total Property Damage (million)
TEXAS	$132,000.92
LOUISIANA	$130,601.72
FLORIDA	$85,349.94
CALIFORNIA	$52,999.60
MISSISSIPPI	$45,057.24
NEW JERSEY	$35,611.89
PUERTO RICO	$26,343.10
ALABAMA	$14,931.64
TENNESSEE	$11,000.95
MISSOURI	$10,994.86
COLORADO	$9,960.99
OKLAHOMA	$9,373.65
WASHINGTON	$9,161.63
OHIO	$8,633.29
NORTH CAROLINA	$8,242.54
MICHIGAN	$6,849.81
ARKANSAS	$6,381.35
ILLINOIS	$6,143.43
NEW YORK	$6,130.04
HAWAII	$6,091.89
GEORGIA	$5,609.90
IOWA	$5,485.61
ARIZONA	$5,443.74
OREGON	$4,921.02
GUAM	$4,250.22
NEBRASKA	$4,230.67
PENNSYLVANIA	$3,966.31
NEW MEXICO	$3,898.89
WISCONSIN	$3,872.33
KANSAS	$3,812.52
MINNESOTA	$3,432.67
KENTUCKY	$2,939.95
INDIANA	$2,866.21
VIRGINIA	$2,710.18
VERMONT	$2,160.55
NORTH DAKOTA	$2,004.93
MARYLAND	$1,827.91
WEST VIRGINIA	$1,564.19
DISTRICT OF COLUMBIA	$1,505.17
UTAH	$1,384.29
SOUTH CAROLINA	$1,312.36
IDAHO	$1,138.97
MASSACHUSETTS	$1,122.63
SOUTH DAKOTA	$880.26
ALASKA	$781.13
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS	$645.60
NEVADA	$503.96

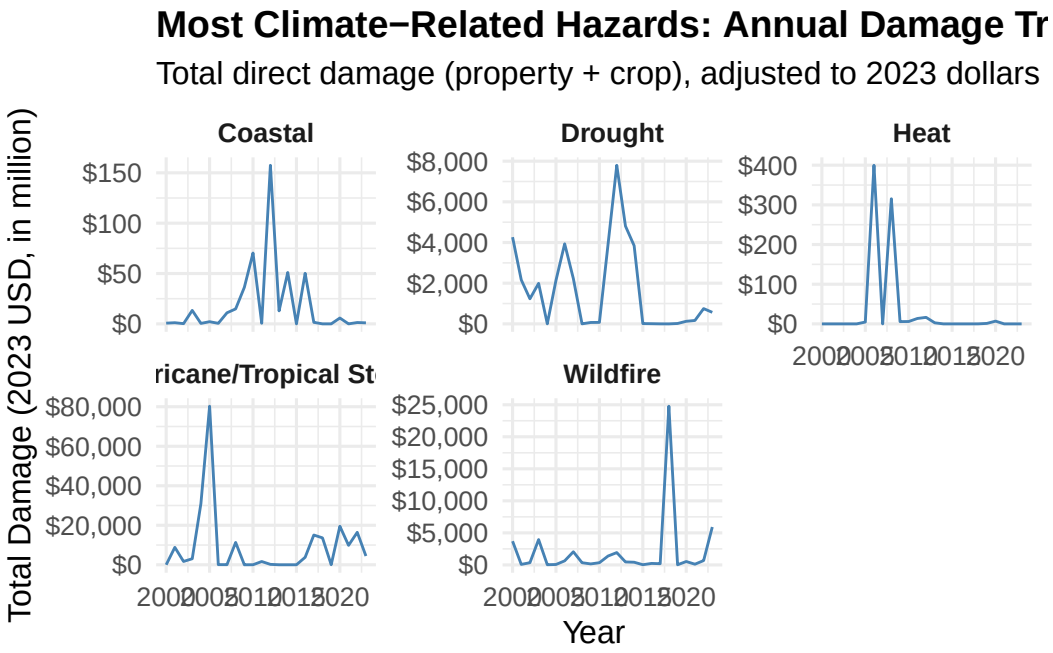
Total Damage by Hazard Type (Adjusted to 2023 Dollars)

