

4.11 SEVERE WEATHER

The term severe weather is used to represent a broad range of weather phenomena in Utah. For the purpose of this mitigation plan, severe weather includes:

- Convective weather (lightning, straight-line wind, hail, tornadoes)
- Winter storms
- Extreme cold
- Extreme heat
- Synoptic winds (gradient, downslope)
- Climate-related hazards

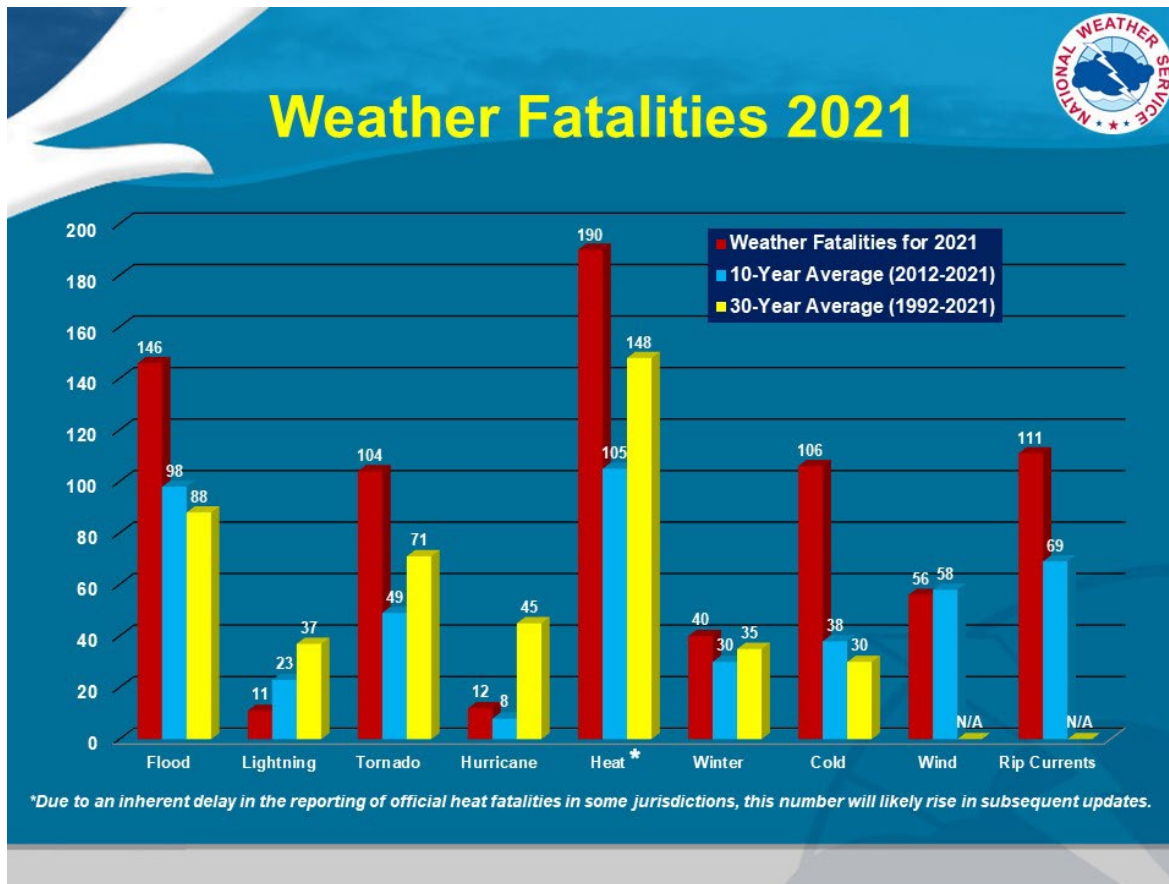
4.11.1 Description

The National Centers for Environmental Information (NCEI) reports that the U.S. has sustained 323 weather and climate disasters from 1980 to 2021, where overall damages/costs reached or exceeded \$1 billion (including CPI adjustment to 2021). The total cost of these 323 events exceeds \$2.195 trillion, an average of \$6.8 billion per event. The National Weather Service's NCEI reports that nearly 98% of presidentially declared disasters are weather-related. The NCEI also reports that in 2021 alone, there were twenty weather events causing over \$1 billion dollars of damage in the United States. The Congressional Research Service reports tornadoes, severe thunderstorms, and related weather events cause nearly 57 percent of all insured catastrophic losses in the United States since 1953.

Weather events vary from state to state, but their impact is not just economic. Hazards induced by weather events such as floods, tornadoes, lightning strikes, winter storms and extreme temperatures claim the lives of around 500 Americans annually. These risks can be mitigated through weather education, warning, and preparedness.

The National Weather Service (NWS) keeps track of weather-related fatalities in the United States. Nationally, the weather event with the highest fatality rate is heat, but in Utah winter storms cause the most deaths. Additionally, the NWS 2021 saw a greater number of fatalities for most hazards than an average year.

Figure 4-95 U.S. Severe Weather Fatalities



Source: NWS, <https://www.weather.gov/hazstat/>

Hail

Hail: Showery precipitation in the form of irregular pellets or balls of ice, more than 5 mm in diameter, falling from a cumulonimbus cloud.

Hail is created when strong, rising currents of air within a storm called updrafts carry water droplets to a height where they freeze. As ice particles grow in size, they become too heavy to be supported by the updraft and fall to the ground.

In the state of Utah, hail has caused over \$6.5 billion in reported property damage and \$200,000 in reported crop damages, as recorded by the NCEI database. The table below summarizes losses from hail across the state of Utah.

Table 4-66 Historic Losses from Hail Events in the State of Utah (1955-2022)

	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	# DAYS WITH EVENTS	TOTAL # OF EVENTS
Hail	0	8	\$6,533,000	\$203,250	306	563

Source: NCEI, 1955-2022

Lightning

Lightning: A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds, between the cloud and the air, or between a cloud and the ground.

Lightning Channel: The irregular path through the air along which a lightning discharge occurs.

Lightning Discharge: The series of electrical processes by which charge is transferred along a channel of high ion density between electrical charge centers of opposite signs.

Lightning Stroke: A series of repeated electrical discharges comprising a single lightning discharge.

Thunder: The sound caused by the rapid expansion, then contraction, of air in the lightning channel.

A bolt of lightning can reach up to 10 miles in length, soar to temperatures of approximately 50,000 degrees Fahrenheit, and contain 100 million electrical volts.

Vaisala Annual Lightning Report 2020 reported that there were 170 million recorded lightning events in the US in 2020. Utah ranks as one of the lowest states in the U.S. for lightning activity (49th), with 319,792 cloud-to-ground lightning flashes in 2020. Although most lightning occurs in the summer, lightning can strike at any time of year. The Center for Disease Control reported that there were 444 lightning strike deaths in the U.S. between 2006 and 2021, and hundreds more were severely injured. Additionally, lightning causes billions of dollars in associated losses by igniting fires and disrupting utility, aviation, and transportation services.

The NCEI reports that lightning has claimed the lives of 21 people in Utah from January 1996 to August 2022, more than any other thunderstorm-related hazard. An additional 42 people suffered lightning-related injuries. Many lightning strikes are also responsible for igniting wildfires across the state. The NCEI also reported over \$1.75 million in property damages across the state. A summary of these losses is recorded in the table below.

Table 4-67 Historic Losses from Lightning Events in the State of Utah (1996-2022)

	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	# DAYS WITH EVENTS	TOTAL # OF EVENTS
Lightning	21	42	\$1,752,200	\$0	70	74

Source: NCEI, 1996-2022

Tornadoes

Tornadoes: A violently rotating column of air, usually pendant to a cumulonimbus, with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise. On a local scale, it is the most destructive of all atmospheric phenomena.

