

A GEOGRAPHIC ASSESSMENT OF MAJOR DISASTER DECLARATIONS ACROSS THE LOWER 48 STATES

*A summary report produced by the
Southern Climate Impacts Planning Program (SCIPP)*

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March 2011



This publication is issued by the Southern Climate Impacts Planning Program as authorized by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration Cooperative Agreement, NA080AR4320886. Copies have not been printed but are available through the SCIPP website at www.southernclimate.org.

OVERVIEW

The Federal Emergency Management Agency (FEMA) maintains a historical archive of major disaster declarations dating back to 1953. This archive documents a variety of details for each declaration including the date, location, incident type, and a description of the event. From 1953 through the end of 2009, a total of 1,764 separate disasters were declared across the 50 states. Each of these declarations played a critical role in the recovery process by providing affected areas with much-needed federal assistance to recover from a major event. Furthermore, funds also supported mitigation activities to reduce the impacts of future disaster events.

The early portion of the disaster archive (1953-1963) contains limited location information with data available only at the state level. Beginning on December 24, 1964 disaster information is available on a county-level scale, which provides an improved level of detail regarding impacted areas. To make use of this detailed information, FEMA has produced several excellent Geographic Information Systems (GIS) maps illustrating the number of disasters declared in each county across the country during the full period of record as well as the most recent 10-year period (e.g., <http://www.gismaps.fema.gov/recent.pdf>). Such maps provide a wealth of information and illustrate areas most susceptible to disasters in the past.

Taking this mapping concept and applying it further, the Southern Climate Impacts Planning Program (SCIPP) has recently undertaken a GIS study to assess the past occurrence of disasters across the lower forty-eight contiguous states. The purpose of the study was to geographically assess weather-related disaster declarations in an effort to understand where specific hazards have occurred most frequently and when. Please note that this assessment is focused primarily on weather and climate-related hazards and is limited to hazards recorded by FEMA (i.e., drought is not included in the analysis).

Much of the remainder of this report is primarily graphical in nature, with a heavy emphasis on the map results found in the assessment. A brief discussion will follow the GIS imagery to provide an interpretation of the results.

ABOUT SCIPP

SCIPP is a member of the National Oceanic and Atmospheric Administration (NOAA) Regional Integrated Sciences and Assessments (RISA) program. Based at the University of Oklahoma and Louisiana State University, SCIPP conducts integrated physical and social science research across a large portion of the south central United States including Oklahoma, Texas, Arkansas, Louisiana, Tennessee, and Mississippi. SCIPP's research and engagement efforts are focused particularly in the areas of extreme weather events and multi-hazard planning. Additional interests include coastal planning, adaptation planning, and water resources planning.

SCIPP conducts a blend of physical and social science research to advance the scientific understanding of the south's climate – including climate variability and change. Particular emphasis is placed on the application of, use, and need for climate information by a variety of stakeholders. For more information about SCIPP please visit:

<http://www.southernclimate.org/>.



METHODS

The dataset used for this assessment was the “FEMA Disaster Declarations Summary” available from www.data.gov at the following URL (as of March 14, 2011): <http://www.data.gov/raw/1491>. A series of pre-processing steps were undertaken to get the data into a format needed to develop GIS maps. An initial processing step included assigning unique Federal Information Processing Standards (FIPS) county codes to each county name listed in the FEMA archive. Since a series of identical county names exist across the U.S. (i.e., Washington County, Jefferson County, Franklin County, etc.), this step was undertaken to establish a unique number for each county to prevent duplicate counts. Another critical pre-processing step involved tabulating counts for each U.S. county for a variety of variables including number of disasters for each month, each decade, and each type of hazard.

Tabulating counts of disasters by hazard type required further processing due to the way disaster types are recorded in the FEMA archive. The FEMA archive contains two specific columns of information pertaining to the type of disaster: an “Incident Type” and a more descriptive “Title” field. For example, here is a sampling of data for one disaster event in a particular county:

Disaster Number	State	Declaration Date	Incident Type	Title	Designated County
229	KS	July 18, 1967	Tornado	TORNADOES, SEVERE STORMS & FLOODING	Anderson

Table 1. Sample of data from the FEMA disaster dataset.

While the FEMA dataset includes an explicit definition of the “Incident Type” (i.e., “Tornado”) this single classification oftentimes does not completely classify a range of hazards that accompanied a single event (i.e., “TORNADOES, SEVERE STORMS & FLOODING”). Due to this limitation, pre-processing steps tabulated hazards using the information in the “Title” column to best capture the full range of hazards associated with an event. If a particular event had multiple hazards accompanying it, such as “SEVERE STORMS, MUDSLIDES & FLOODING,” the single disaster event would get counted once in each of those different categories. This method allowed a much more detailed breakdown of hazard types and pulled out critical details contained in the dataset. Each of these pre-processing steps was accomplished through the use of Perl scripting.

Table 2 shows the specific words used to tabulate each hazard type based on the disaster title field. The selection of the words was accomplished through a full review of the disaster archive to identify all key words used. In some instances misspelled words were identified (“SEVER STORMS”, etc.); every effort was made to account for these errors in the dataset.

Additional tabulations were done on a state basis to identify the frequency of disasters at the state scale. The statewide analysis was done using spreadsheet software. For all data analysis only major disaster declarations were included in frequency counts. Additional data in the archive such as emergency declarations, fire management assistance, and fire suppression authorization listings were not included.

Hazard Category	Matching Words in Disaster "Title" Field Could Contain:
Coastal Storm	COASTAL STORM
Fire	FIRE
Flooding	FLOOD, RAIN, SNOWMELT, or SNOW MELT
Freeze	FREEZE or FREEZING
Hurricane	HURRICANE or TROPICAL
Ice Jam	ICE JAM
Landslides	LAND or LANDSLIDE
Mudslides	MUD or MUDSLIDE
Severe Storms	SEVERE STORM, SEVERE WEATHER, SEVERE THUNDERSTORM, or SEVERE WX
Snowmelt	SNOWMELT or SNOW MELT
Tornado	TORNADO
Winter Storm	WINTER, SNOWFALL, SNOWSTORM, HEAVY SNOW, SNOW, BLIZZARD, SLEET, FREEZING RAIN, or ICE STORM (snowmelt was not included in the count)

Table 2. Text used to tabulate the different types of hazards. The left column denotes the hazard category, while the right column shows the text in the FEMA disaster "Title" field used to accumulate a single disaster count for that category. Only one of the words in the right column was needed per disaster event.

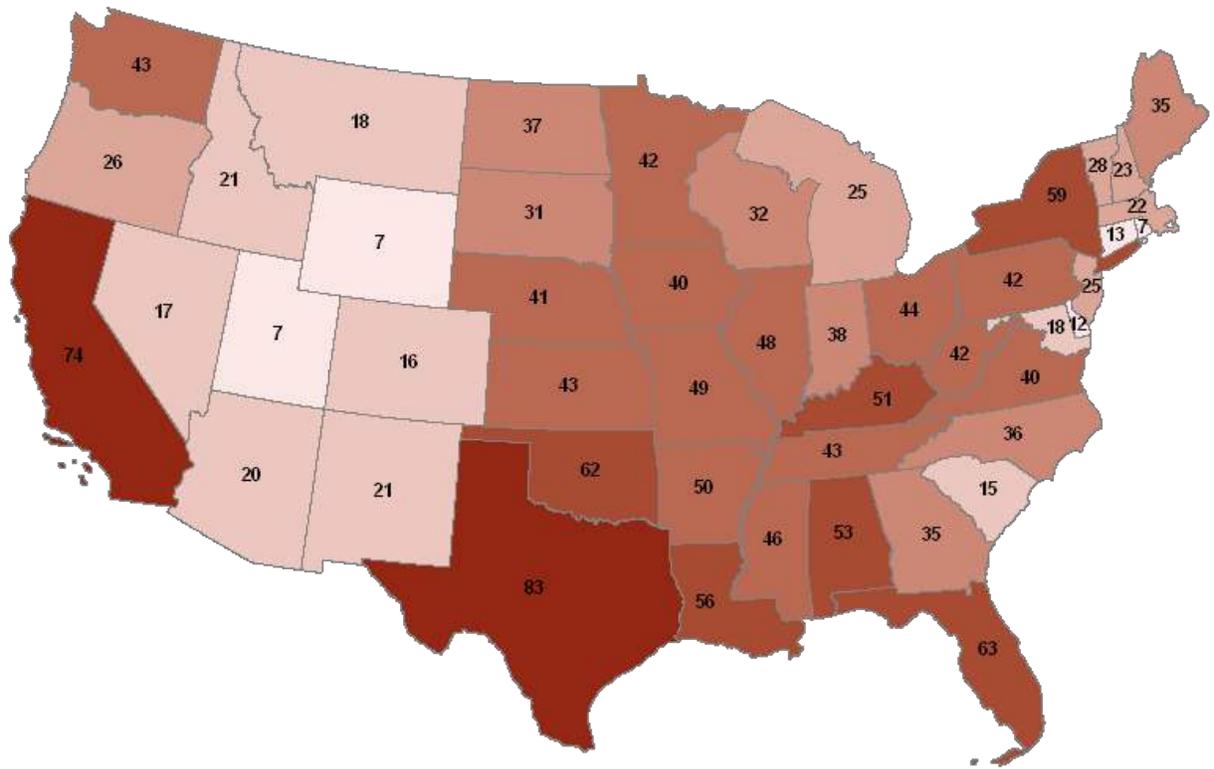
With pre-processing completed, the data was brought into GIS mapping software (ESRI's ArcGIS) to visualize the information in a variety of ways. The data were joined with a 2009 TIGER/Line county boundaries shapefile (obtained from: <http://www2.census.gov/cgi-bin/shapefiles2009/national-files>), which connected the myriad of disaster tabulations for each county to a map. On the state basis, the disaster tabulations were joined with a 2009 TIGER/LINE state boundaries shapefile (available at the same URL as above). Maps were then made by visualizing the particular tabulation (e.g., counts by month, by decade, by disaster type, etc). This involved the creation of more than 50 maps, many of which appear in this report.

RESULTS

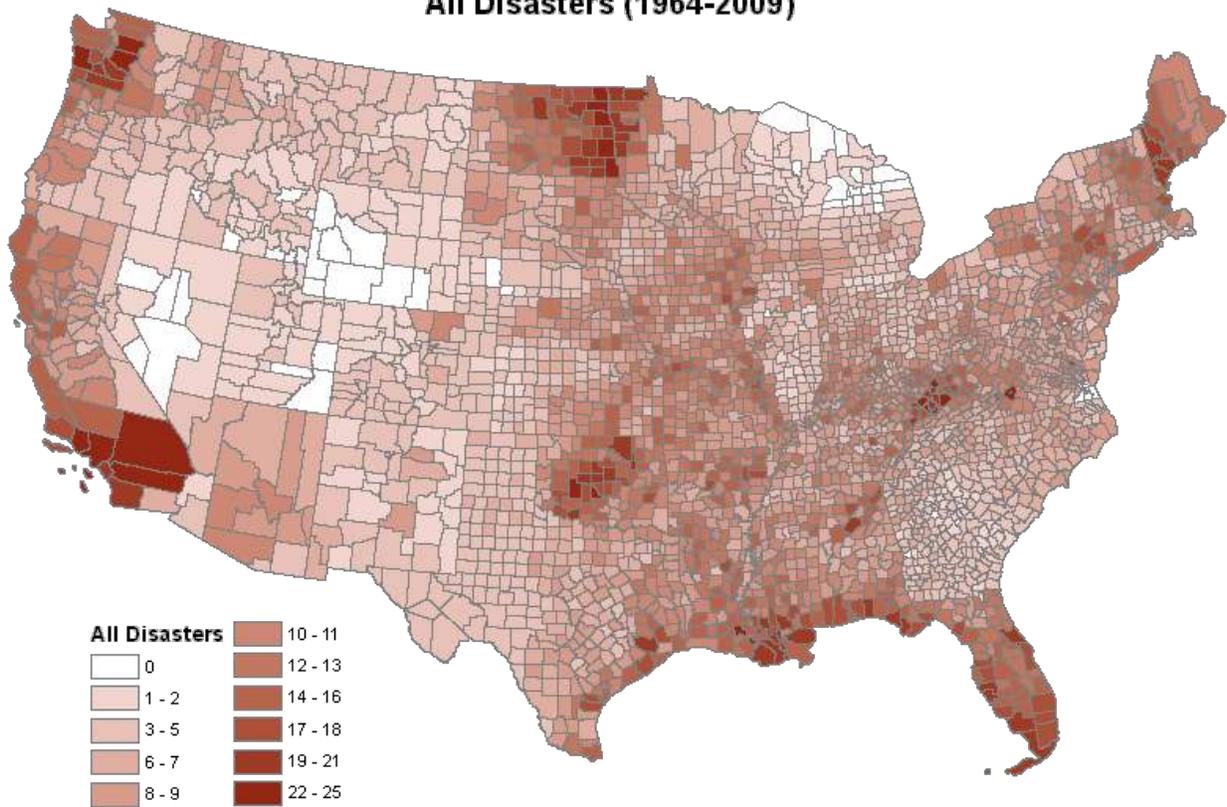
A series of GIS maps depicting many different aspects of the FEMA disaster archive is included in this section. Maps include depictions of **the number of:** All Disasters, Disasters by Hazard Type, Disasters by Decade, and Disasters by Month. The maps appearing in this section use a common color scheme to illustrate the number of disaster declarations at either the county or state-scale through varying shades of red. Light reds depict fewer disaster declarations, darker red colors are associated with more disasters, and white indicates zero disasters. County-scale maps include a legend at the bottom to define the colors while state-scale maps have no legends and include printed text over each state to denote the number of disaster declarations. All images have an associated title that details the contents of the map below it. Please note that state-based and county-based maps pull from different periods of record due to the absence of county-based disaster data prior to December 24, 1964. The period depicted in each map is denoted in parentheses.

ALL DISASTERS

All Disasters (1953-2009)

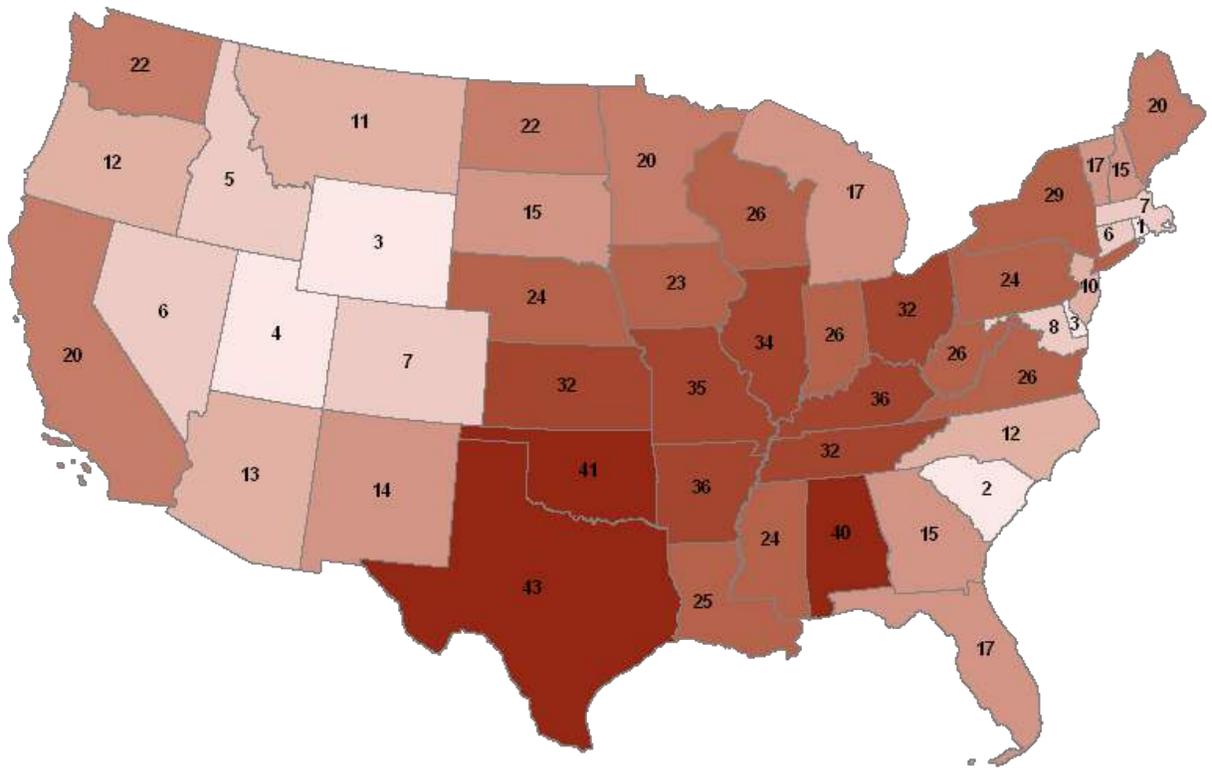


All Disasters (1964-2009)