hazard	Total Property Damage (million)	Total Crop Damage (million)
Flooding	$278,109.33	$11,921.20
Hurricane/Tropical Storm	$208,123.52	$12,746.90
Wildfire	$47,771.32	$543.11
Tornado	$46,648.56	$462.14
Hail	$38,764.72	$4,149.43
Wind	$27,403.43	$2,540.72
Earthquake	$20,578.82	$0.00
Winter Weather	$15,434.16	$8,274.82
Severe Storm/Thunder Storm	$6,541.55	$1,642.13
Landslide	$3,845.13	$29.92
Drought	$3,298.01	$36,837.79
Lightning	$1,243.52	$7.19
Coastal	$432.07	$1.22
Tsunami/Seiche	$103.82	$0.00
Fog	$62.98	$0.00
Heat	$41.35	$730.90
Volcano	$19.36	$33.89
Avalanche	$13.48	$0.00

```r
most_climate_related_hazards <- c(
  "Drought",
  "Flood",
  "Heat",
  "Hurricane/Tropical Storm",
  "Wildfire",
  "Coastal"
)

plot_top_hazards <- sheldus_clean %>%
  filter(hazard %in% most_climate_related_hazards) %>%
  mutate(total_dmg = propertydmg + cropdmg) %>%
  mutate(total_dmg = total_dmg / 1e6) %>%
  group_by(year, hazard) %>%
  summarize(total_dmg = sum(total_dmg, na.rm = TRUE), .groups = "drop") %>%
  ggplot(aes(x = year, y = total_dmg)) +
  geom_line(color = "steelblue") +
  facet_wrap(~ hazard, scales = "free_y") +
  scale_y_continuous(labels = label_dollar()) +
  labs(
    title = "Most Climate-Related Hazards: Annual Damage Trends",
    subtitle = "Total direct damage (property + crop), adjusted to 2023 dollars",
    x = "Year",
    y = "Total Damage (2023 USD, in million)"
  ) +
  theme_minimal(base_size = 12) +
  theme(
    strip.text = element_text(face = "bold"),
    plot.title = element_text(face = "bold")
  )

plot_top_hazards
```



Data ready for merge

```
sheldus_formerge <- sheldus |>
  select(
    statename,
    year,
    hazard,
    cropdmg,
    "cropdmg(adj 2023)",
    cropdmgpercapita,
    propertydmg,
    "propertydmg(adj 2023)",
    propertydmgpercapita,
    duration_days
  ) |>
  rename(
    cropdmg_adj = "cropdmg(adj 2023)",
    propertydmg_adj = "propertydmg(adj 2023)",
    state = statename
  )
```

```
summary(sheldus_formerge)
```

```
    state                year         hazard             cropdmg
 Length:9563        Min.   :2000   Length:9563        Min.   :0.000e+00
 Class :character   1st Qu.:2006   Class :character   1st Qu.:0.000e+00
 Mode  :character   Median :2011   Mode  :character   Median :0.000e+00
                    Mean   :2011                      Mean   :6.048e+06
                    3rd Qu.:2017                      3rd Qu.:3.000e+03
                    Max.   :2023                      Max.   :3.000e+09

  cropdmg_adj        cropdmgpercapita     propertydmg
 Min.   :0.000e+00   Min.   :     0.00   Min.   :0.000e+00
 1st Qu.:0.000e+00   1st Qu.:     0.00   1st Qu.:3.100e+04
 Median :0.000e+00   Median :     0.00   Median :5.592e+05
 Mean   :8.357e+06   Mean   :   649.40   Mean   :5.459e+07
 3rd Qu.:3.696e+03   3rd Qu.:     0.06   3rd Qu.:3.537e+06
 Max.   :3.815e+09   Max.   :525557.64   Max.   :4.411e+10
                     NA's   :35
 propertydmg_adj     propertydmgpercapita duration_days
 Min.   :0.000e+00   Min.   :     0.00    Min.   :  1.000
 1st Qu.:4.210e+04   1st Qu.:     0.54    1st Qu.:  1.000
 Median :7.510e+05   Median :    16.26    Median :  1.000
 Mean   :7.304e+07   Mean   :  1240.41    Mean   :  2.985
 3rd Qu.:4.942e+06   3rd Qu.:   133.10    3rd Qu.:  2.000
 Max.   :5.324e+10   Max.   :829879.70    Max.   :351.000
                     NA's   :35
```

Descriptive Statistics

```
library(psych)

describe(sheldus_formerge |> select(-state, -year, -hazard))
```

```
                    vars    n        mean           sd    median    trimmed
cropdmg                1 9563  6048100.34 7.905309e+07      0.00   17319.04
cropdmg_adj            2 9563  8357352.75 1.062094e+08      0.00   23703.55
cropdmgpercapita       3 9528      649.40 1.038799e+04      0.00       0.95
propertydmg            4 9563 54585404.69 8.308901e+08 559250.00 2172119.32
propertydmg_adj        5 9563 73035148.93 1.110126e+09 751000.00 2960802.99
```

```
propertydmgpercapita    6 9528     1240.41 1.729825e+04     16.26      83.46
duration_days           7 9563        2.99 7.340000e+00      1.00       1.54
                          mad min          max        range  skew kurtosis
cropdmg                   0.0   0 3.000000e+09 3.000000e+09 24.92   753.15
cropdmg_adj               0.0   0 3.815137e+09 3.815137e+09 23.52   667.98
cropdmgpercapita          0.0   0 5.255576e+05 5.255576e+05 31.41  1194.07
propertydmg          829144.1   0 4.410998e+10 4.410998e+10 31.73  1265.27
propertydmg_adj     1113432.6   0 5.323977e+10 5.323977e+10 31.13  1177.35
propertydmgpercapita     24.1   0 8.298797e+05 8.298797e+05 33.55  1336.44
duration_days             0.0   1 3.510000e+02 3.500000e+02 23.85  1058.89
                             se
cropdmg                808391.60
cropdmg_adj           1086090.26
cropdmgpercapita          106.42
propertydmg           8496625.90
propertydmg_adj      11352075.88
propertydmgpercapita      177.22
duration_days               0.08
```