Funnel Cloud: A condensation funnel extending from the base of a towering cumulonimbus, associated with a rotating column of air that is not in contact with the ground.

Tornadoes may appear nearly transparent until dust, debris, and/or moisture are picked up. Tornadoes generally move from southwest to northeast, but they can move in any direction and can suddenly change directions. The average forward speed of a tornado is 30 mph, but they

can vary from nearly stationary to 70 mph. The strongest tornadoes have rotating winds of more than 200 mph.

Tornadoes can occur at any time of day and any day of the year, although in Utah, tornadoes are most likely to occur during late spring, summer, and early fall.

Although tornadoes occur in many parts of the world, they are found most frequently in the United States. The National Weather Service reports that in an average year, 1,000 tornadoes cause 80 fatalities, 1,500 injuries, and \$1.1 billion in damage nationwide.

While Utah has some tornadoes every year, these storms represent a relatively low risk for most areas when compared to states in the mid-western and southern U.S. Hurricanes tend to produce similar wind speeds over widespread areas, but the maximum winds in tornadoes are usually confined to the circulation.

Utah’s Strongest Tornadoes

There have been 12 tornadoes recorded in the state of Utah that have had winds of 111 mph or greater (see Table 4-69 for EF and F rated wind speeds).

- F2 January 22, 1943 Young Ward
- F2 June 16, 1955 Sanpete County
- F2 June 3, 1963 Bountiful
- F2 February 9, 1965 Salt Lake County
- F2 November 2, 1967 Emery
- F2 August 14, 1968 West Weber
- F2 June 10, 1970 Grand County
- F2 May 29, 1987 Lewiston
- F3 August 11, 1993 Uinta Mountains
- F2 August 11, 1999 Salt Lake City
- F2 September 8, 2002 Manti
- EF2 June 19, 2022 Duchesne County

The NCEI dataset has recorded 138 tornado events in the state of Utah from 1950-August of 2022. These events resulted in one fatality, 91 injuries, over \$174.7 million in property damages, and \$607,700 in crop damages. The table below summarizes damages in the state.

Table 4-68 Historic Losses from Tornado Events in the State of Utah (1950-2022)

	FATALITIE S	INJURIE S	PROPERTY DAMAG E	CROP DAMAG E	# DAYS WITH EVENT S	TOTAL # OF EVENT S
Tornadoe s	1	91	\$174,713,920	\$607,700	119	138

Source: NCEI, 1950-2022

The National Weather Service (NWS) has used the Enhanced Fujita Scale (EF Scale) since 2007. The EF Scale goes from zero to five and relies on wind speed to determine the strength of a tornado while the F-scale is based on the amount of destruction a tornado causes on a scale of zero to 12. A set of wind estimates based on damage used to classify tornadoes intensity assigns a category from EF0 through EF5, with higher numbers indicating stronger winds and increased likelihood of property and crop damage, injuries caused by object projectiles and even loss of life.

To determine a tornado’s EF rating, 28 damage indicators and a corresponding Degree of Damage (DOD) are used. The EF Scale table and supporting information can be found at <http://www.spc.noaa.gov/efscale/ef-scale.html>.

Table 4-69 Fujita and Enhanced Fujita Scales

FUJITA SCALE		ENHANCED FUJITA SCALE (2007)	
F0	(40-72 mph)	EF0	(65-85 mph)
F1	(73-112 mph)	EF1	(86-110 mph)
F2	(113-157 mph)	EF2	(111-135 mph)
F3	(158-206 mph)	EF3	(136-165 mph)
F4	(207-260 mph)	EF4	(166-200 mph)
F5	(261-318 mph)	EF5	(>200 mph)

Source: National Weather Service

The table below summarizes significant tornado events in the state from 1950 to August of 2022. These events have either resulted in \$50,000 in damages, injuries, or fatalities.

Table 4-70 Number of Observed Tornadoes by County 1950-2022

COUNTY	EVENTS	COUNTY	EVENTS	COUNTY	EVENTS
Beaver	6	Iron	4	Sevier	4
Box Elder	11	Juab	2	Summit	0
Cache	4	Kane	0	Tooele	5
Carbon	1	Millard	4	Uintah	6
Daggett	1	Morgan	1	Utah	10
Davis	12	Piute	1	Wasatch	0
Duchesne	5	Rich	3	Washington	2
Emery	9	Salt Lake	15	Wayne	8
Garfield	3	San Juan	0	Weber	8
Grand	5	Sanpete	10	TOTAL	142

Source: NCEI, 1950-2022

Straight-line Winds

Straight-Line Winds: All winds produced by a thunderstorm not associated with the rotation of tornadoes. Straight-line winds are responsible for most thunderstorm wind damage, and speeds can exceed 100 mph.

Downburst: A strong downdraft current of air from a cumulonimbus cloud, often associated with intense thunderstorms. Downdrafts may produce damaging winds at the surface. A downburst can cause damage equivalent to a strong tornado.

Microburst: A convective downdraft with an affected outflow area of less than 2½ miles wide and peak winds lasting less than five minutes. Microbursts may induce dangerous horizontal and/or vertical wind shears, which can adversely affect aircraft performance and cause property damage.

Dry Microburst: A microburst with little or no precipitation reaching the earth. On the ground, the only visible sign might be a dust plume or a ring of blowing dust beneath an area.

Table 4-71 Thunderstorm Wind Gusts

Thunderstorm Wind Gust Hazards	
Risk Level	Hazard Description
Low	Chance of a damaging wind gust (>57 mph or 50 kt) is in the 5-15% range. Strong wind gusts expected to be in the 39 to 57 mph (34-49 kt) range.
Moderate	Chance of a damaging wind gust (>57 mph or 50 kt) is in the 15-25% range. Damaging wind gusts expected to be in the 58 to 75 mph (50-64 kt) range.
High	Chance of a damaging wind gust (>57 mph or 50 kt) is greater than 25%. Destructive wind gusts expected to exceed 75 mph (64 kt) range.

Source: National Weather Service: <https://www.weather.gov/mhx/ConvectiveWindGust>

The NCEI dataset has recorded 1,714 straight-line wind events (documented as thunderstorm wind events in the database) in the state of Utah from 1955-August of 2022. These events resulted in 6 fatalities, 43 injuries, over \$67.9 million in property damages, and \$361,300 in crop damages. The table below summarizes damages in the state.

Table 4-72 NCEI Straight-line Winds Summary (1955-2022)

	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	# DAYS WITH EVENTS	TOTAL # OF EVENTS
Straight-line Winds	6	43	\$67,904,650	\$361,300	698	1,714

Source: NCEI 1955-2022

Synoptic Wind Events

High Winds: Speeds created by gradient winds, downslope winds and gap winds can produce catastrophic damage. They also pose a health hazard and can be life threatening.

Gradient High Winds: High winds covering a large area due to synoptic-scale, extra-tropical low-pressure systems.

Gap Winds: Strong winds channeled through gaps in mountain ranges.

Downslope Winds: Winds generated as a deep layer of air is forced over a barrier. In these events, winds accelerate down the mountain and form a wave at the base of the terrain, with the strongest winds expected in the wave region.

In total, the NCEI database reported that high winds and strong winds resulted in 4 fatalities, 109 injuries, \$127,843,600 in property damages, and \$1,110,000 in crop damages from 1996 to 2022. A summary of events is detailed in the table below. Table 4-73 highlights the events that resulted in \$50,000 or more in damages. It is important to note that the NCEI records synoptic wind events on a zonal scale, therefore, events may be duplicated in the database.