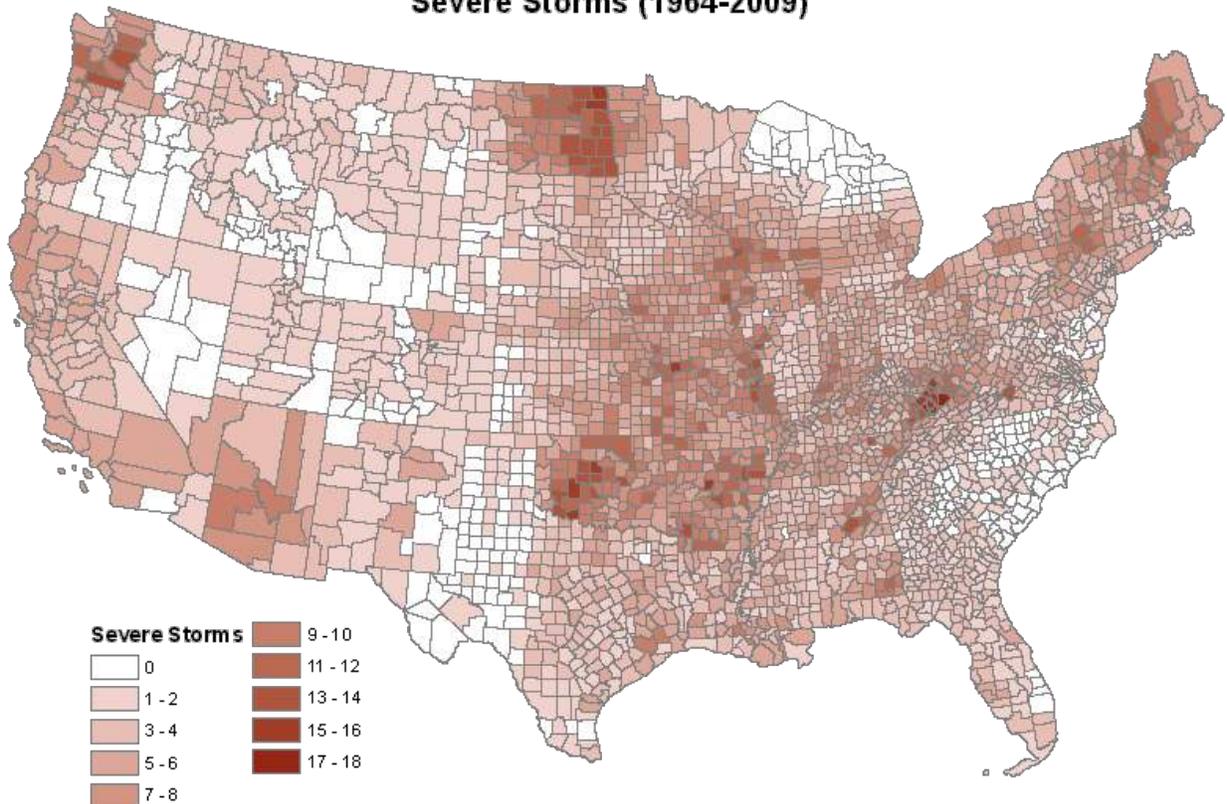


DISASTERS BY HAZARD TYPE

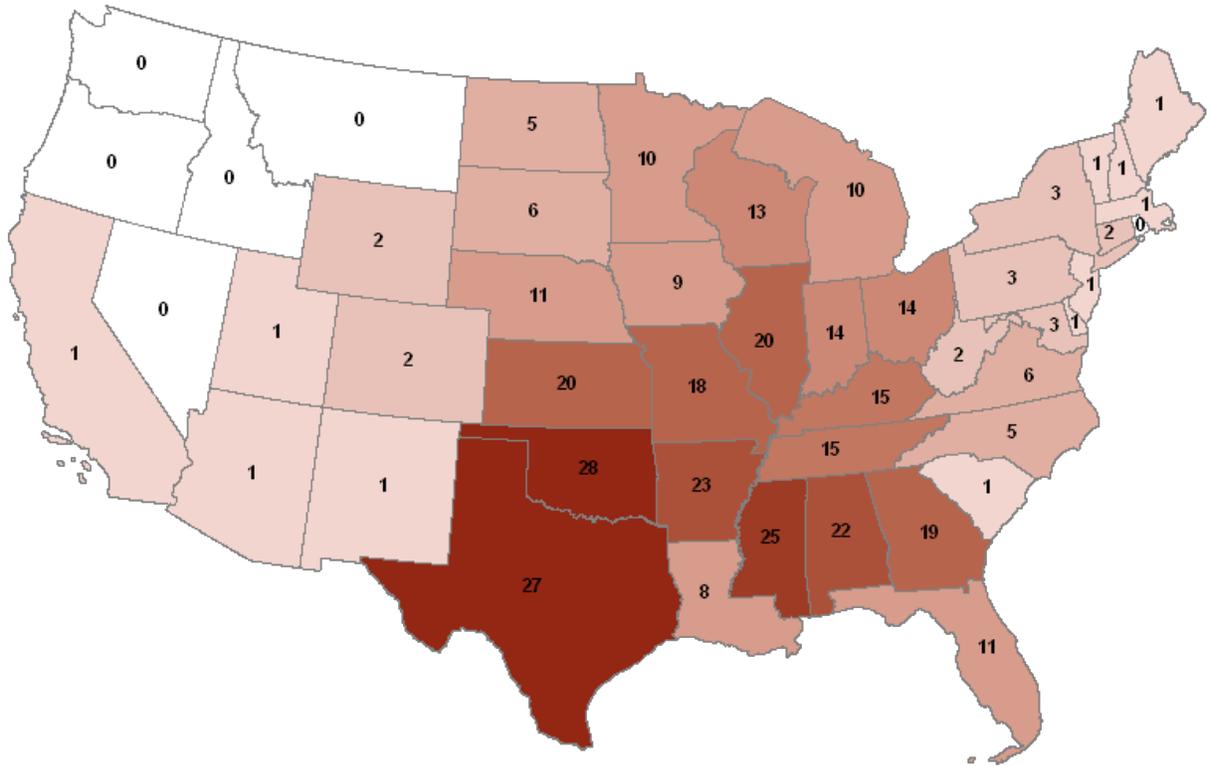
Severe Storms (1953-2009)



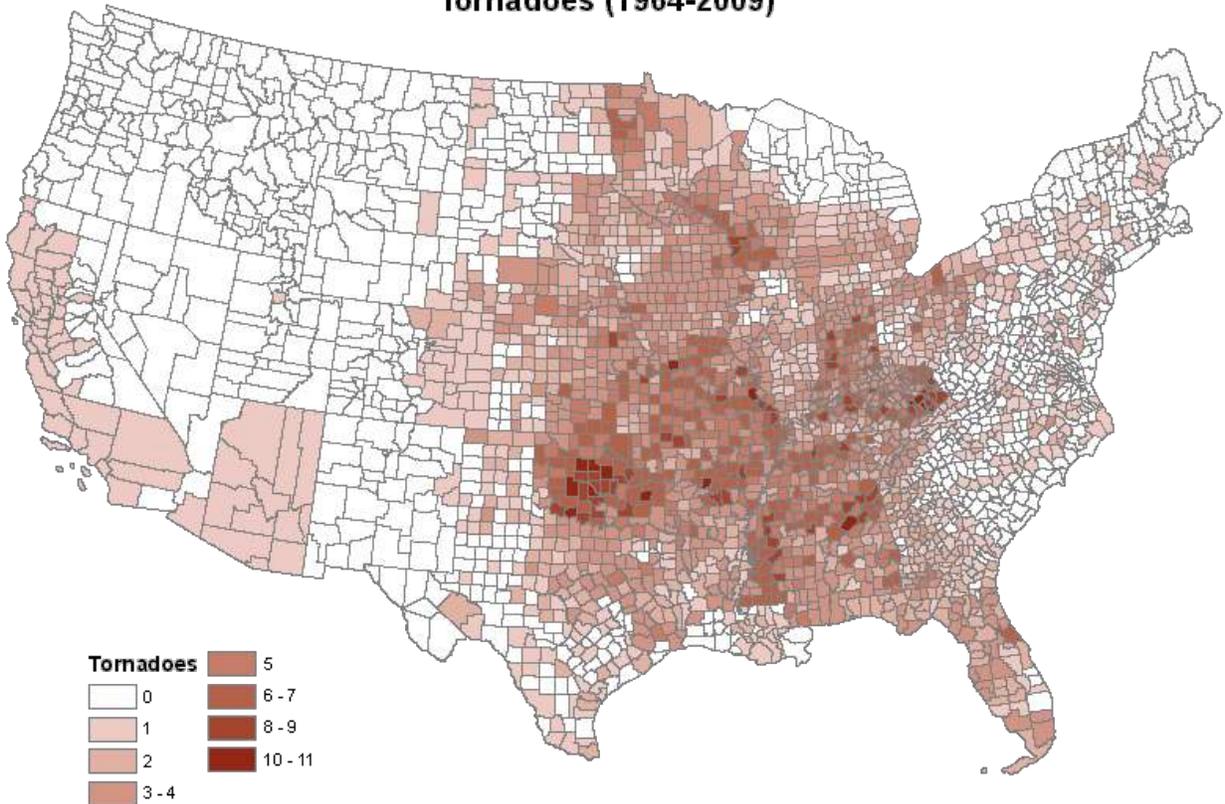
Severe Storms (1964-2009)



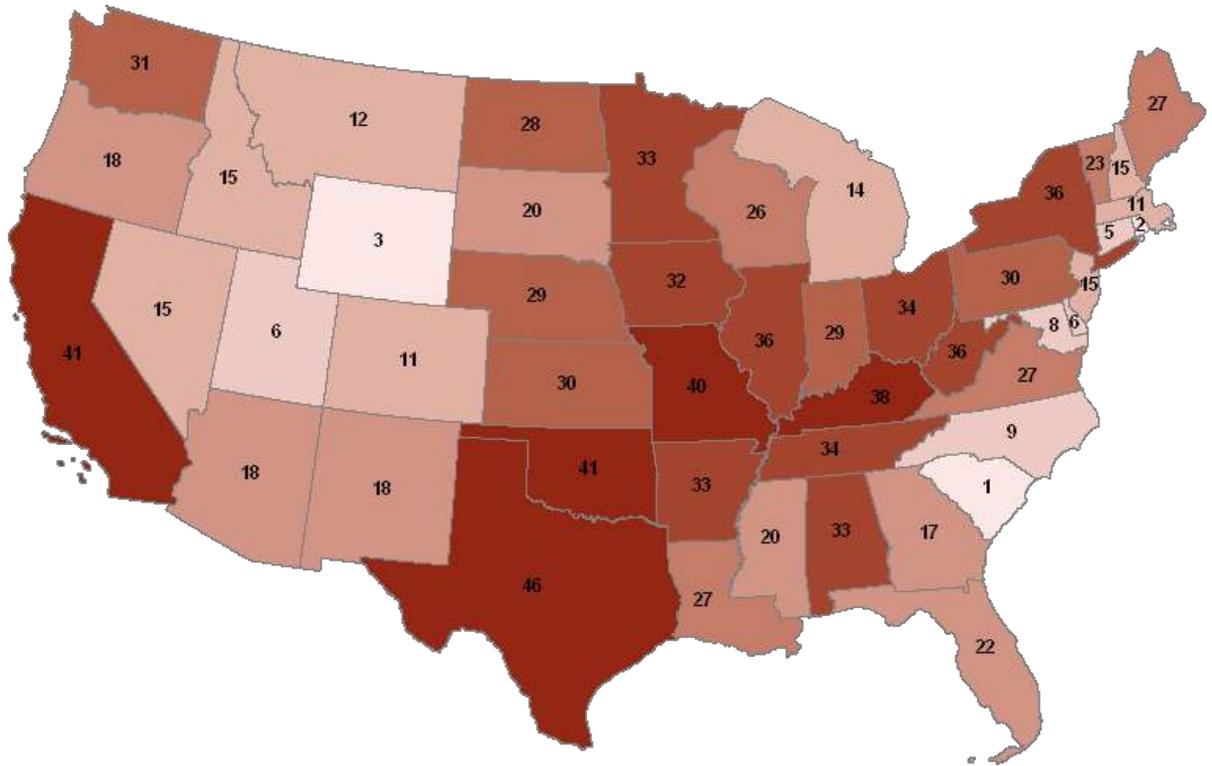
Tornadoes (1953-2009)



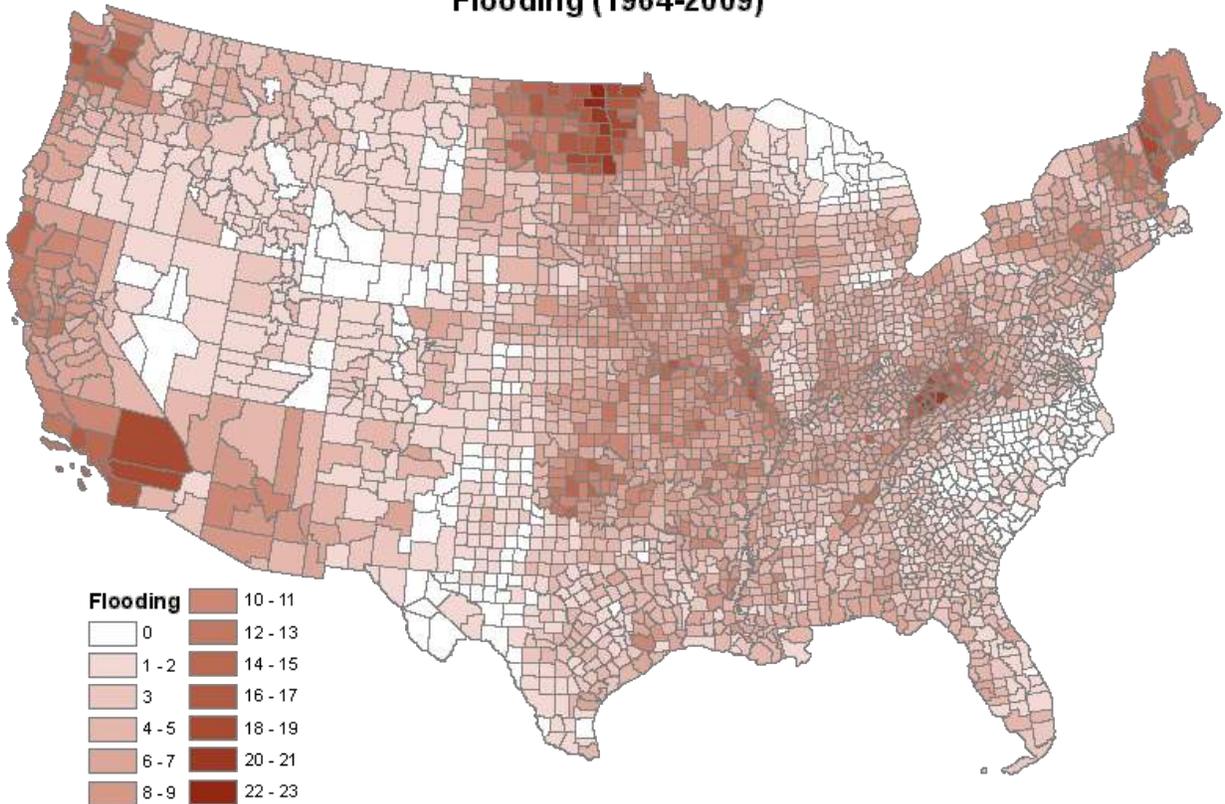
Tornadoes (1964-2009)



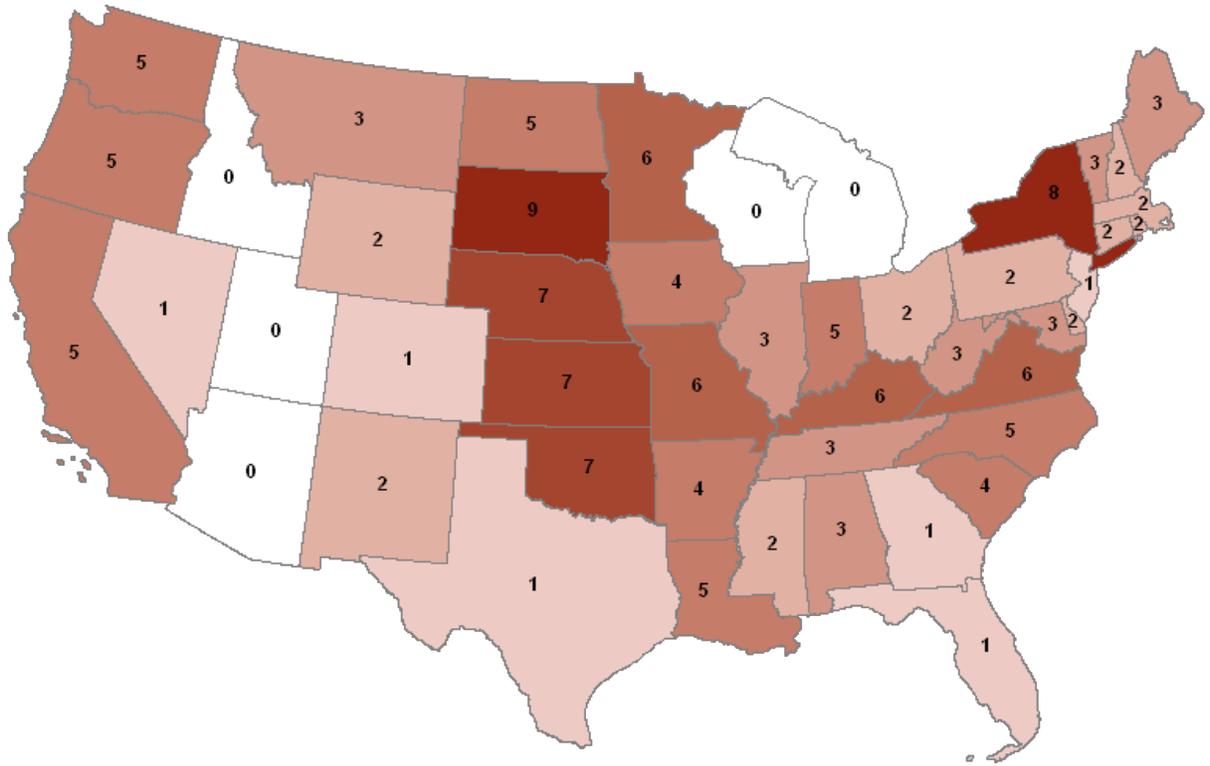
Flooding (1953-2009)



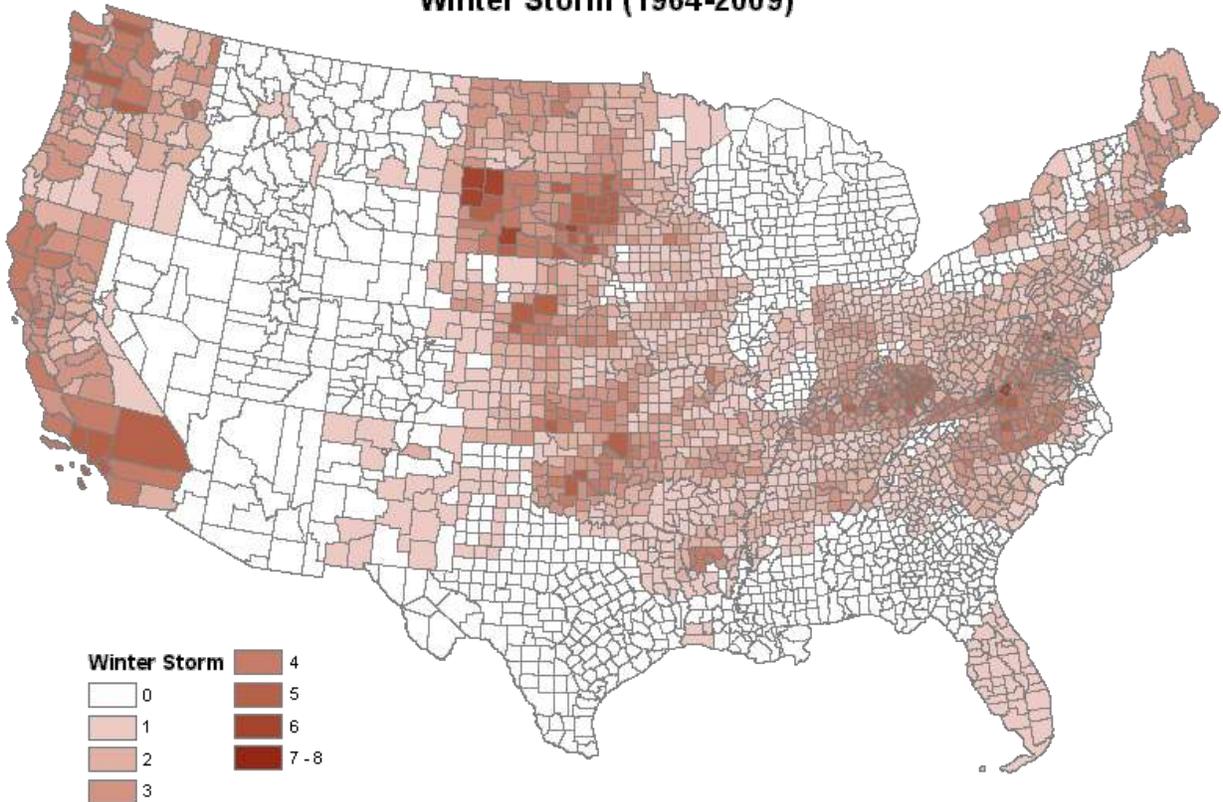
Flooding (1964-2009)



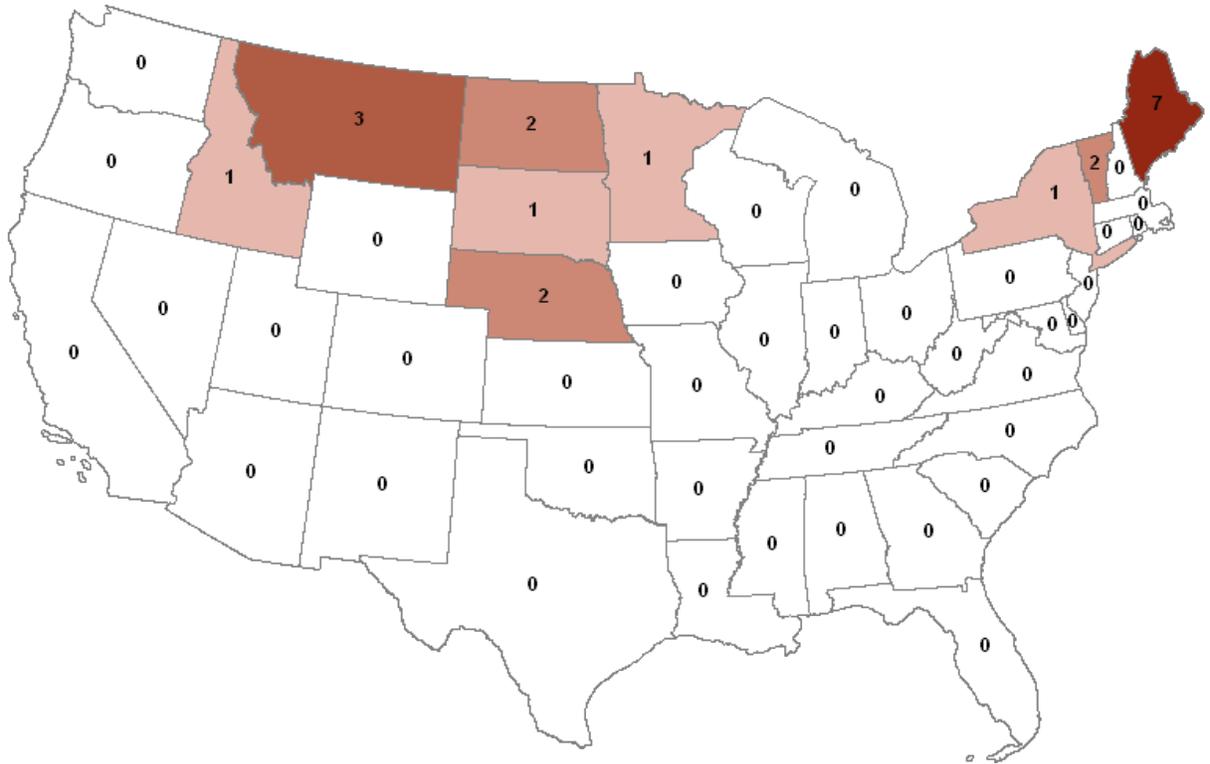
Winter Storm (1953-2009)



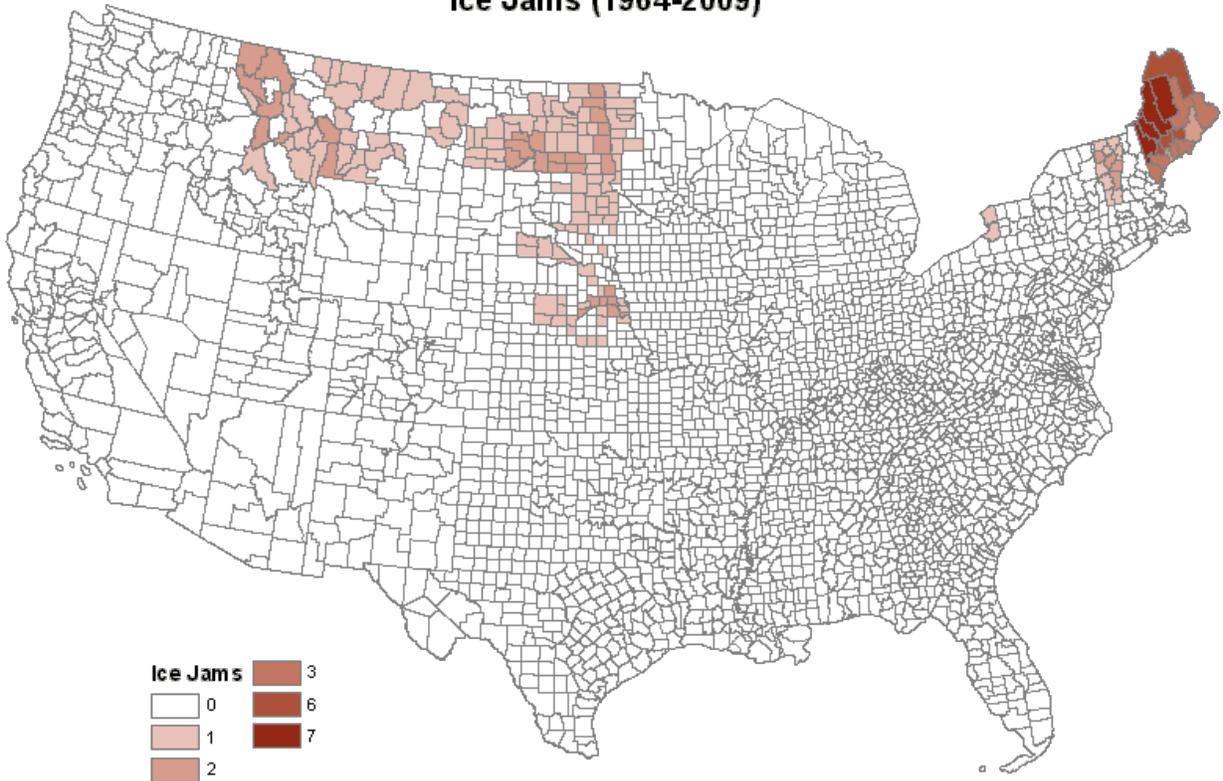
Winter Storm (1964-2009)



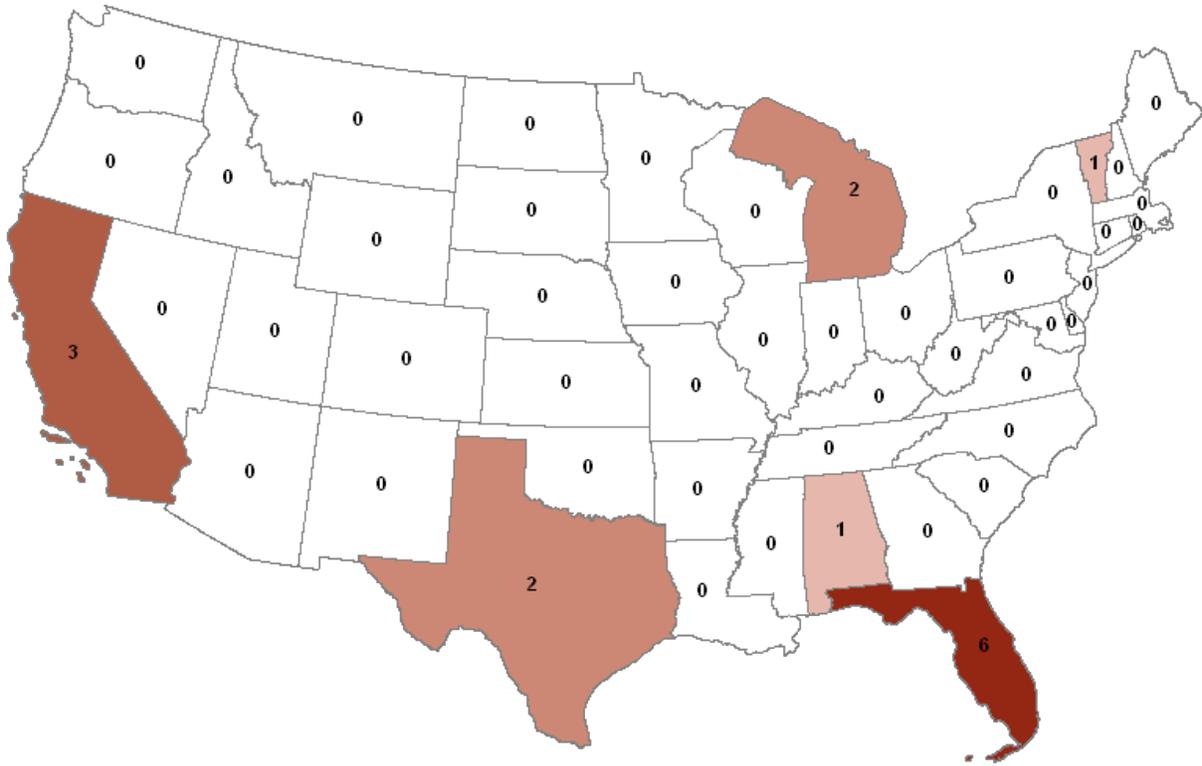
Ice Jams (1953-2009)



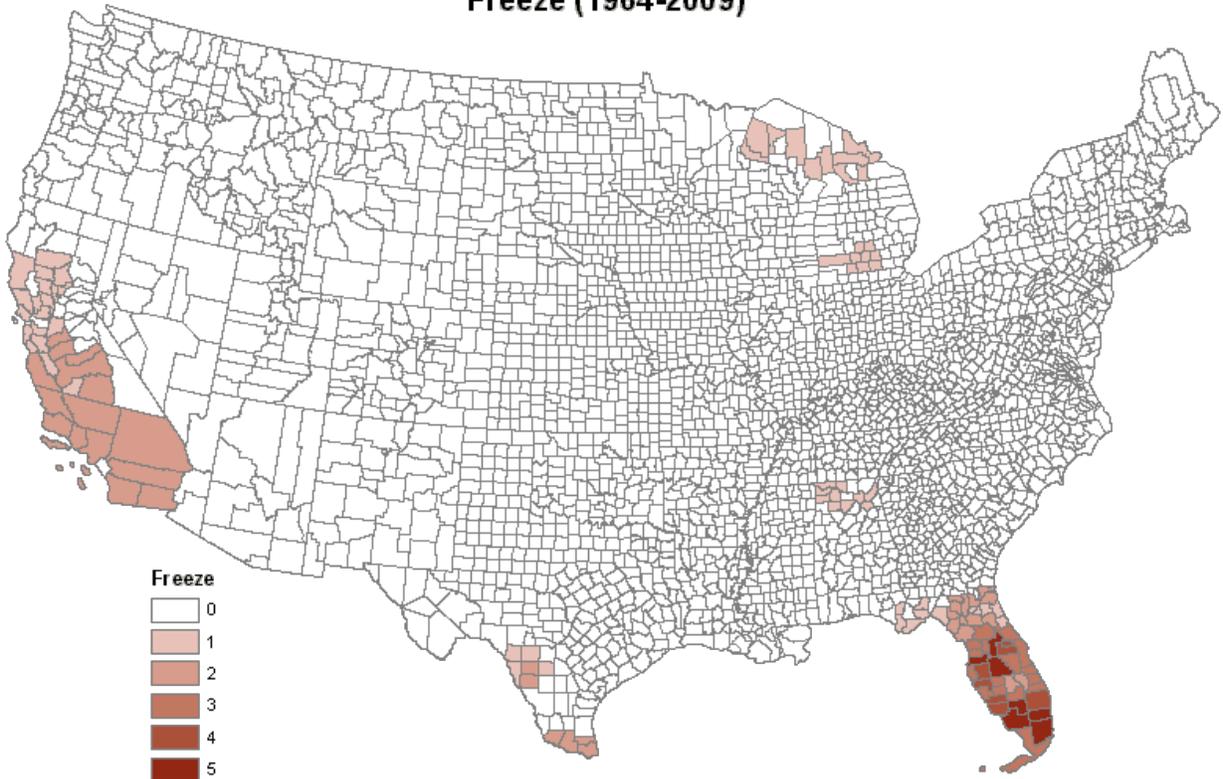
Ice Jams (1964-2009)



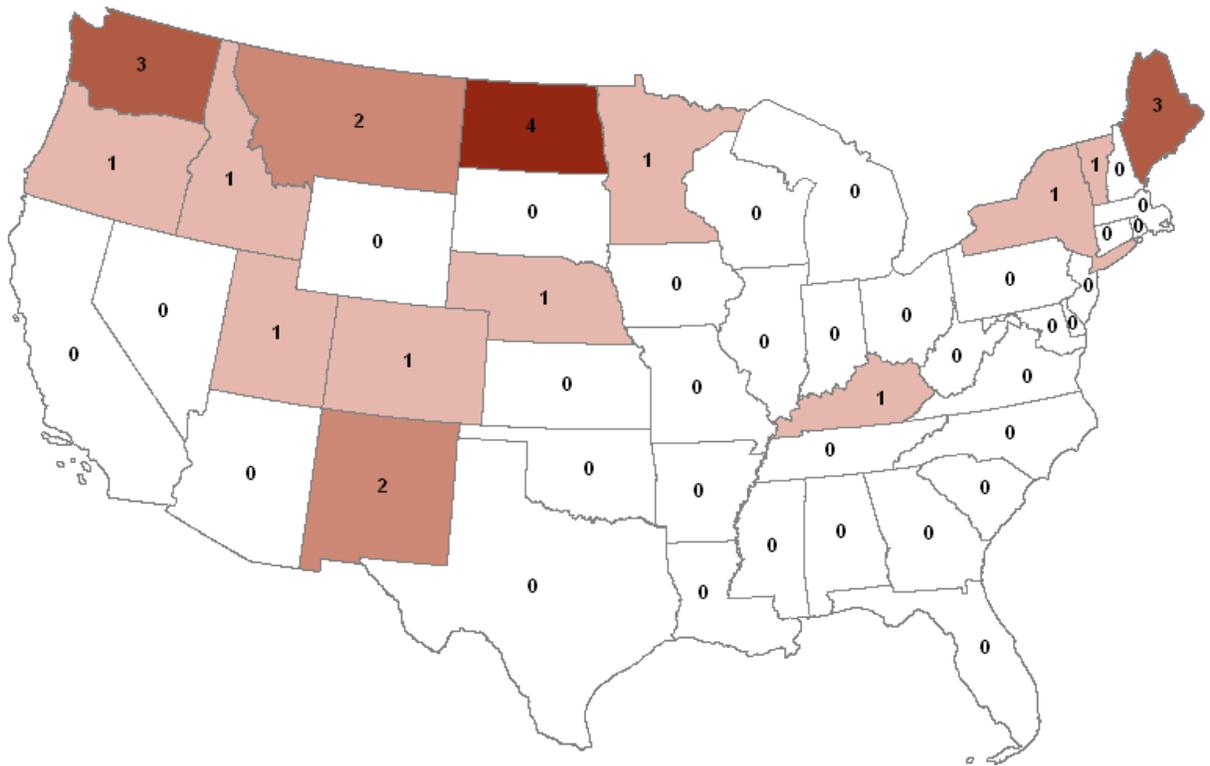
Freeze (1953-2009)



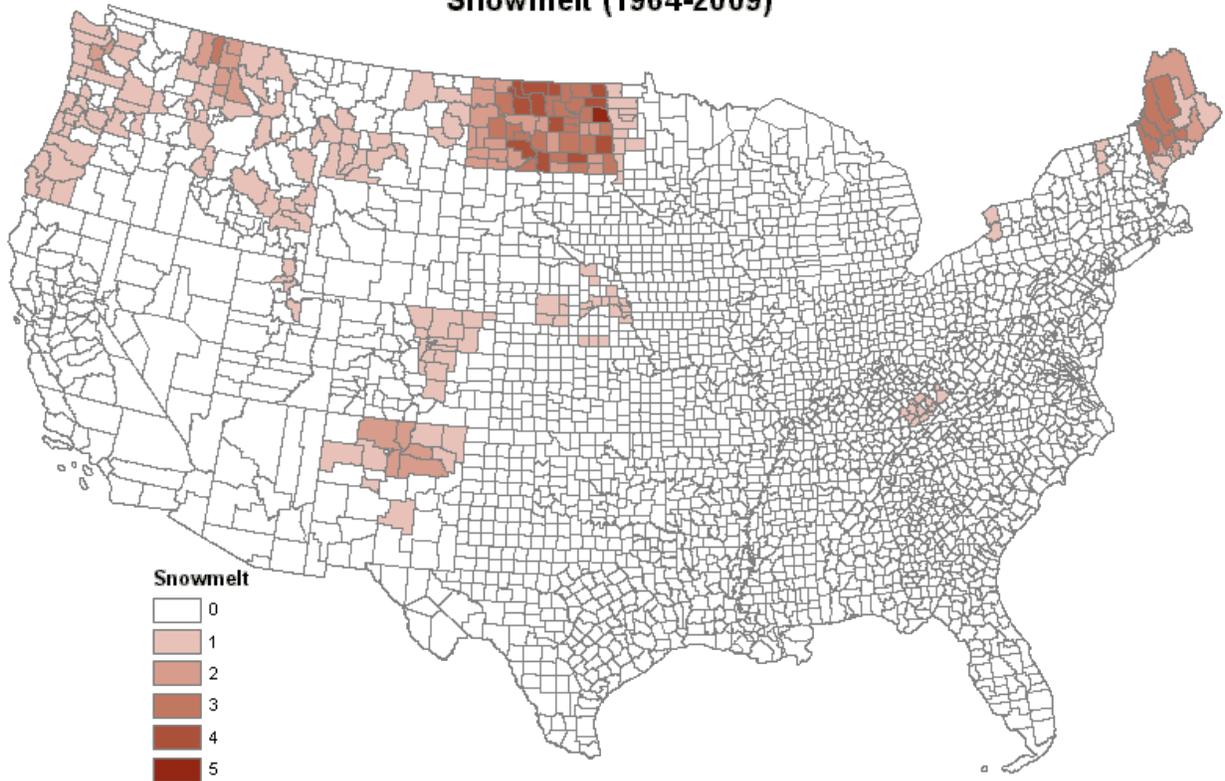
Freeze (1964-2009)