Table 4-73 NCEI Synoptic Wind Events Summary

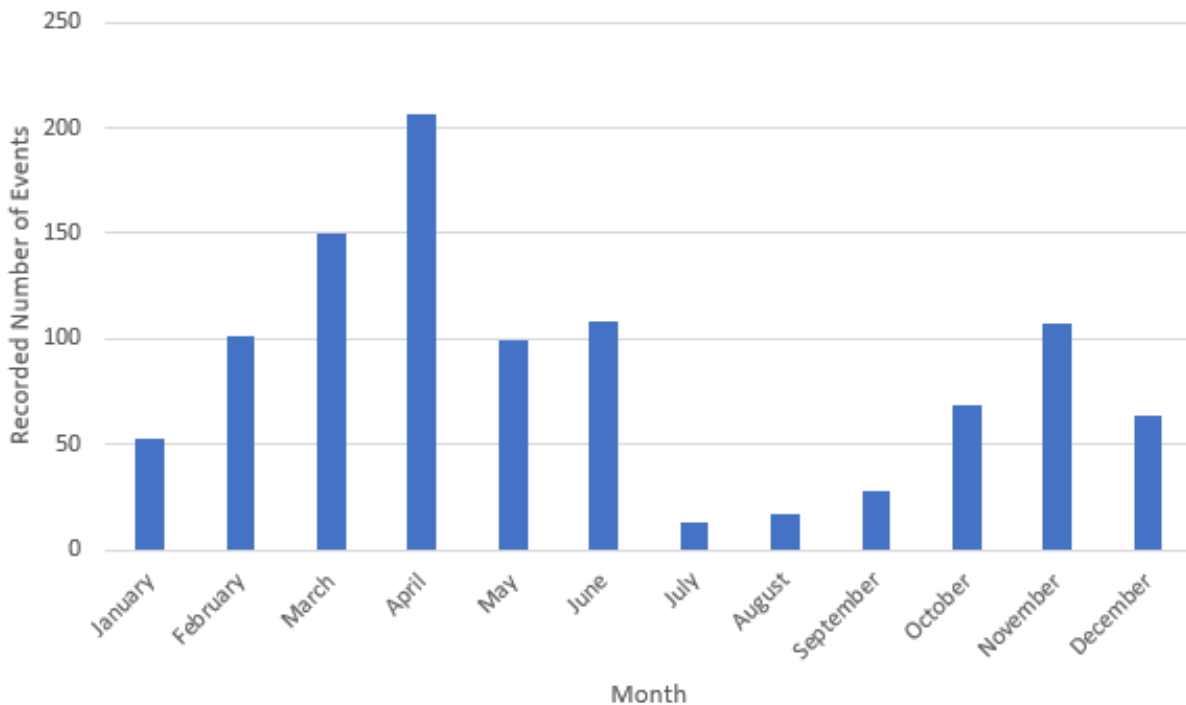
	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	# DAYS WITH EVENTS	TOTAL # OF EVENTS
High Wind	4	105	\$127,542,100	\$1,110,000	378	964

	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	# DAYS WITH EVENTS	TOTAL # OF EVENTS
Strong Wind	0	4	\$235,500	\$0	24	34
Total	4	109	\$127,777,600	\$1,110,000	393*	998

Source: NCEI 1996-2022

Figure 4-96 shows the number of recorded synoptic wind events in Utah by month of the year. The highest number of wind events occurred in the spring months, with a peak number of events in April followed by March.

Figure 4-96 Temporal Trend of Synoptic Wind Events by Month in Utah (1996-2022)



Source: NCEI, 1996-2022

Winter Storm and Extreme Cold

Blizzard: Sustained wind or frequent gusts of 35 miles an hour or greater and considerable falling and/or blowing snow, reducing visibility to less than ¼ mile and prevailing for a period of 3 hours or longer.

Blowing Snow: Wind-driven snow that reduces surface visibility. Blowing snow can be falling snow, or snow that has already accumulated and is picked up and redistributed by strong winds. Blowing snow is usually accompanied by drifting snow.

Freeze: The condition that exists when, over a widespread area, the surface temperature of the air remains below freezing (32°F/0°C) for a sufficient time to constitute the characteristic feature of the weather. **Ice Storm:** An ice storm is used to describe occasions when damaging accumulations of ice are observed or expected during freezing rain situations.

Lake Effect Snow: Localized, convective snow bands that occur in the lee of lakes when relatively cold airflows over warm water.

Frostbite: Human tissue damage caused by exposure to intense cold. Frostbite causes a loss of feeling and a white or pale appearance in extremities, such as fingers, toes, ear lobes or the tip of the nose.

Hypothermia: A rapid, progressive mental and physical collapse that accompanies the lowering of body temperature. The warning signs of hypothermia include low body temperature, uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion.

FEMA reports that, in an average year, winter weather is directly or indirectly involved in over 540,000 vehicular accidents in the United States leading to 1,900 fatalities and over 146,000 injuries. Additional loss of life can be caused by avalanches and exposure to cold. Annual economic losses total in the billions resulting from snow removal, road closures contributing to lost retail, wages and tax revenue, flight cancellations and delays, damage to utilities, flooding from snowmelt, and agriculture and timber damage.

Ice storms can bring down trees, topple utility poles and towers and disrupt communications and power for days while utility companies work to repair the damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze and become slick before other surfaces.

In total, the NCEI database reported that winter weather has resulted in 23 fatalities, 467 injuries, over \$52.7 in property damages, and nearly \$400,000 in crop damages from 1996 to 2022. Table 4-74 summarizes these events.

Table 4-74 Summary of Winter Weather Events (1996-2022)

	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	# DAYS WITH EVENTS	TOTAL # OF EVENTS
Blizzard	3	50	\$40,000,000	\$0	7	34
Ice Storm	0	0	\$0	\$0	4	6
Winter Storm	20	417	\$12,595,000	\$298,000	357	1,561
Winter Weather	0	0	\$120,000	\$0	409	672
Cold/Wind Chill	0	0	\$60,000	\$100,000	6	40
Extreme Cold/Wind Chill	0	0	\$0	\$0	1	3
Total	23	467	\$52,775,000	\$398,000	784	2,316

Source: NCEI, 1996-2022

Winter storms are considered deceptive killers because most deaths are indirectly related to the storm. Fatalities occur to individuals involved in traffic accidents caused by icy roads, heart attacks brought on by the exertion of shoveling snow and hypothermia due to prolonged exposure to the cold. The NOAA reports that, of all fatalities related to ice and snow, about 70% occur in automobiles and 25% are a result of people caught out in the elements. Most winter storm fatalities occur in males over age 40. Fifty percent of all exposure-related deaths are

people over age 60 and more than 75% of victims are male. About 20% of winter fatalities occur inside the home, primarily when people leave space heaters on that catch fire or die of carbon monoxide poisoning from furnaces that aren't properly ventilated.