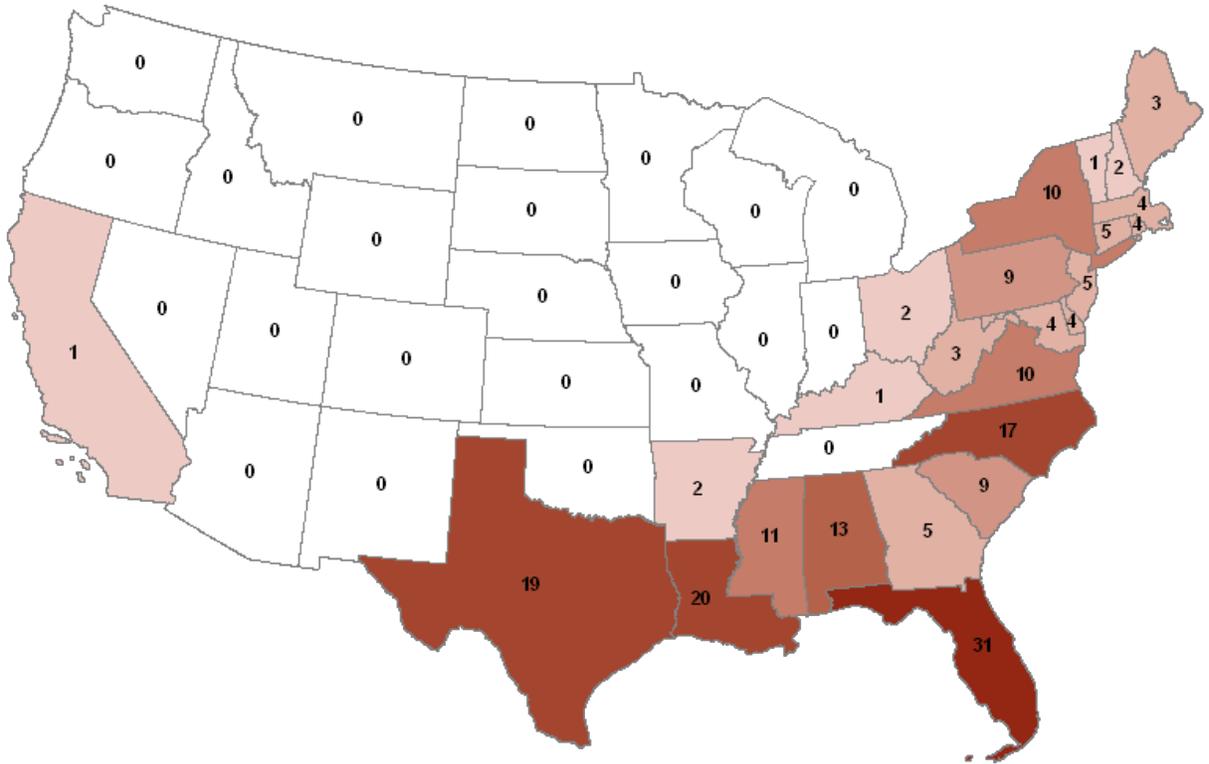
Snowmelt (1953-2009)



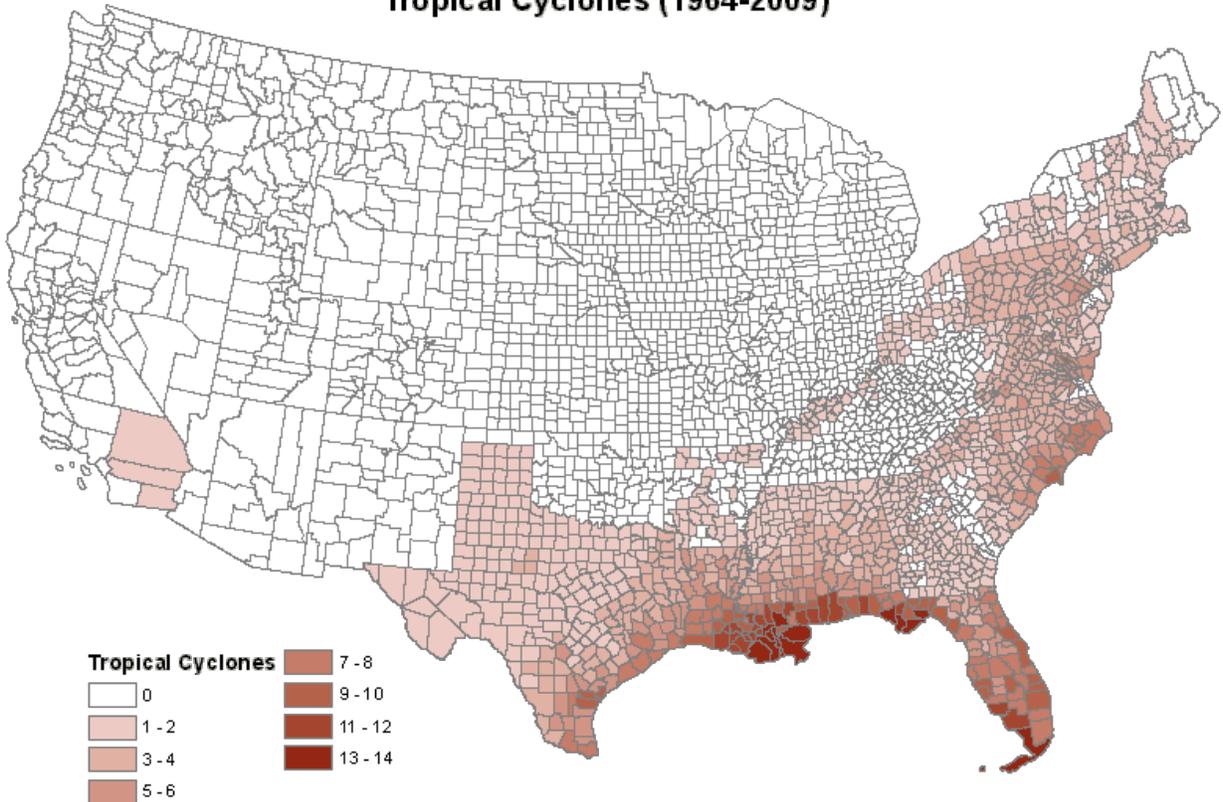
Snowmelt (1964-2009)



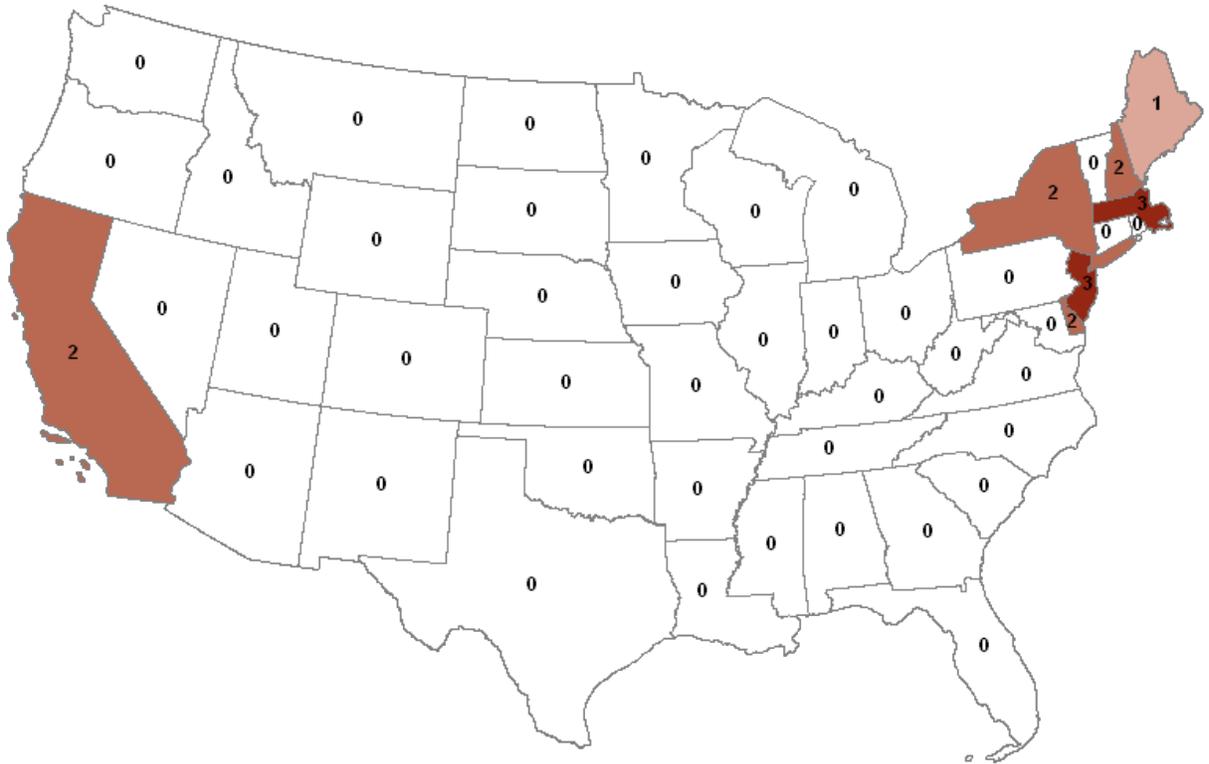
Tropical Cyclones (1953-2009)



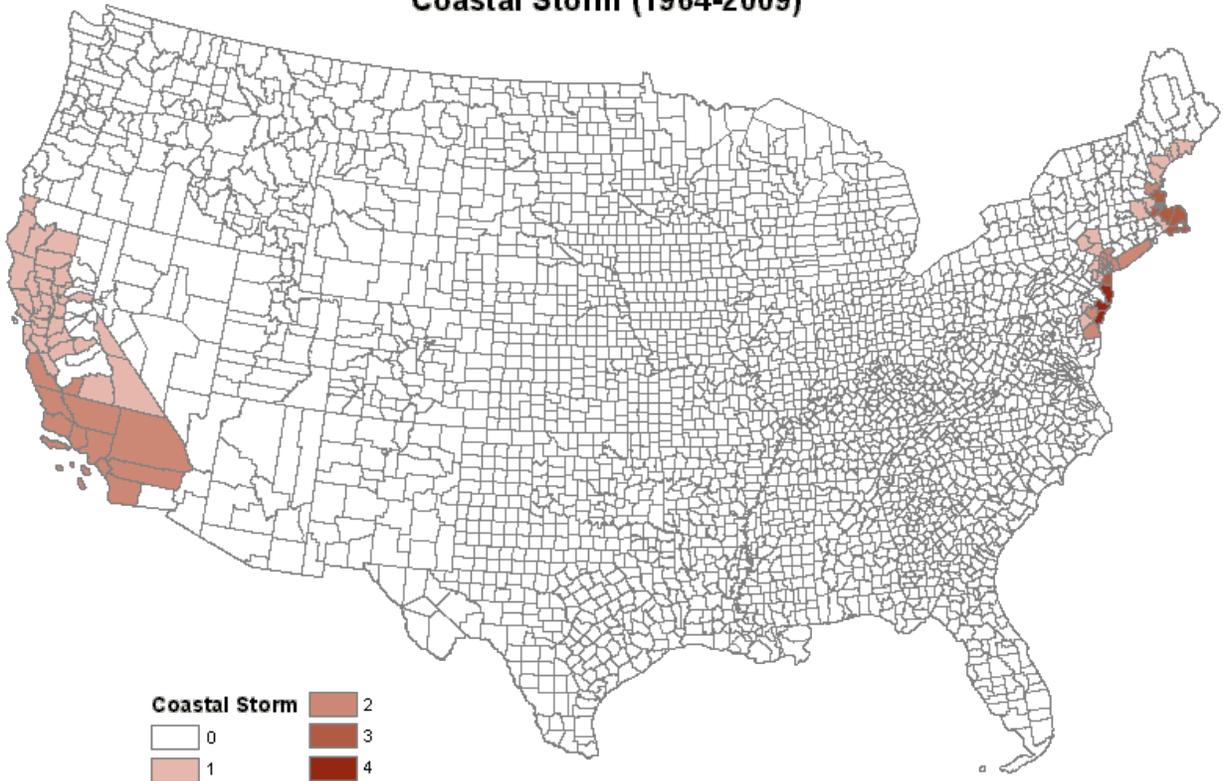
Tropical Cyclones (1964-2009)



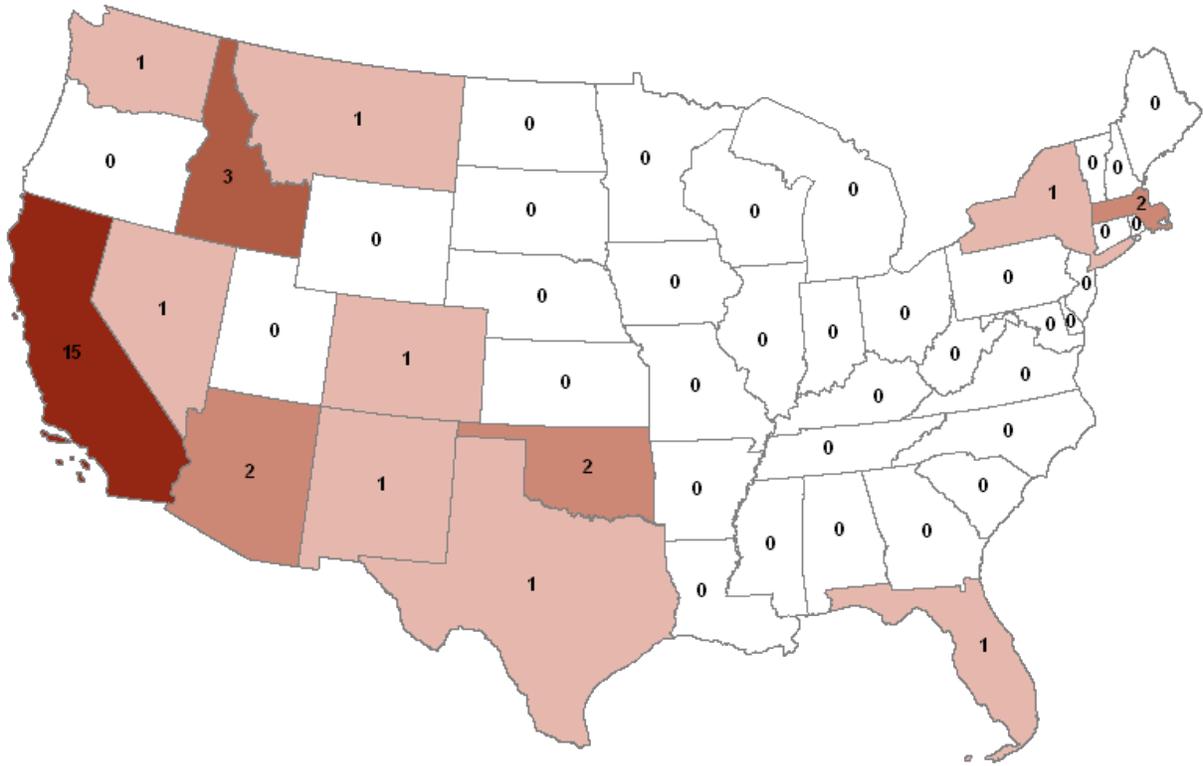
Coastal Storm (1953-2009)



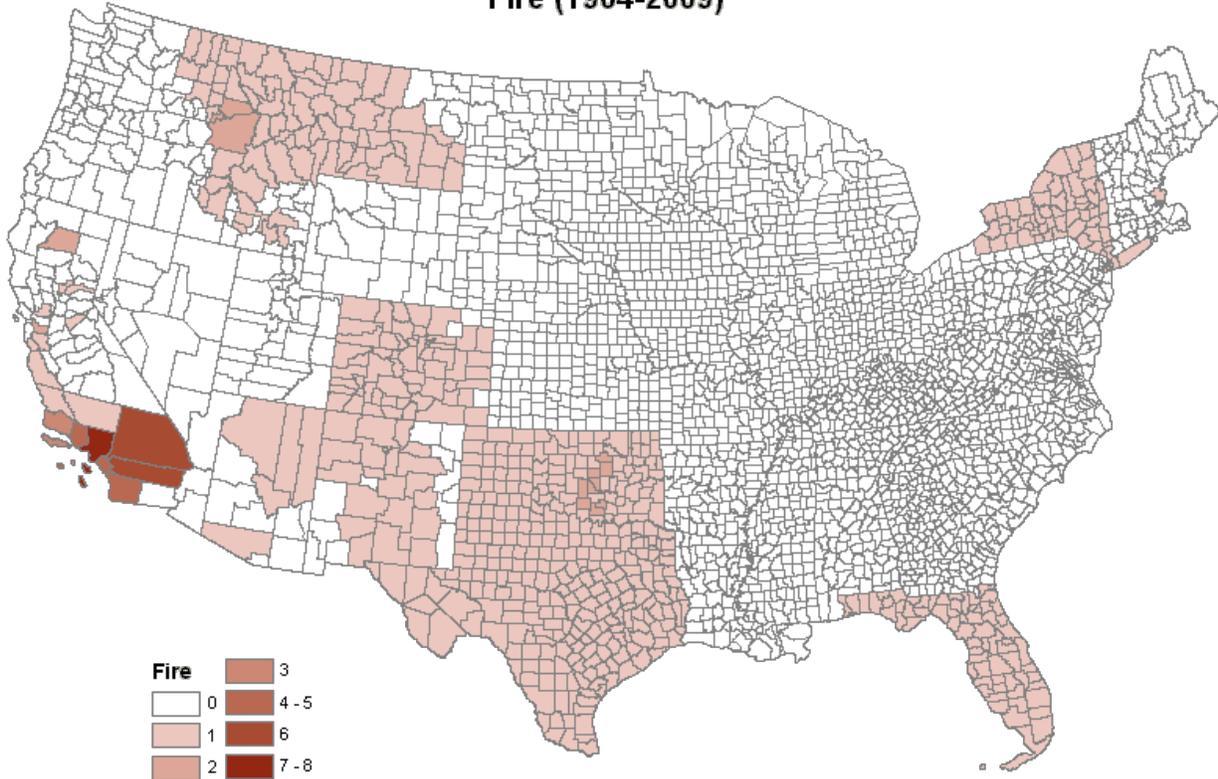
Coastal Storm (1964-2009)



Fire (1953-2009)