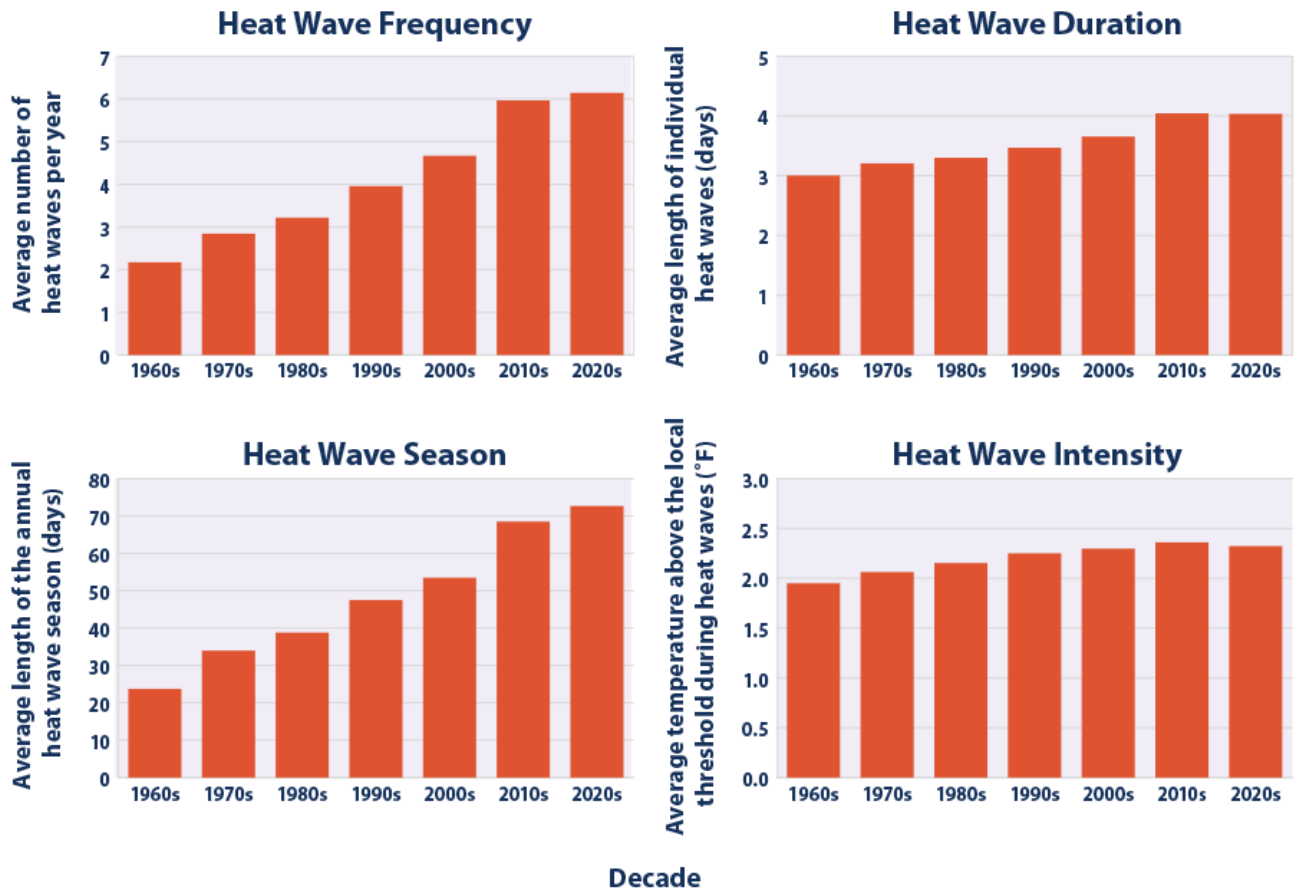
Freeze hazards occur when temperatures are below freezing for a sustained period causing harm to Utah's vulnerable agriculture, like fruit trees. Below freezing temperatures does serve a purpose in killing off some infestations, pests, and pathogens during the winter months but sustained periods of freezing temperatures occurring during spring growing seasons can cause extensive crop damage. Secondary impacts of freezes include major economic impacts on farmers, farm workers, packers and shippers of agricultural products leading to increases in food prices for consumers or shortages.

Extreme Heat

Heat waves do not cause damage or elicit the immediate response that floods, fires, earthquakes, and other disasters do but they can be more deadly than other severe weather. Heat is the leading weather-related killer in the United States. The CDC reports that extreme heat is responsible for over 600 fatalities each year in the US. In extreme heat and high humidity evaporation is slowed and the body must work overtime to maintain a normal temperature and avoid heat-related illnesses and death.

The United States Environmental Protection Agency (EPA) reports on heat wave trends across the United States by decade from 1961-2021. The trends show an increase in heat wave duration, frequency, length of season, and intensity. The figure below summarizes these events.

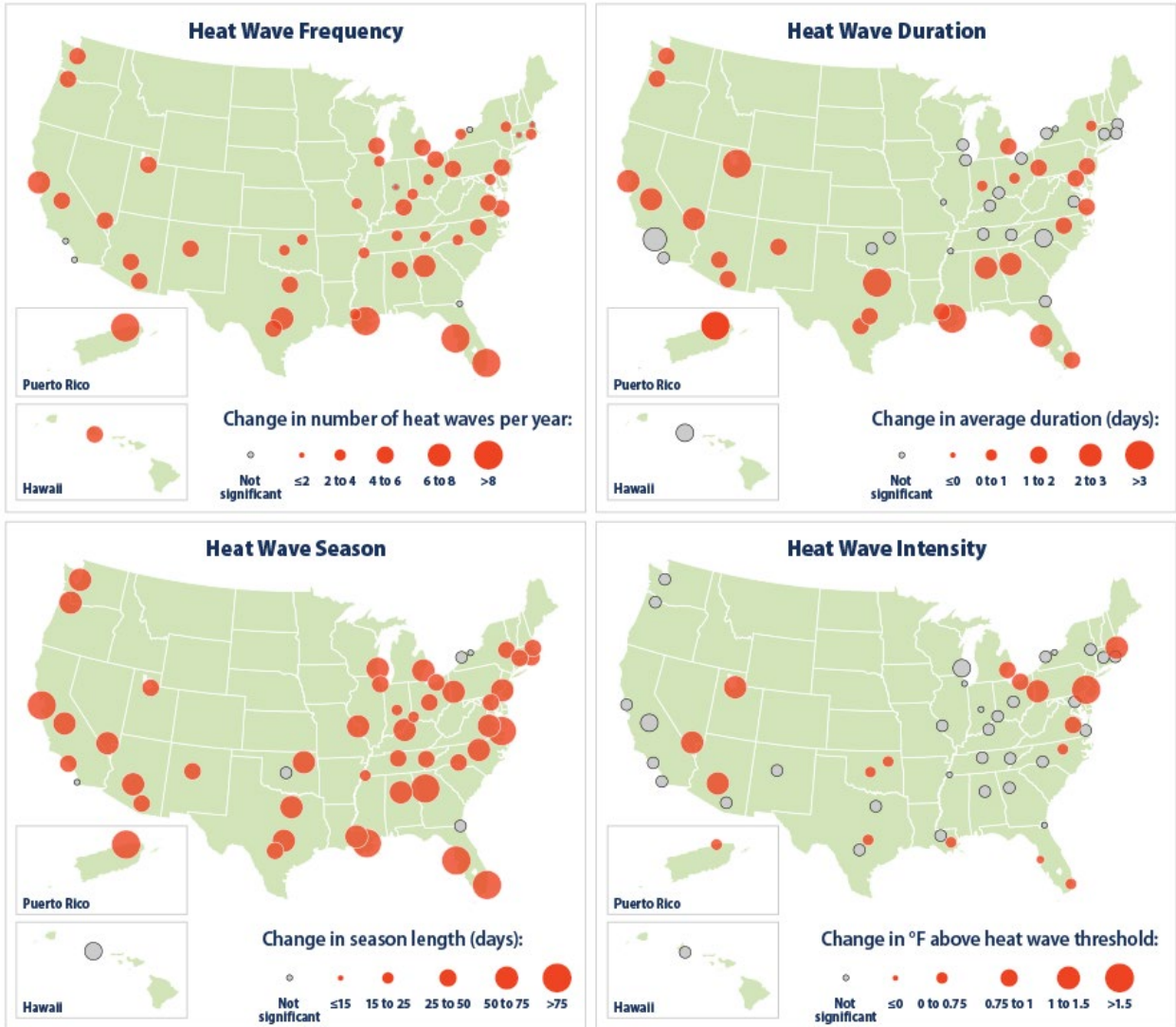
Figure 4-97 Heat Wave Trends in the U.S. (1961-2021)



Source: U.S. EPA

The U.S. EPA analyzed the above trends in 50 large metropolitan cities across the country. Salt Lake City was analyzed in this study, which indicated that heat wave frequency, duration, intensity, and length of season have been increasing in the city.

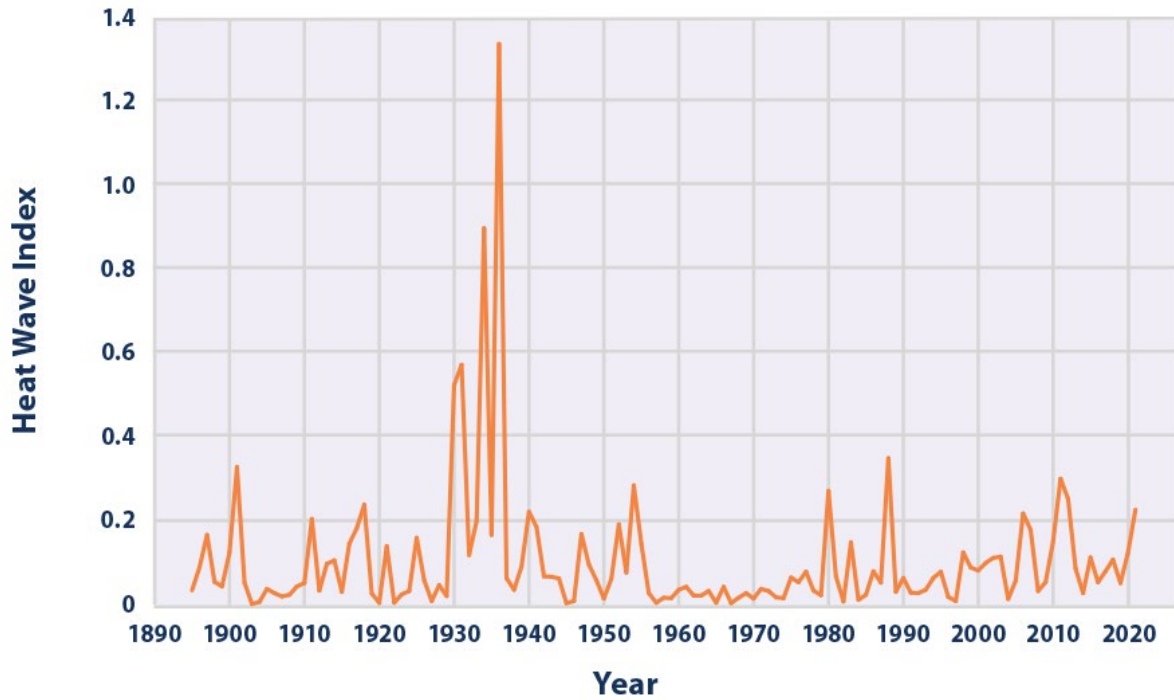
Figure 4-98 Heat Wave Trends in 50 Large Cities in The United States



Source: U.S. EPA

The U.S. EPA collected data on the annual values of the U.S. Heat Wave Index from 1895 to 2021, shown in the figure below. A heat wave index value of 0.3 (for example) could mean that 30% of the contiguous United States experienced one heat wave, 10 percent of the country experienced three heat waves, or some other combination of frequency and area resulted in this value.

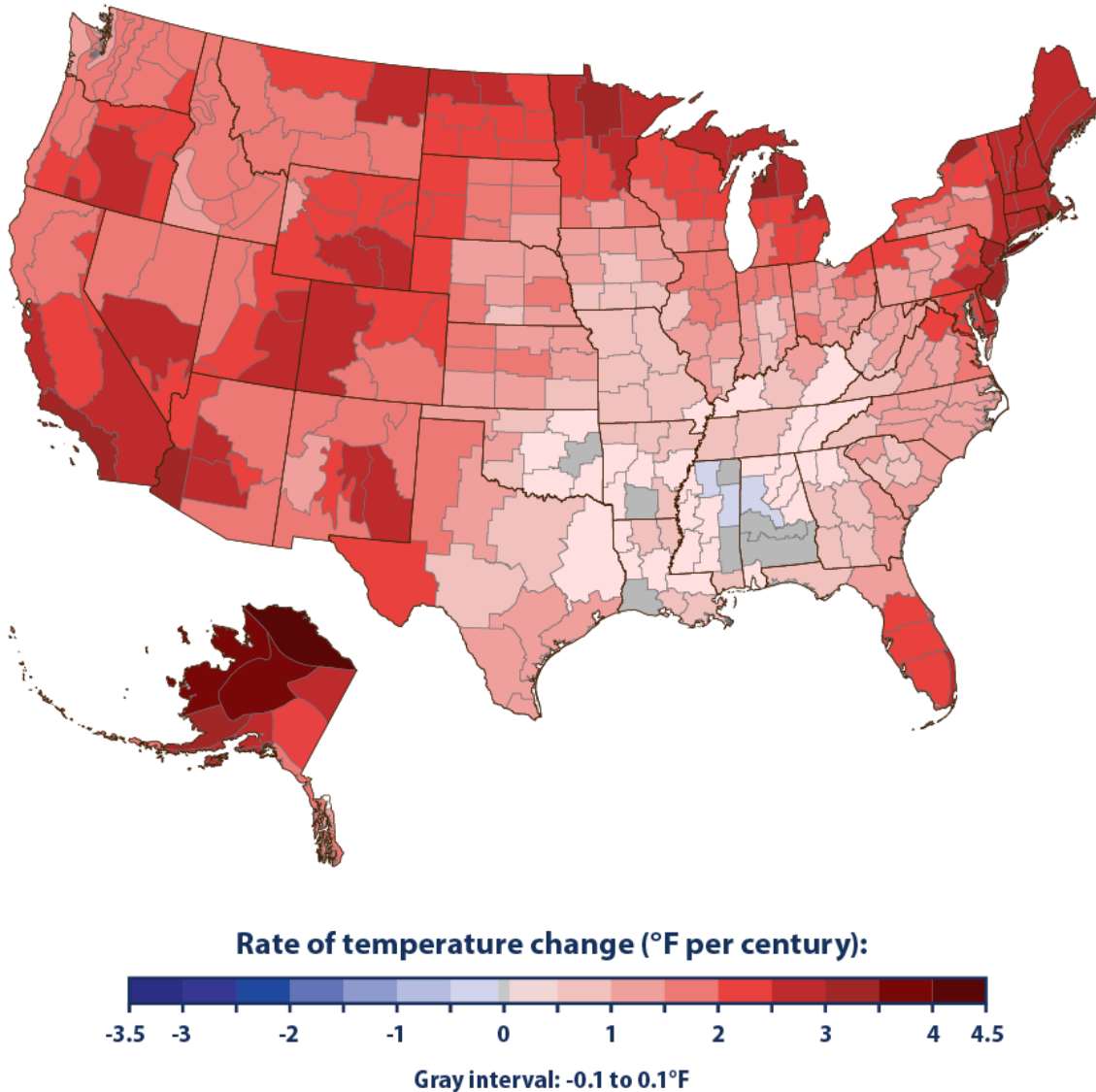
Figure 4-99 Heat Wave Index 1895 - 2021



Source: US Annual Heat Wave Index 1895 - 2021

The U.S. EPA reports on air temperature changes across the United States. The figure below presents the temperature changes aggregated by climate divisions, which are defined by the NOAA. Nearly all states in the U.S. have been experiencing warmer air temperatures. Utah has been experiencing an increase in temperature change by 1-3 degrees F per century.