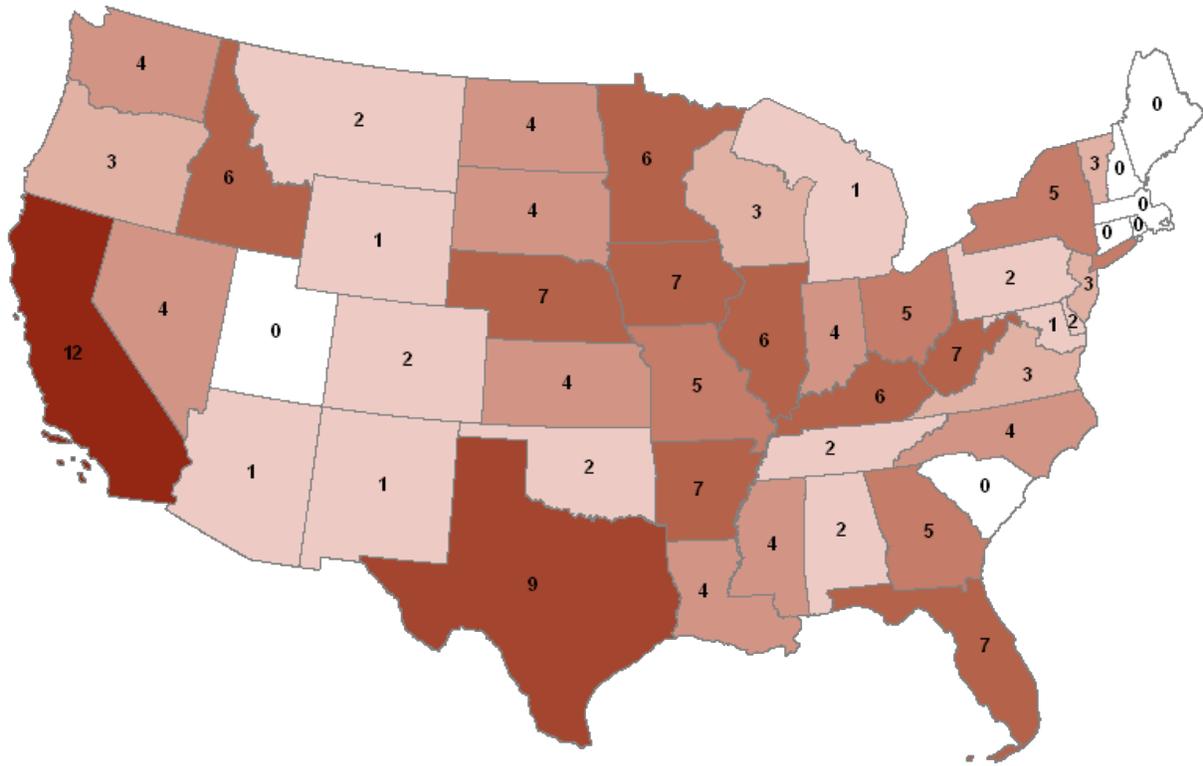


Fire (1964-2009)

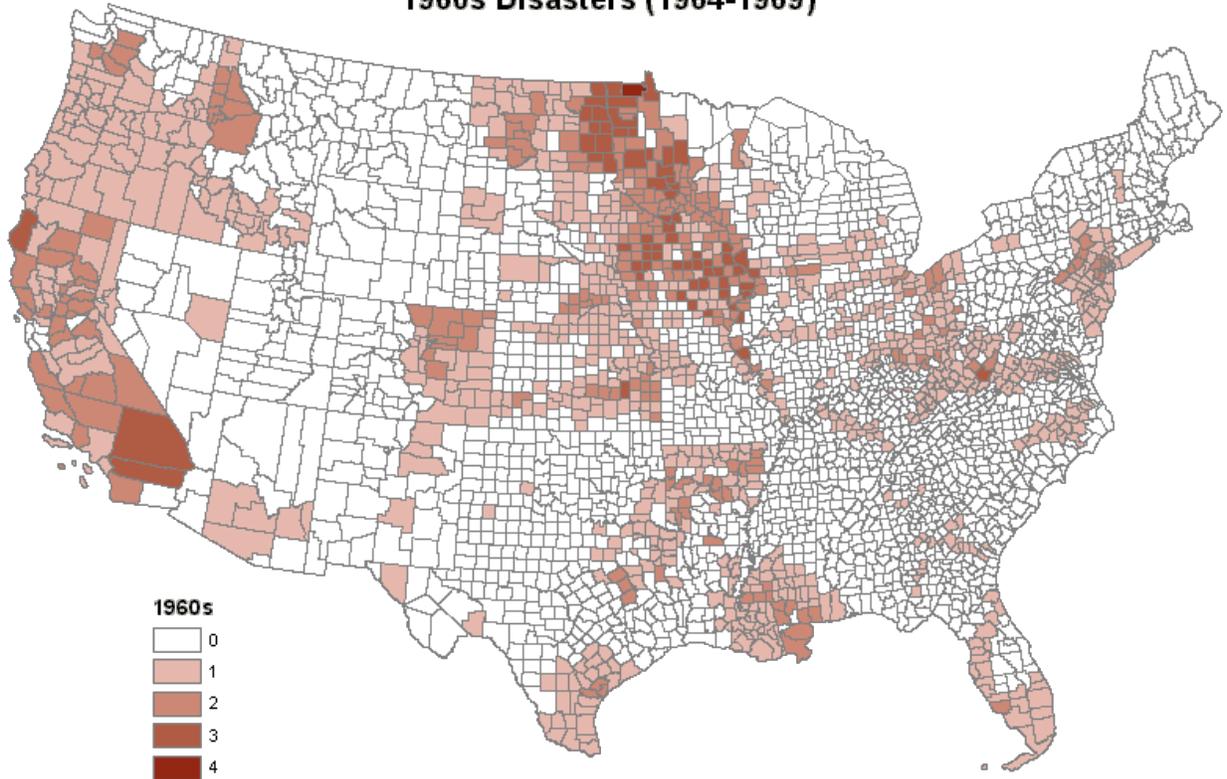


DISASTERS BY DECADE

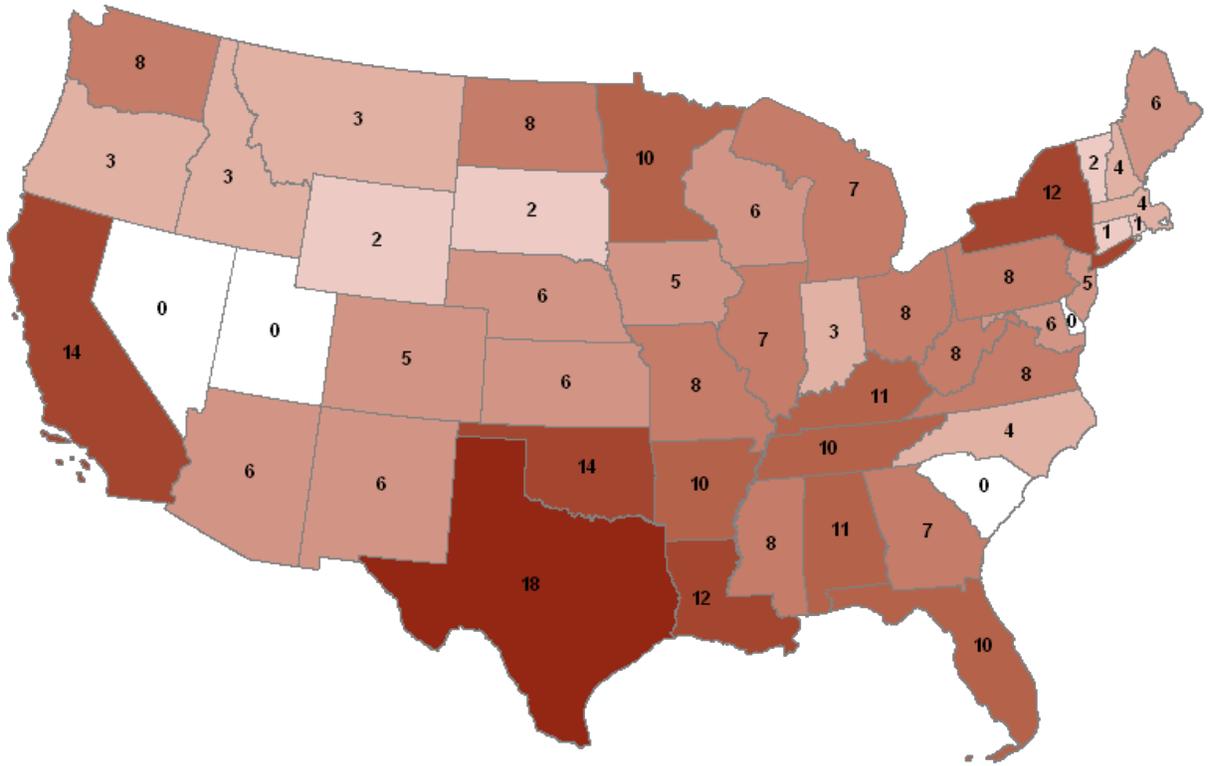
1960s Disasters



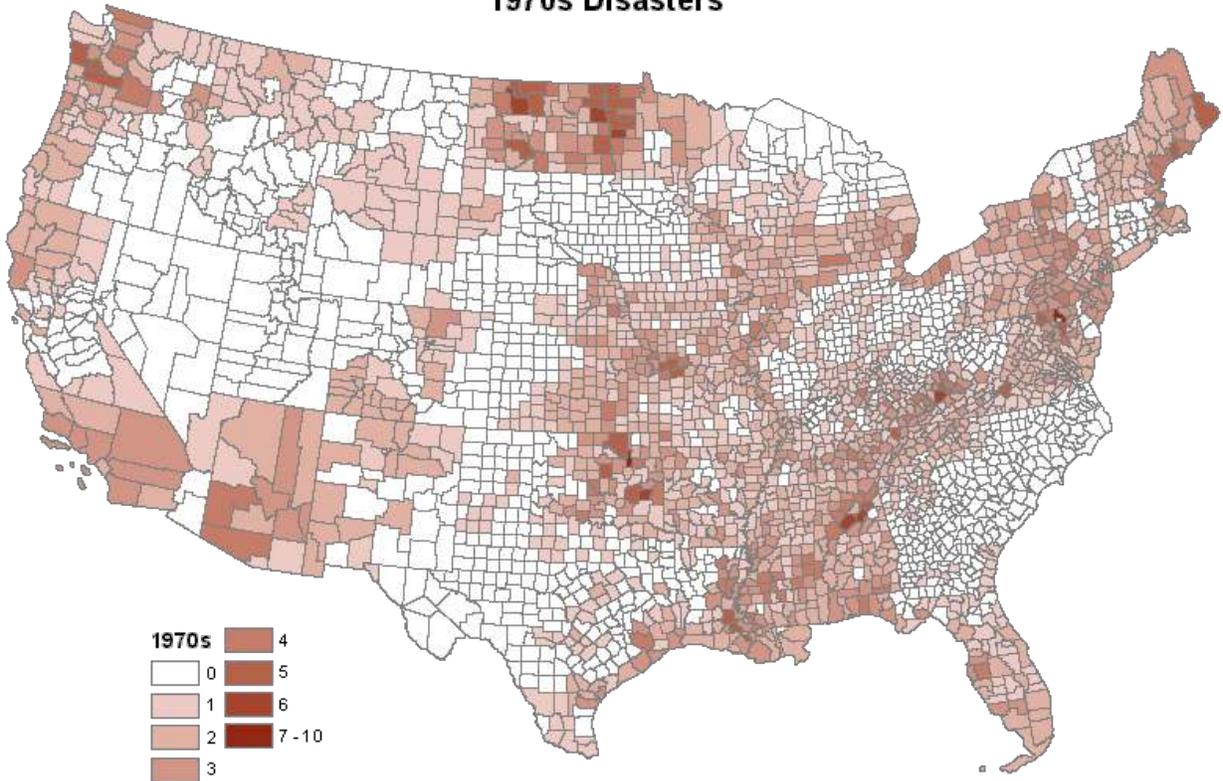
1960s Disasters (1964-1969)