Figure 4-100 Rate of Temperature Change in the US 1901 – 2021



Source: EPA, NOAA

Groups typically identified as “heat sensitive” or “heat vulnerable” include the elderly and children, people on certain medications and/or with preexisting conditions which make them sensitive to heat, outdoor workers and those exercising or doing strenuous activities, people without a reliable source of cooling and/or water and people not acclimated to the high temperatures. Additionally, some economic sectors are also affected by increasing high temperatures such as individuals employed in the energy and transportation industries.

Several factors influence the impacts of a heat event including how significantly above normal high temperatures are, the time of year and the duration of the unusual heat. When the Heat Index is 90°F, heat exhaustion is possible with prolonged exposure and/or physical activity. Heat exhaustion occurs when the body is dehydrated resulting in an imbalance of electrolytes. Symptoms include headache, nausea, dizziness, cool and clammy skin, flushed face, cramps, weakness, rapid pulse, and profuse perspiration. First aid to treat heat exhaustion involves

moving to a cooler spot, wrapping the individual in a cool, wet sheet, calling for medical assistance and giving the patient drinking water with a small amount of salt added (one teaspoon per quart). Without intervention, heat exhaustion can lead to collapse and heatstroke if perspiration is impeded as the body overheats causing confusion, coma and death.

Heat events do not get emergency disaster declaration status, although they can be deadly for human populations and devastating for agriculture. Vulnerable populations may include people with developmental or intellectual disabilities including cerebral palsy, epilepsy, and autism. Those with vision or hearing impediments, mobility limitations, chronic health conditions like diabetes, arthritis, dialysis and asthma, adults with age-related limitations and children are all more susceptible to heat events. Animals including domestic pets, livestock and poultry are also susceptible to extreme heat and can have economic implications for Utah's agricultural economy. As temperatures rise, Utahans will face greater risk of death from dehydration, heat stroke/exhaustion, heart attack, stroke and respiratory distress caused by extreme heat. By mid-century, extreme heat events in urban centers could cause two to three times more heat-related deaths than occur today. By 2100, hotter temperatures are expected throughout the state, with an increase of 3 to 5.5°F if the state adopts lower emissions standards and 8 to 10.5°F with current emission standards.

Additional Consequences: Energy Shortages and Outages

Rocky Mountain Power reported on March 6th, 2022, that roughly 30,000 customers in Southern Utah, Idaho, and Wyoming experienced power outages due to heavy, wet snow accumulating on power equipment and trees. Rolling blackouts are a last resort measure by an electric utility company to avoid a total blackout of the power system when the demand for electricity exceeds the power supply capability of the network. Heat waves and rolling blackouts are becoming increasingly common in neighboring states like California. In July 2006 a heat storm event affected most Western states, producing record energy demand levels in California, Arizona, and Utah. Secondary impacts of energy shortages most often affect vulnerable populations including individuals who rely on electric powered life-saving medical equipment. During periods of extreme heat emergencies, the elderly and the very young are also more vulnerable to the loss of cooling systems requiring power sources. With climate warming, higher costs from increased demand for cooling homes and businesses in the summer are expected to outweigh the decreases in heating costs in the cooler seasons. Educating the public about power usage and pleas for energy conservation can mitigate rolling blackouts and help prevent traffic, flight, and public transportation disruptions.

4.11.2 Geographic Area

The geographic extent of severe weather is extensive. The entire state of Utah is vulnerable to severe weather, but there are regional variations apparent when looking at the frequency of events. Some types of hazards occur on a regional scale and typically impact several/all counties in the planning area at once such as extreme heat and cold events. Other hazards, such as lightning, hail, and tornadoes tend to impact smaller areas per event. Lightning tends to strike a single point and it is rare for lightning to strike people or property multiple times in one storm event. Hail and heavy rain generally occur in small pockets of an accompanying storm. Despite variations in the scale of impact per each weather event, all counties in the state of Utah are vulnerable to severe weather events.

4.11.3 Extent/Magnitude

There are variations in the extent for severe weather events in the state of Utah. The extent scales that are described previously in Section 4.11.1 include:

Table 4-75 Summary of Severe Weather Extent/Magnitude

SEVERE WEATHER SUB-HAZARD	EXTENT SCALE	NOTES ON TYPICAL AND MAXIMUM EXTENT LEVEL
Hail	Tornado and Storm Research Organization Hailstorm Intensity Scale	Sizes of 1 to 2 inches do the most damage based on past events, but larger diameter hail is possible. Event of greatest magnitude caused \$5.5 million in reported damages in 1994.
Lightning	Lightning Activity Level	No magnitude scale, but statewide Utah averages 4.2 lightning strikes per km ² per year. Typically, higher frequency in the more mountainous counties.
Tornadoes	Fujita and Enhanced Fujita Scales	Tornadoes of EF2 are most typical but up to EF5 could be possible
Straight Line Winds	NWS thunderstorm wind gusts	Highest wind speed recorded 105.8 mph, according to NCEI. Average, based on notable events record, is 71 mph.
Synoptic Winds	Beaufort scale	Highest wind speed recorded 110.5 mph, according to NCEI. Average, based on notable events record, is 76.5 mph.
Winter Storm	No defined scale but NWS definitions of types of storms	Blizzards are the most damaging and have occurred frequently throughout the state. Snowfall totals of 12 inches or greater in a single event are also common. Damages resulting from frozen pipes, closed roads and transportation accidents, and collapsed roofs are also possible. The greatest magnitude event occurred in 1997 and resulted in 50 injuries, 3 deaths, and \$40 million in reported damages.
Extreme Cold	No defined scale. NWS Wind Chill Chart describes felt temperatures.	The coldest recorded temperature in Utah was -69 °F. Below freezing and subzero temperatures occur in the state on an annual basis.
Extreme Heat	NWS HeatRisk Prototype	The highest recorded temperature in Utah was 117 °F. Temperatures above 100 °F occur in the state on an annual basis.

As highlighted above, severe weather can result in significant economic damages, crop damages, injury, and death. Some types of severe weather are more destructive than others. The NCEI dataset reported that severe winter weather resulted in the greatest number of injuries (467) and deaths (23) in the state from 1996-2022. Many of these injuries and fatalities were as a result of traffic accidents caused by poor road conditions due to weather. Tornado events caused the greatest total property damages (over \$174.7 million) from 1950-2022. The least destructive severe weather hazards reported in the state were hail and heat, both of which still resulted in injury, and hail resulted in more than \$6.5 million in property damages.

4.11.4 Past Occurrences

Hail

The table below summarizes hail events in Utah from 1955-2022 that resulted in \$10,000 or more in losses. While there have been 59 hail events recorded since the previous plan (from May 2017-August 2022), only one of these events resulted in reported damages, but this is likely not inclusive of insured losses.

Table 4-76 Utah Hail with Recorded Damage \$10,000 or more 1955-2022

DATE	LOCATION	COUNTY	SIZE (INCHES)	PROPERTY DAMAGE (ESTIMATE)	CROP DAMAGE (ESTIMATE)
8/17/2021	Beaver	Beaver	2	\$20,000	\$0
4/28/2016	Beaver	Beaver	0.25	\$25,000	\$0
5/16/2014	Maeser	Uintah	1.5	\$20,000	\$0
9/22/2013	Montezuma Creek	San Juan	1.5	\$20,000	\$0
9/17/2013	Blanding	San Juan	1.75	\$20,000	\$0
9/17/2013	(4Bl) Blanding Muni A	San Juan	1.75	\$20,000	\$0
9/17/2013	Maeser	Uintah	1.75	\$30,000	\$0
9/17/2013	Vernal	Uintah	1.5	\$20,000	\$0
8/3/2010	Loa	Wayne	1	\$20,000	\$0
8/6/2009	(Vel)Vernal Arpt	Uintah	1.75	\$100,000	\$40,000
8/6/2009	Dutch John	Daggett	1.75	\$80,000	\$0
8/6/2009	Manila	Daggett	1.25	\$20,000	\$0
6/21/2009	Jensen	Uintah	1.75	\$20,000	\$0
6/21/2009	Randlett	Uintah	1.75	\$0	\$20,000
9/29/2004	Kanab	Kane	0.01	\$20,000	\$0
7/15/2004	Manila	Daggett	1.25	\$30,000	\$0
6/21/2004	Brigham City	Box Elder	0.01	\$24,000	\$0
9/21/2000	Cisco	Grand	1	\$10,000	\$0
9/3/1999	Naples	Uintah	1.75	\$40,000	\$0
8/26/1998	American Fork	Utah	1.25	\$300,000	\$100,000
9/8/1997	Hatch	Garfield	0.75	\$10,000	\$0
9/7/1997	American Fork	Utah	1.5	\$25,000	\$0
9/6/1997	Paradise	Cache	1	\$10,000	\$0
8/17/1997	South Jordan	Salt Lake	1	\$10,000	\$0
7/10/1997	Yost	Box Elder	1.75	\$30,000	\$30,000
6/10/1997	Caineville	Wayne	2	\$15,000	\$0
6/10/1997	Salt Lake City	Salt Lake	1	\$15,000	\$0
7/26/1996	(Cdc)Cedar City Arpt	Iron	1	\$50,000	\$0
10/5/1994	Salt Lake City	Salt Lake	0.75	\$500,000	\$0
10/5/1994	Cottonwood Hts	Salt Lake	1	\$5,000,000	\$0

Source: NCEI, 1955-2022

Lightning

The NCEI reported 4 lightning events in the state of Utah since 2018, but the database is known to have gaps in information due to reporting inconsistencies. A full list of lightning events in the state from 1996 to 2022 is presented in the table below.

Table 4-77 Utah Lightning Fatalities, Injuries, and Property Damage

DATE	LOCATION	COUNTY	FATALITIES	INJURIES	PROPERTY DAMAGE
7/22/2021	St. George	Washington	0	0	\$10,000
6/24/2021	Potash	Grand	0	2	\$0
6/7/2020	Cedar Valley	Utah	0	1	\$0
4/7/2018	Santa Clara	Washington	0	0	\$400,000
7/29/2017	Beaver	Beaver	0	2	\$0
7/22/2016	Lucerne Valley	Daggett	1	1	\$0
10/18/2015	Minersville	Iron	0	0	\$8,000
8/30/2015	Lehi	Utah	1	0	\$0
5/28/2015	West Pt	Davis	0	0	\$2,000
7/15/2013	Roper	Salt Lake	0	0	\$5,000
7/15/2013	Altamont	Duchesne	0	0	\$80,000
7/6/2013	Uintah	Weber	0	0	\$20,000
5/7/2013	Bennion	Salt Lake	0	0	\$200
5/7/2013	Salt Lake City Intl	Salt Lake	0	0	\$5,000
7/29/2012	Pineview	Summit	0	1	\$0
7/21/2012	Boulder	Garfield	1	0	\$0
8/19/2011	Wilson	Weber	0	1	\$0
8/18/2011	Bryce Canyon	Garfield	1	0	\$0
7/13/2011	Utah Railway Jct	Carbon	1	1	\$0
7/11/2011	Cleveland	Emery	1	0	\$0
4/25/2011	Ellerbeck	Tooele	0	0	\$50,000
10/5/2010	Santa Clara	Washington	0	2	\$0
8/4/2010	Moab	Grand	0	0	\$2,000
8/24/2009	Spring Lake	Utah	0	1	\$5,000
6/26/2009	Monticello	San Juan	0	0	\$100,000
5/30/2009	Manila	Daggett	0	0	\$500
7/6/2008	Richfield	Sevier	0	1	\$0
6/3/2008	Dutch John	Daggett	0	0	\$1,000
10/13/2007	Pineview	Summit	1	2	\$0
7/21/2007	Manila	Daggett	0	0	\$500
6/6/2007	Manila	Daggett	0	0	\$500
8/2/2005	Mountain Home	Duchesne	1	0	\$0
6/23/2005	Dutch John	Daggett	0	0	\$500
6/21/2005	Salina	Sevier	0	1	\$0

DATE	LOCATION	COUNTY	FATALITIES	INJURIES	PROPERTY DAMAGE
5/30/2005	Dutch John	Daggett	0	0	\$500
5/17/2005	Dutch John	Daggett	0	0	\$500
5/6/2005	Dutch John	Daggett	0	0	\$500
5/5/2005	Ballard	Uintah	0	0	\$3,000
8/1/2004	Heber City	Wasatch	0	0	\$15,000
6/20/2004	Manila	Daggett	0	0	\$2,000
10/1/2003	Central Portion	Wasatch	1	0	\$0
8/29/2003	Central Portion	Utah	0	1	\$0
8/14/2003	Central Portion	Summit	1	2	\$0
8/3/2003	North Ogden	Weber	0	0	\$15,000
7/19/2003	Central Portion	Summit	2	3	\$0
7/19/2003	La Sal Jct	San Juan	0	0	\$1,000
7/25/2002	Countywide	Salt Lake	2	0	\$0
6/26/2001	Fairview	Sanpete	0	1	\$0
8/23/2000	Central Portion	Tooele	2	4	\$0
8/16/2000	Bryce Canyon	Garfield	0	1	\$0
7/22/2000	Moab	Grand	0	0	\$2,000
7/10/2000	Layton	Davis	0	0	\$100,000
7/9/2000	Moab	Grand	0	0	\$100,000
6/9/2000	Myton	Duchesne	0	0	\$200,000
5/29/2000	Ballard	Uintah	0	0	\$10,000
5/25/2000	Orem	Utah	0	0	\$1,500
5/24/2000	Midvale	Salt Lake	1	6	\$0
5/24/2000	Midvale	Salt Lake	0	1	\$0
7/14/1999	Crescent Jct	Grand	0	0	\$0
5/29/1999	Cisco	Grand	1	0	\$0
5/4/1999	South Ogden	Weber	0	1	\$0
5/2/1999	Midvale	Salt Lake	0	0	\$5,000
4/26/1999	Kaysville	Davis	0	0	\$50,000
10/3/1998	Alpine	Utah	0	1	\$100,000
9/1/1998	Santa Clara	Washington	0	0	\$10,000
8/26/1998	Holladay	Salt Lake	0	1	\$10,000
7/10/1998	Draper	Salt Lake	1	2	\$0
6/3/1998	Orem	Utah	0	0	\$50,000
10/23/1997	Salt Lake City	Salt Lake	0	0	\$26,000
9/7/1997	Orem	Utah	0	0	\$10,000
8/13/1997	Holladay	Salt Lake	0	0	\$300,000
7/18/1997	Neola	Duchesne	1	2	\$0
5/20/1997	Bountiful	Davis	0	0	\$50,000
8/17/1996	Moab	Grand	1	0	\$0

DATE	LOCATION	COUNTY	FATALITIES	INJURIES	PROPERTY DAMAGE
Total			21	42	\$1,752,200

Source: NCEI, 1996-2022

Since the previous plan, four lightning events have been documented in the State of Utah, resulting in \$410,000. Details were provided by the NCEI database on these events:

- **July 22nd, 2021:** Lightning struck a home in St. George and blew a hole in the roof, starting a fire. The damages were estimated to total \$10,000.
- **April 7th, 2018:** Lightning struck a home, resulting in a fire that caused significant damages to a home in St. George. Damages were estimated to cost \$400,000.