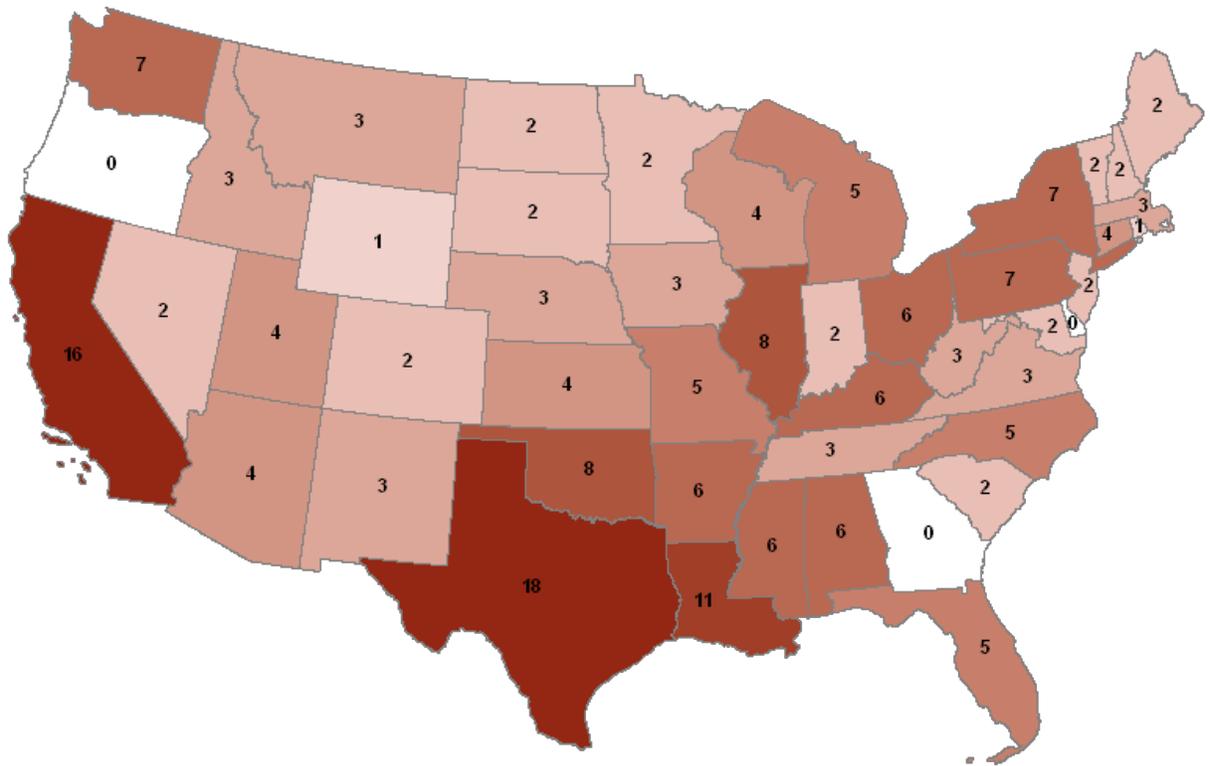
1970s Disasters



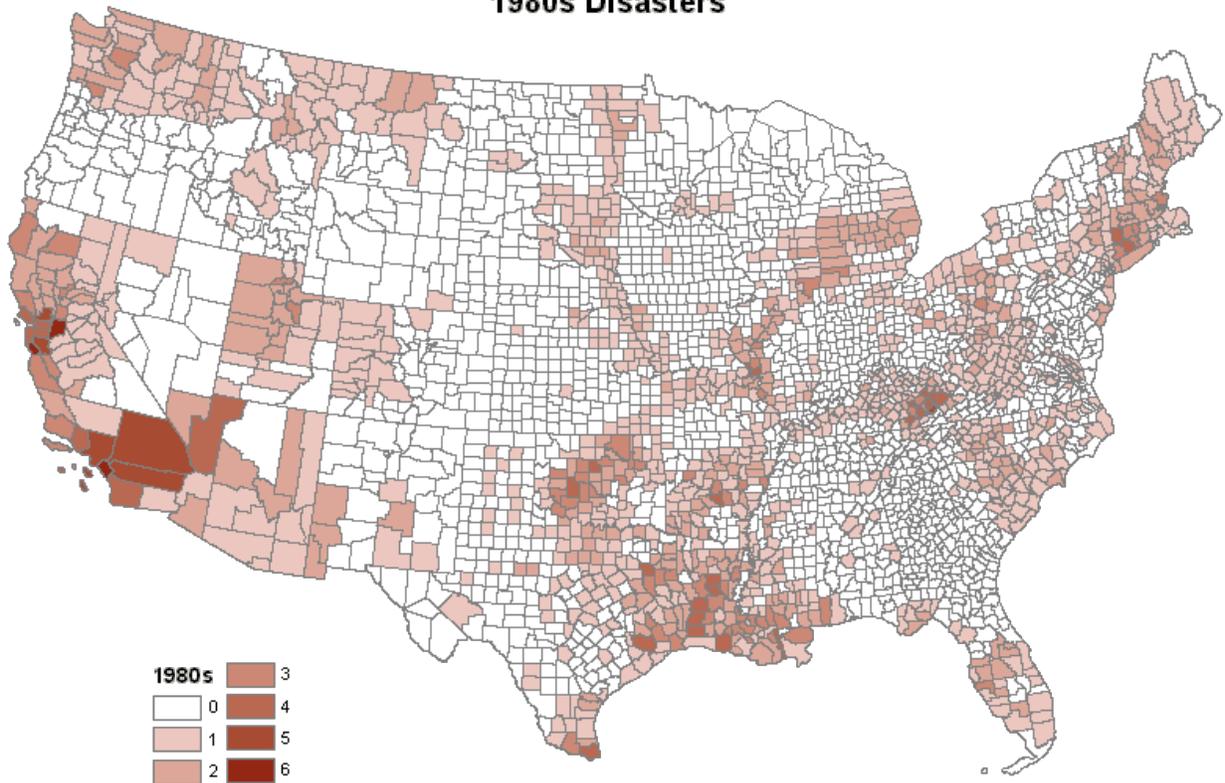
1970s Disasters



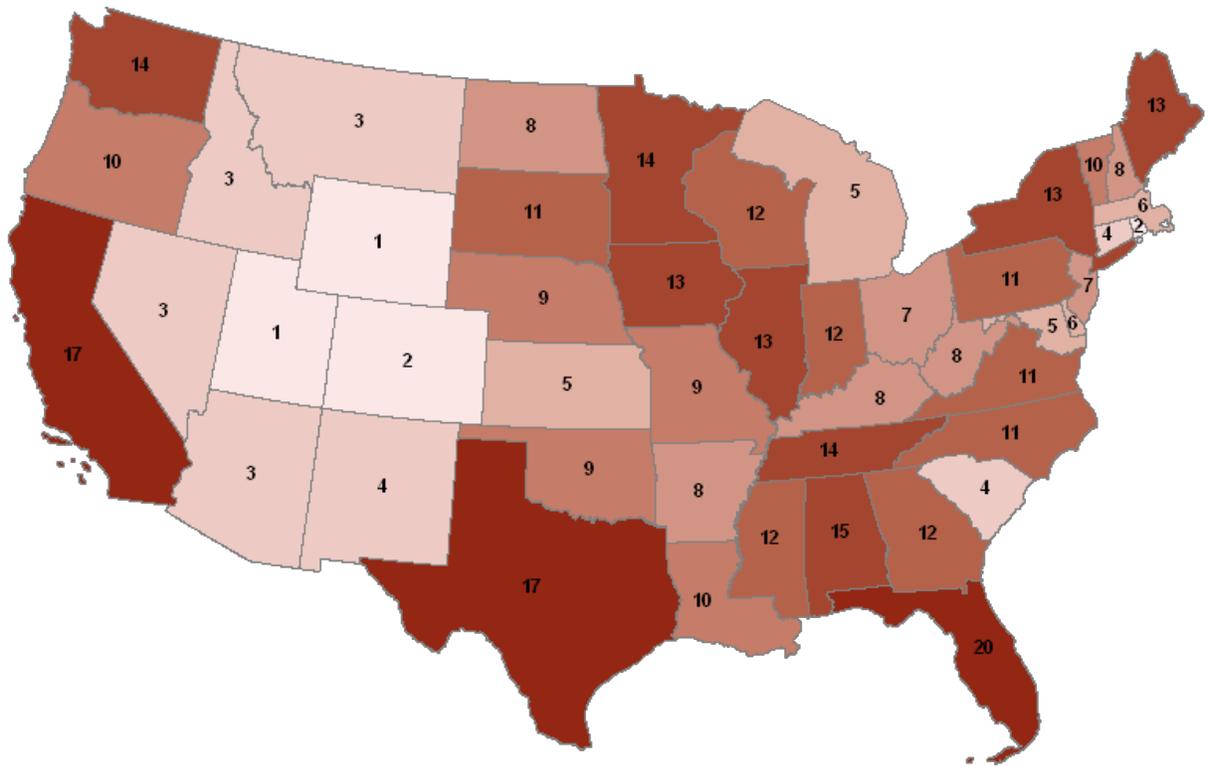
1980s Disasters



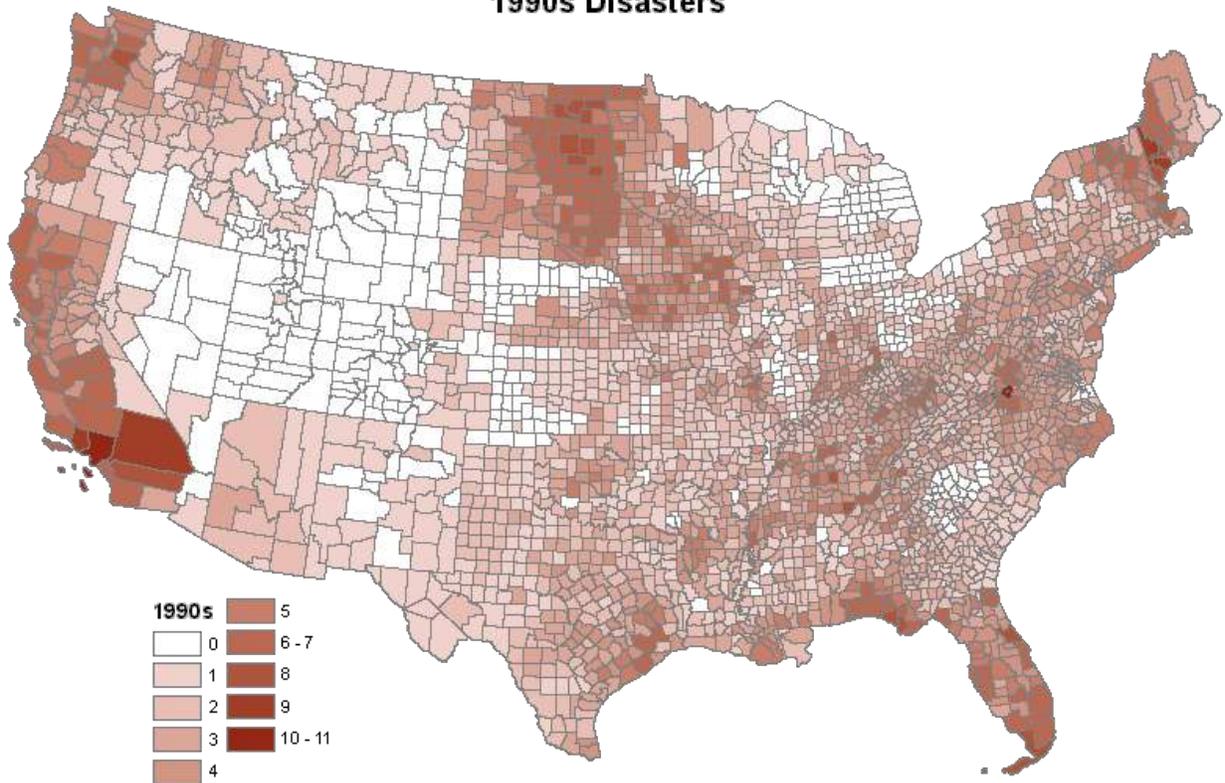
1980s Disasters



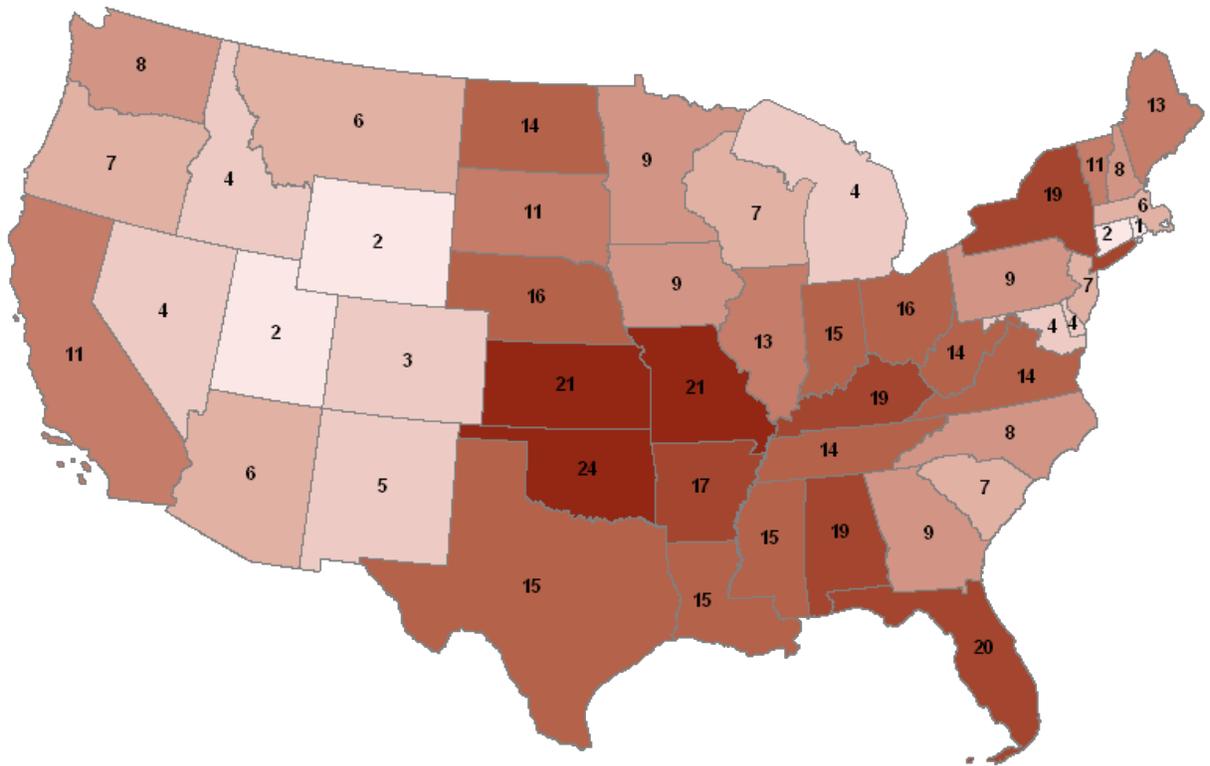
1990s Disasters



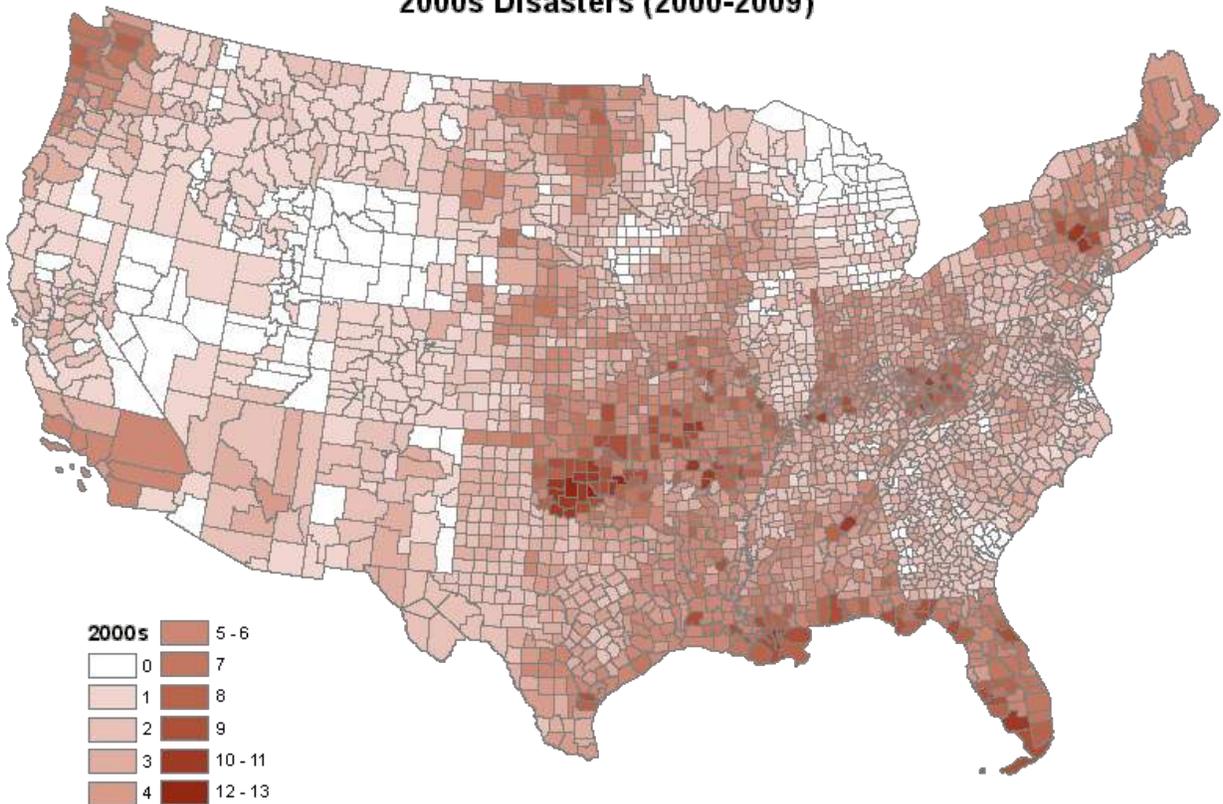
1990s Disasters



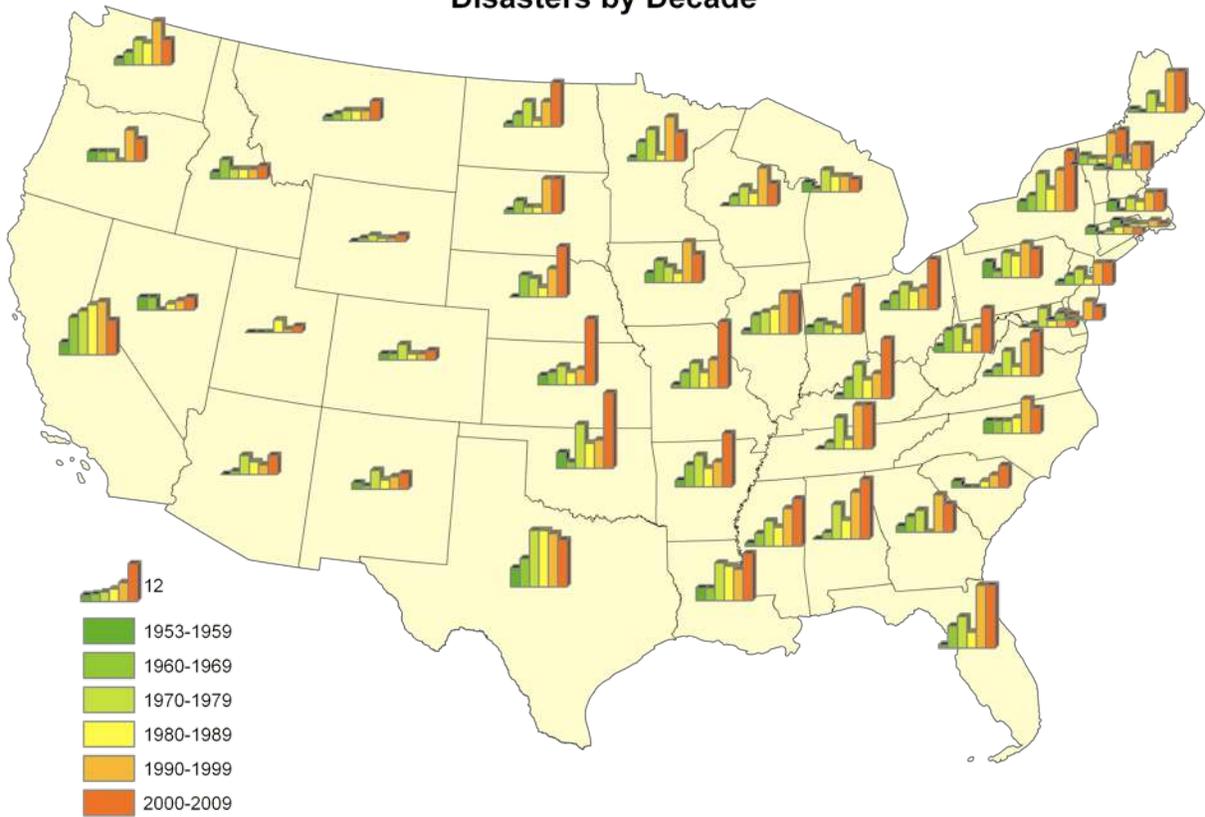
2000s Disasters (2000-2009)



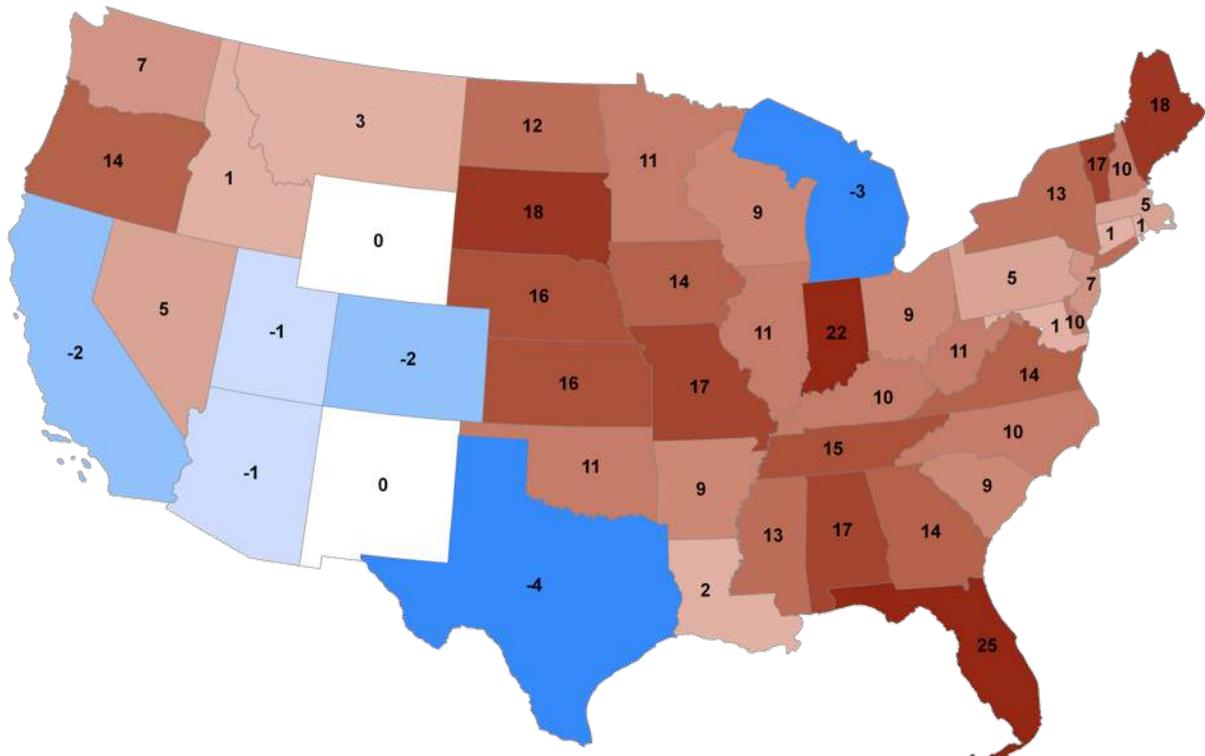
2000s Disasters (2000-2009)



Disasters by Decade

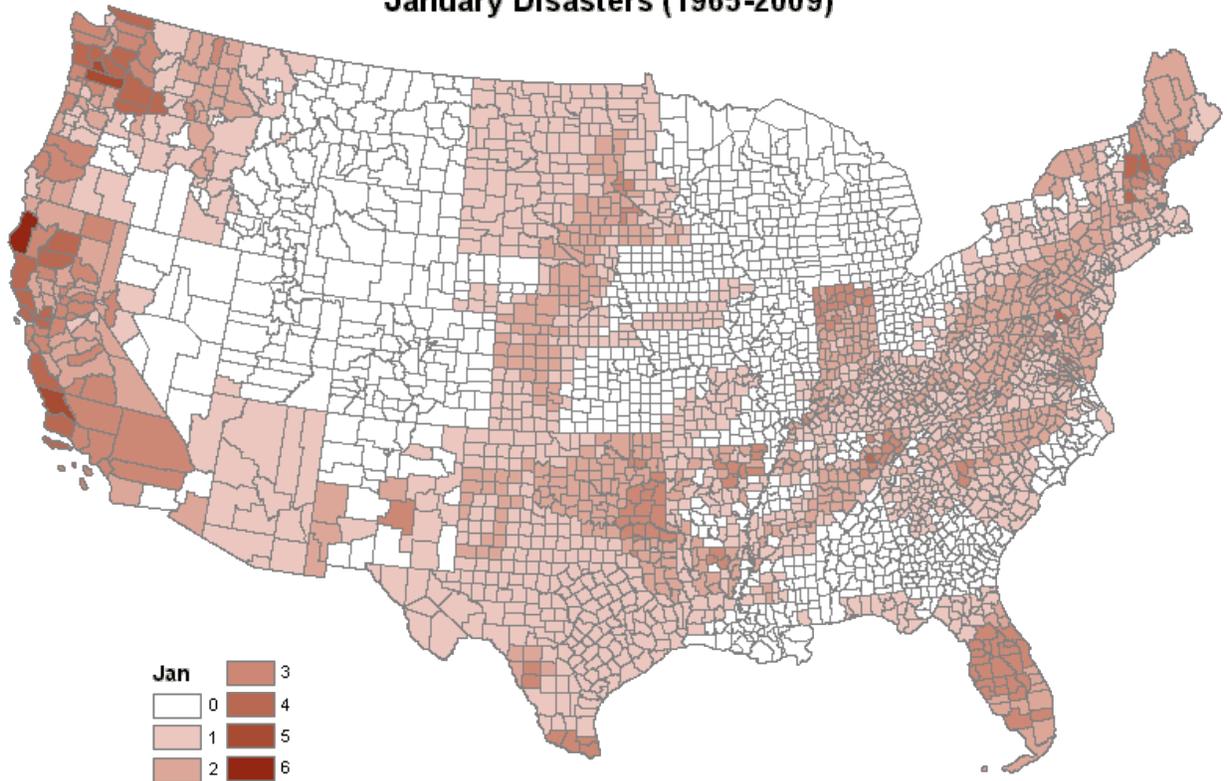


Change in Number of Disasters from 1970-1989 to 1990-2009

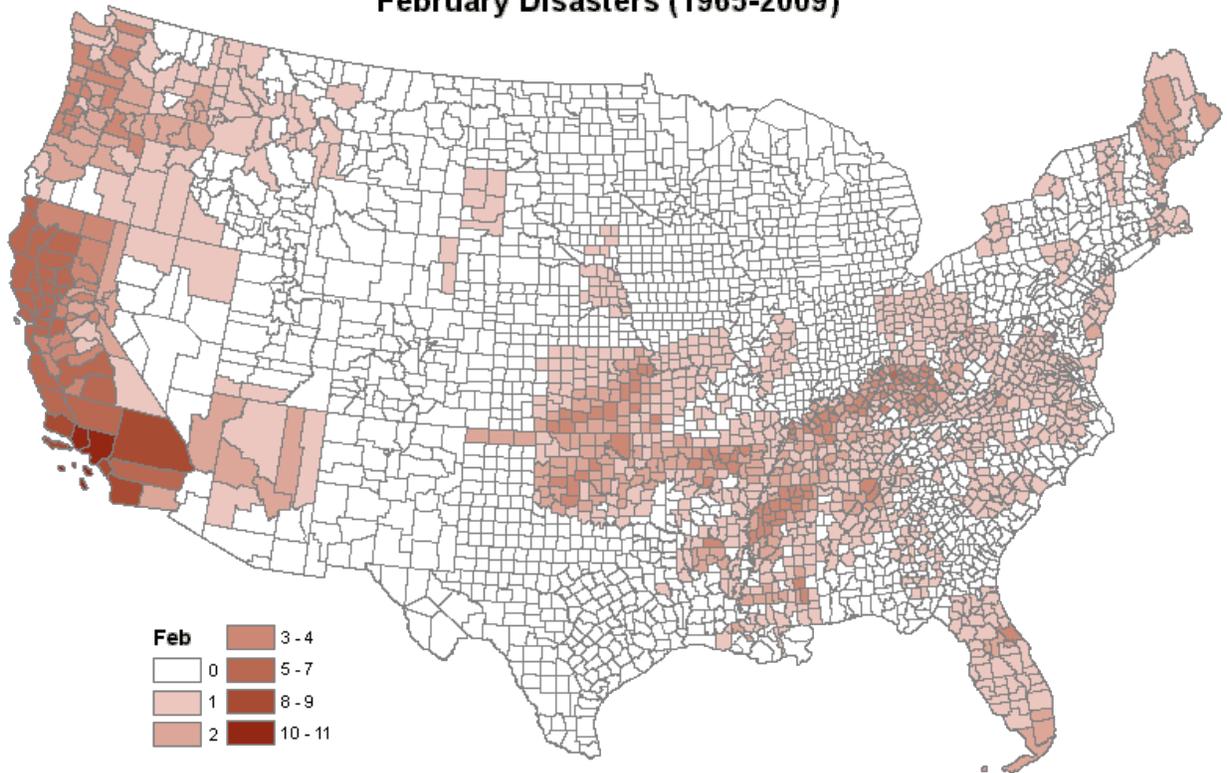


DISASTERS BY MONTH

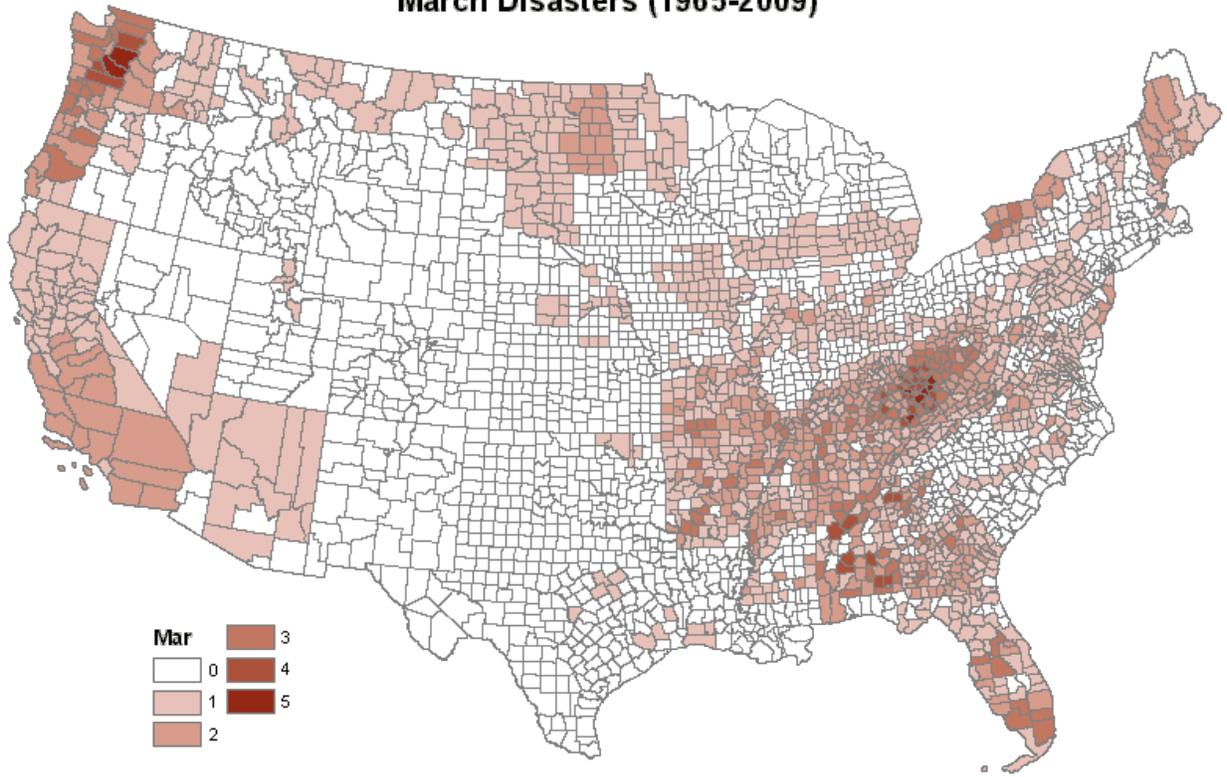
January Disasters (1965-2009)



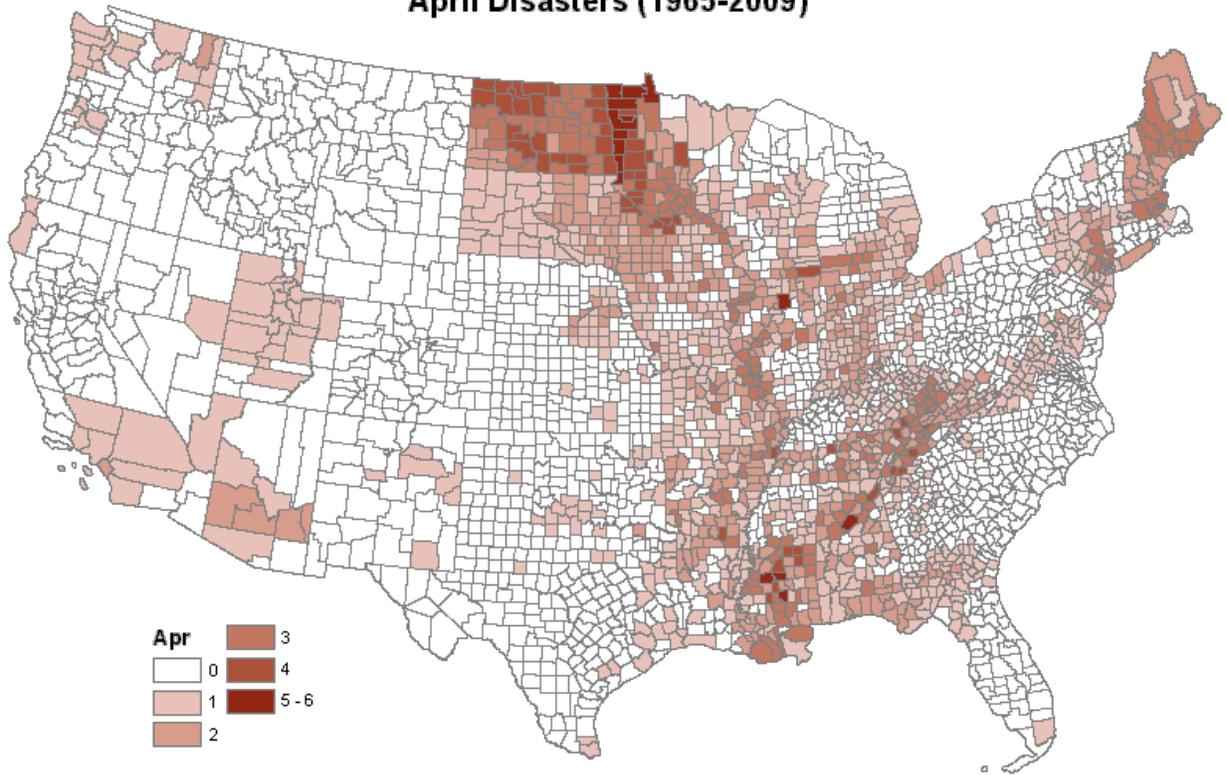
February Disasters (1965-2009)



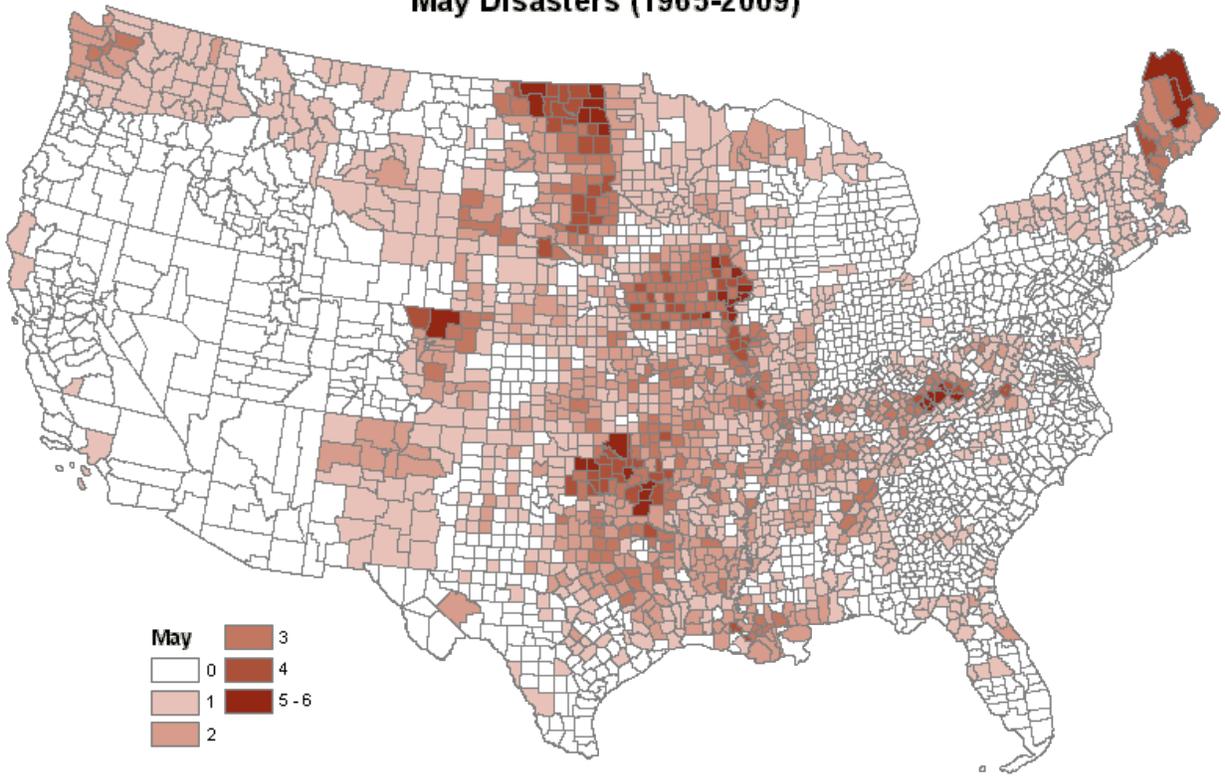
March Disasters (1965-2009)



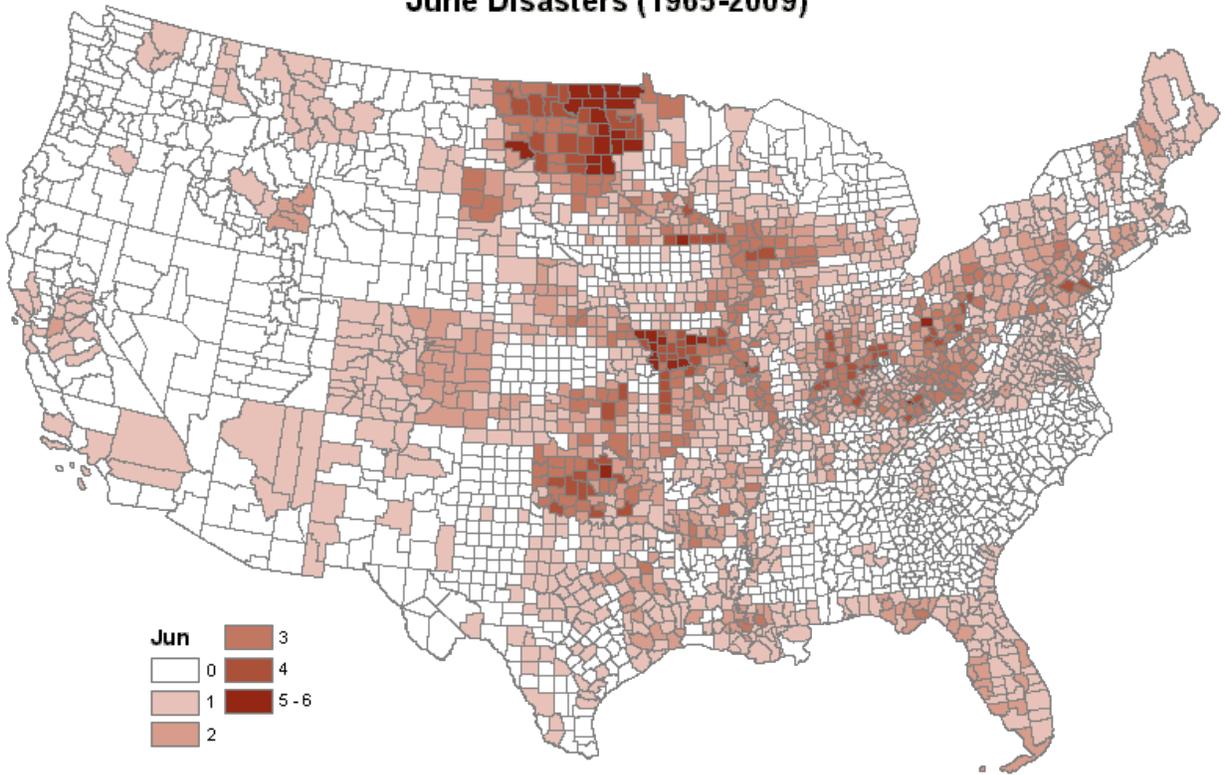
April Disasters (1965-2009)



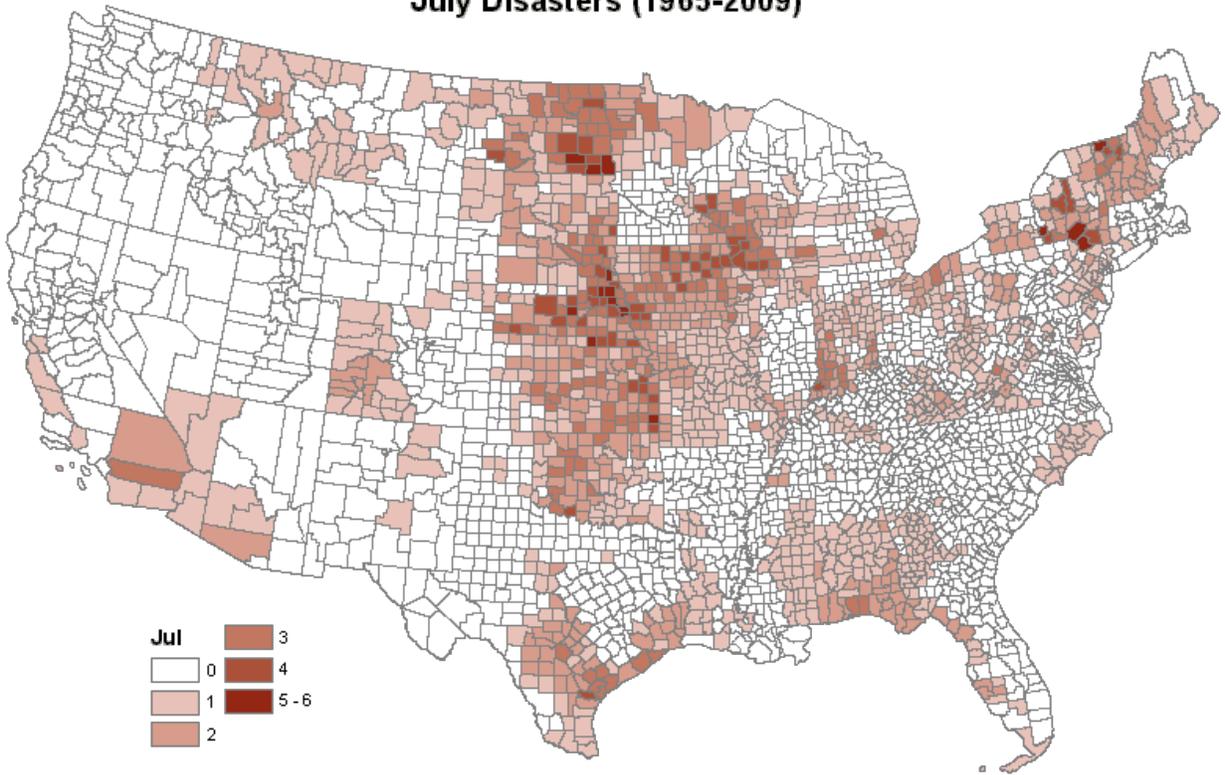
May Disasters (1965-2009)



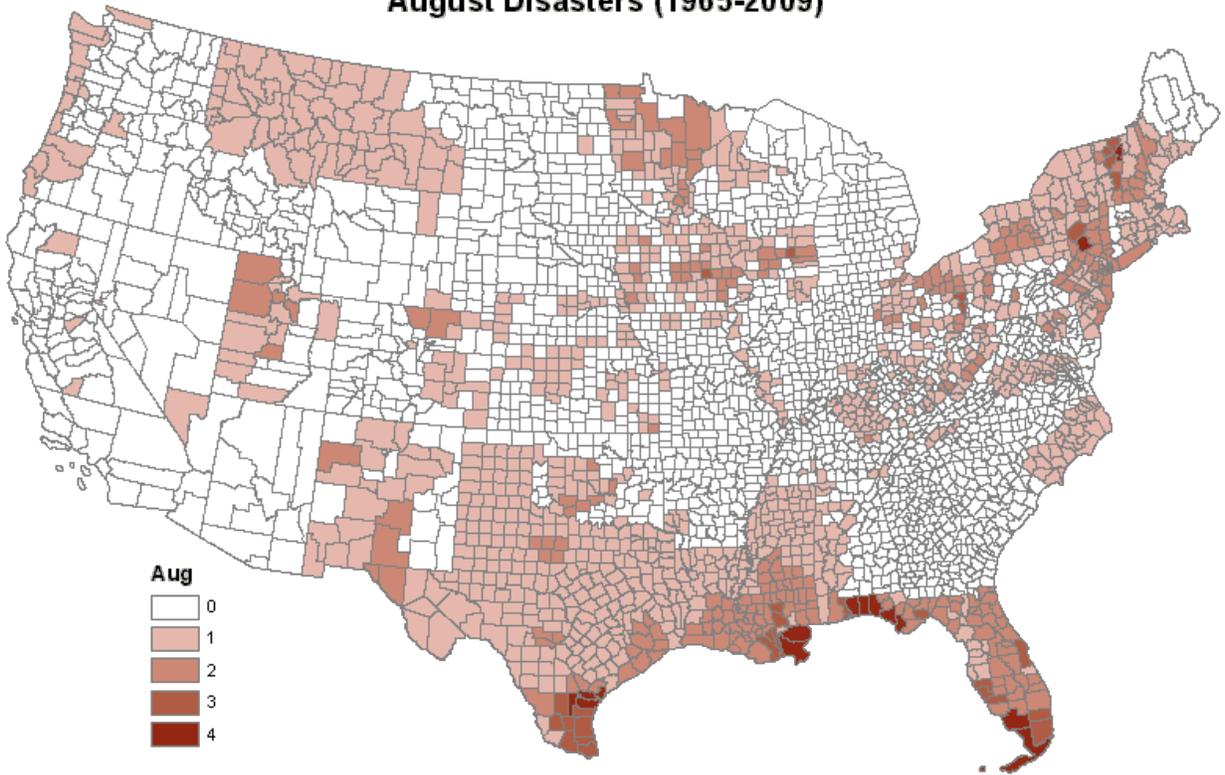
June Disasters (1965-2009)



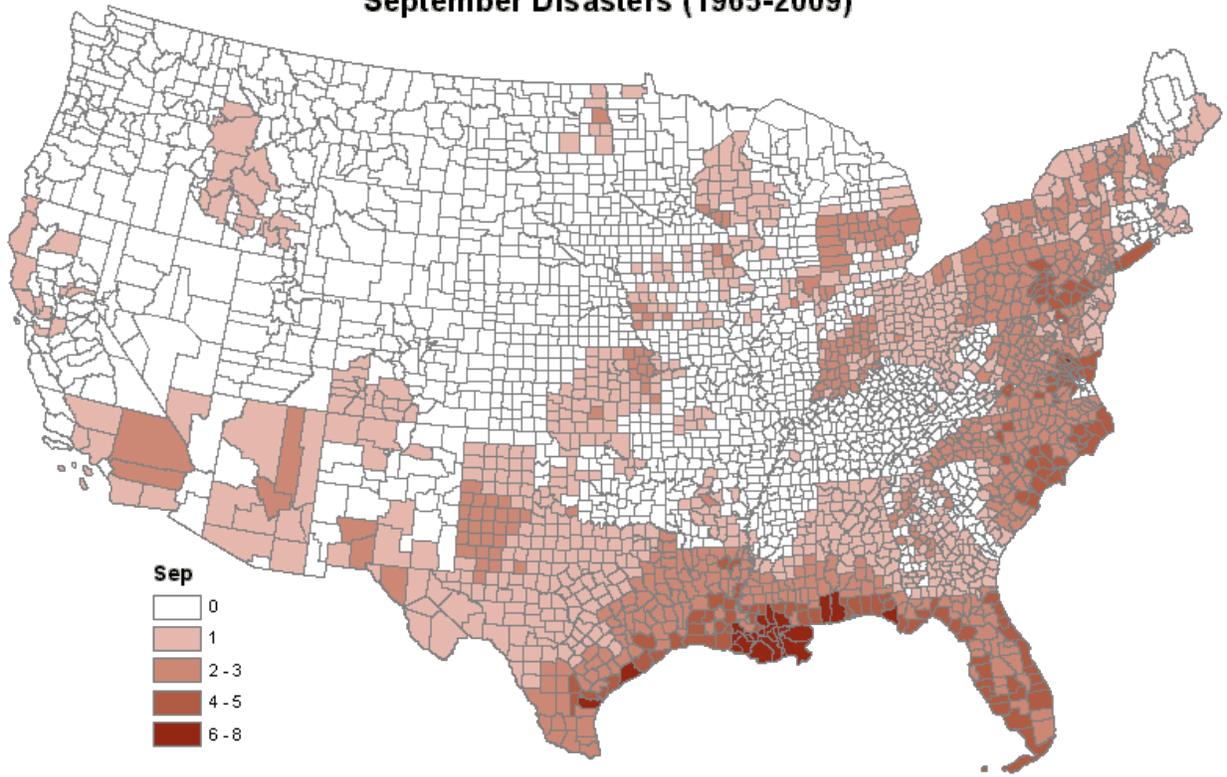
July Disasters (1965-2009)



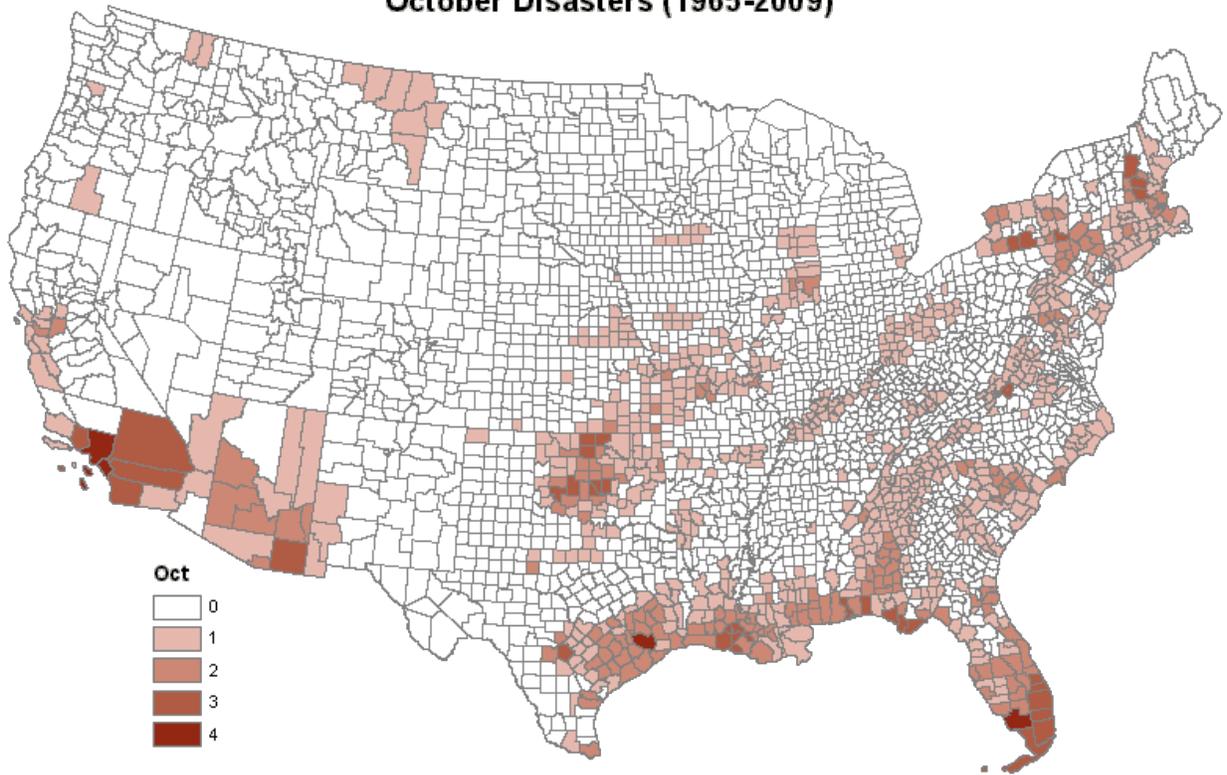
August Disasters (1965-2009)



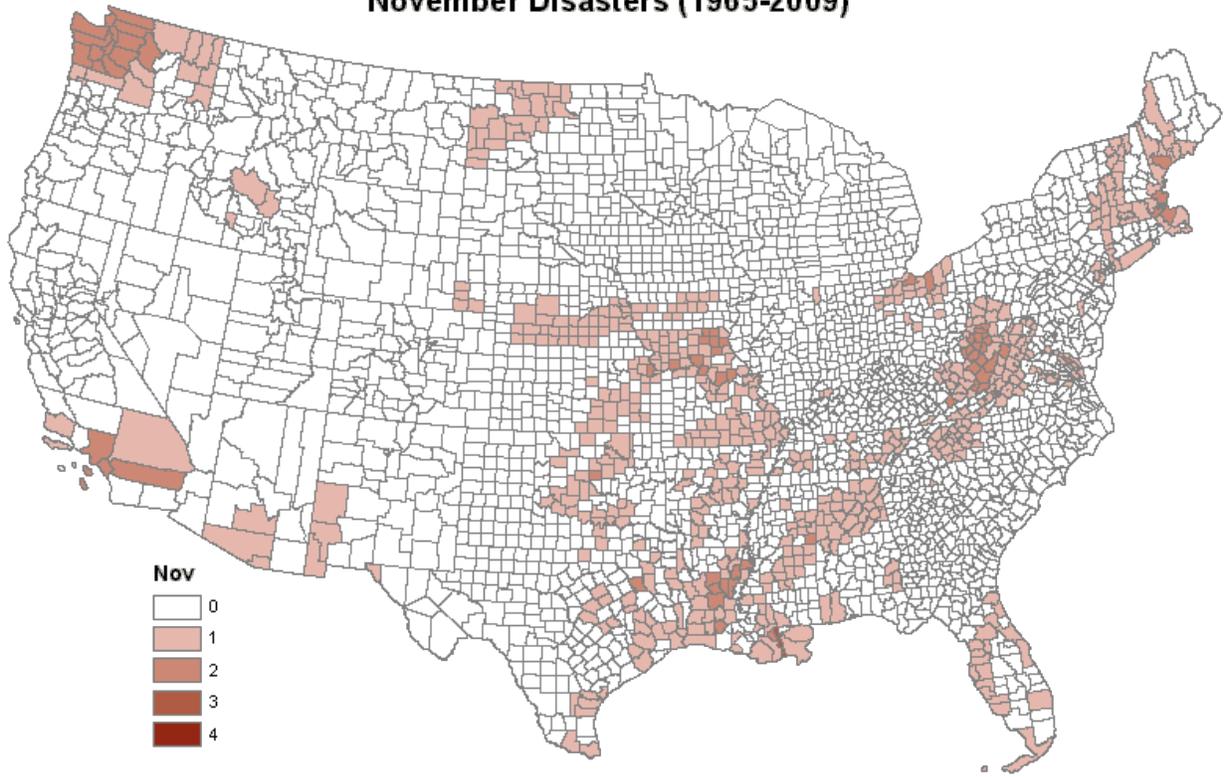
September Disasters (1965-2009)



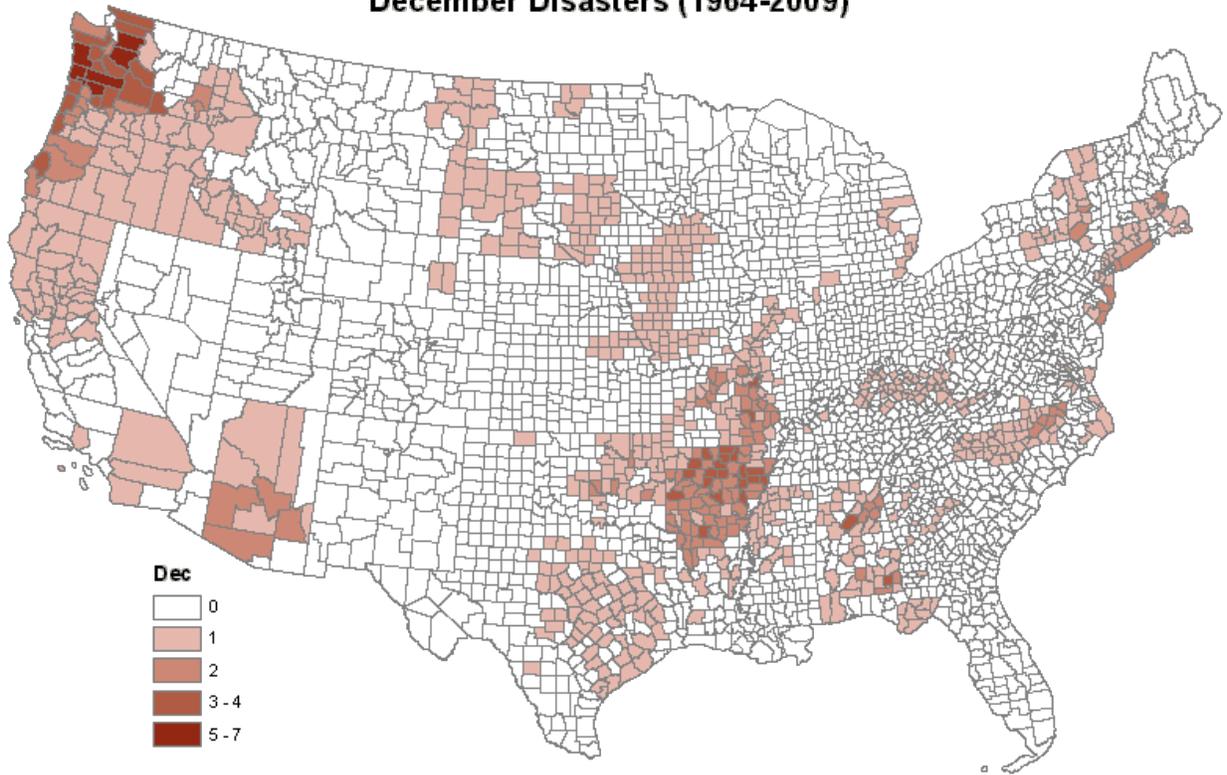
October Disasters (1965-2009)



November Disasters (1965-2009)



December Disasters (1964-2009)



BRIEF DISCUSSION

FEMA's archive of major disaster declarations represents nearly 1,800 separate disaster declarations made across the United States (territories excluded) from May 1953 through December 2009. These declarations play a critical role in providing areas impacted by disasters with funding to recover from an event as well as mitigate the impacts of future events. While declarations encompass a wide variety of types spanning weather and climate hazards (severe weather, winter weather, flooding, wildfires, etc.), geologic hazards (e.g., earthquakes, volcanoes, etc.), ecological hazards (e.g., fish losses), and infrastructure/human hazards (e.g., water shortages, dam breaks, terrorist attack, toxic substances, etc.), weather and climate hazards account for a vast majority of FEMA disaster declarations and represented the primary focus of this geographic assessment.

While all states have experienced a disaster, the regions most frequently impacted in the past have included the Great Plains eastward through the Midwest, the Gulf Coast states, portions of the U.S. East Coast, and the U.S. West Coast. A review of county-level disaster maps reveals interesting disparities across state borders, such as the relative minima (with respect to surrounding states) apparent in states such as Illinois and Georgia. While this assessment does not focus on the causes, these appear to be highly human and policy related. From a decadal standpoint, disaster declarations have been on the increase nationally since the 1950s. In fact, 40 of the 48 contiguous states experienced increases in disasters from 1990-2009 as compared to 1970-1989. There are a variety of possible reasons for these increases, including, but not limited to increases in the capacity of state emergency management agencies, increases in the data available to qualify disasters, increased pursuit of declarations at the state level, and increases in U.S. population and built structures, among many other possible causes.

Because a vast majority of disaster declarations are weather-related events, their frequencies largely follow annual climatological cycles. The year begins with declarations concentrated along the west coast as well as portions of the central and eastern United States in conjunction with winter storms. During March spring storm activity becomes evident throughout the Mississippi Valley and Southeast before expanding in coverage towards the west and north during April, May, and June. In addition to spring storm activity, flooding issues are pronounced along the Red River in the Northern Plains during April through June. During July, disaster declarations are most prevalent throughout the Plains and northern portions of the United States in conjunction with summertime thunderstorm activity. Hurricanes become evident along the Gulf and East Coast beginning in June with a peak in activity during the month of September. Disaster frequencies hit an annual low during the late fall (November) before winter storm activity resumes.

FOR MORE INFORMATION

This research was conducted by the Southern Climate Impacts Planning Program, which is a member of the National Oceanic and Atmospheric Administration (NOAA) Regional Integrated Sciences and Assessments Program (RISA). For more information about SCIPP please visit us at <http://www.southernclimate.org/> or contact us at scipp@mesonet.org.

For more information about NOAA's RISA program, please see the program website at: http://www.climate.noaa.gov/cpo_pa/risa/.