Tornadoes

Table 4-78 Tornadoes by Cost \$50,000 and/or with Injuries or Fatalities 1950 to August 2022

HAZARD DATE	COUNTY	EF/F SCALE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
9/2/2021	Davis	EF1	0	0	0	\$750,000
9/22/2016	Weber	EF1	5	0	\$2,000,000	\$0
9/22/2016	Garfield	EF1	0	0	\$300,000	\$0
9/8/2002	Sanpete	F2	0	0	\$2,000,000	\$100,000
5/25/2000	Salt Lake	F0	0	0	\$100,000	\$0
9/3/1999	Uintah	F1	1	0	\$700,000	\$0
8/11/1999	Salt Lake	F2	80	1	\$170,000,000	\$500,000
8/20/1998	Weber	F1	6	0	\$10,000	\$2,000
5/29/1996	Weber	F1	1	0	\$600,000	\$0
5/29/1996	Davis	F0	0	0	\$100,000	\$0
8/11/1993	Duchesne	F3	0	0	\$50,000	\$0
6/2/1993	Davis	F1	2	0	\$2,750	\$0
5/3/1993	Tooele	F1	0	0	\$275,000	\$0
4/4/1993	Wayne	F1	0	0	\$50,000	\$0
4/23/1990	Weber	F0	1	0	\$27,500	\$0
7/8/1989	Salt Lake	F1	0	0	\$2,750	\$0
4/19/1970	Sevier	No Data	1	0	\$275	\$0
8/14/1968	Weber	No Data	1	0	\$25,000	\$0
7/6/1884	Summit	No Data	2	1	No Data	No Data

Storm Data publication of National Centers for Environmental Information, National Oceanic and Atmospheric Administration

The table below summarizes all tornado events in the State of Utah from 1869 to August 2022 with descriptions as provided by the NCEI database.

Table 4-79 Utah Tornado History

DATE	LOCATION	COMMENTS
August 1869	American Fork Canyon	The first recorded mention of tornadic activity in Utah, when a “funnel-shaped waterspout” traveled up the canyon and destroyed seven bridges along the way.
July 6, 1884	near Wanship	A tornado damaged trees and caused one fatality.
May 27, 1941	Bountiful	A tornado caused \$5,000 in damage to farm buildings and power lines.
Jan. 22, 1943	Young Ward	An F2 tornado touched down.
June 5, 1953	Davis County	An F0 tornado touched down.
July 14, 1953	Kanarrville	A small twister broke tree limbs and tore a metal roof off a garage.
May 25, 1954	Laketown	A tornado damaged an eight-block area. Trees were uprooted and buildings flattened.
June 1, 1955	Uintah County	A tornado was reported.
June 16, 1955	Fayette	Two funnel clouds damaged trees and sheds.
Aug. 7, 1957	Salina	A small tornado blew the roofs off a processing plant and a service station.
May 4, 1961	Emery County	A tornado was reported.
July 9, 1962	Grouse Creek	A tornado tore up ground in an uninhabited area for 15 minutes.
June 3, 1963	Bountiful	A tornado hit Bountiful Elementary School, tore the roof off the school and caused \$20,000 in damage. No one was injured. The twister also damaged homes, and one-inch hail after-ward broke windows and damaged cars.
Aug. 28, 1964	Gunnison	A tornado damaged a chicken coop, broke windows and tore the roof off a garage.
Feb. 9, 1965	Magna	A small tornado destroyed a three-car garage. No one was hurt and three vehicles parked inside were not damaged.
June 23, 1965	Woodruff	A tornado overturned a trailer and then moved across open fields before lifting into the air.
June 25, 1965	Tooele County	A tornado was reported.
July 9, 1965	Provo Canyon	A tornado in the Vivian Park area damaged trees, vegetation and power lines over a three-mile path.
Aug. 9, 1965	Tooele County	A tornado was reported.
April 17, 1966	Springville	A tornado touched down, breaking large trees and lifting the roof off a house.
May 9, 1966	Emery County	A tornado was reported.
June 16, 1967	Iron County	A tornado was reported.
Nov. 2, 1967	Emery	The Last Chance Hotel was destroyed by an F2 tornado, though no one was injured.
May 22, 1968	Tooele County	A tornado was reported.
Aug. 14, 1968	Box Elder County	A tornado was reported.

DATE	LOCATION	COMMENTS
Aug. 14, 1968	Salt Lake City	A tornado tore up trees in Pioneer Park and moved toward Temple Square, blowing out windows along the way.
Aug 14, 1968	West Weber	An F2 tornado unroofed a milking barn and lifted a man and boy off the ground. It also carried a horse over a fence and into another pasture, destroyed a barn and a house and caused \$50,000 in damages.
May 31, 1969	Wayne County	Three tornadoes were reported.
April 19, 1970	Annabella	A woman was carried 30 feet by an F1 tornado and then dropped. She received only minor injuries. The twister also damaged two trailers.
June 5, 1970	Box Elder County	A tornado was reported.
June 10, 1970	Davis County	A tornado was reported.
June 10, 1970	Thompson Springs	An F2 tornado damaged trees, leveled two sheds and destroyed a mobile home.
Dec. 2, 1970	Utah County	An F1 tornado was reported.
Sept. 2, 1971	Utah County	An F0 tornado was reported.
May 6, 1981	Cache County	An F1 tornado was reported.
July 24, 1981	Hanksville	An F0 tornado was spotted but caused no damage.
Mar. 29, 1982	Beaver County	An F0 tornado was reported.
May 3, 1982	Beaver County	An F0 tornado was reported.
Sept. 13, 1982	Utah County	An F0 tornado was reported.
Aug. 13, 1984	near Provo	An F0 tornado touched down five miles south of Provo but produced no damage.
Aug. 15, 1984	Sanpete County	An F0 tornado was reported.
Aug. 16, 1984	Box Elder County	Two F0 tornadoes were reported.
Sept. 11, 1984	near Myton	An F0 tornado overturned a car and truck.
May 30, 1986	Iron County	An F1 tornado was reported.
May 30, 1986	Washington County	An F1 tornado was reported.
Aug. 31, 1986	Wayne County	An F0 tornado was reported.
Sept. 9, 1986	Salt Lake County	An F0 tornado was reported.
May 29, 1987	Cache County	An F1 tornado was reported.
Aug. 25, 1987	Box Elder County	An F0 tornado was reported.
Aug. 25, 1987	Cache County	An F0 tornado was reported.
May 29, 1988	Uintah County	An F0 tornado was reported.
Jan. 10, 1989	Sandy	An F1 tornado damaged one home in the Hidden Valley Estates subdivision.

DATE	LOCATION	COMMENTS
Mar. 2, 1989	Salt Lake County	An F1 tornado was reported.
May 11, 1989	Davis County	An F0 tornado was reported.
June 7, 1989	Millard County	An F0 tornado was reported.
July 8, 1989	Midvale	An F1 tornado damaged roofs, trees and power lines.
Sept. 17, 1989	Cache County	An F1 tornado was reported.
Mar. 23, 1990	Vernal	An F0 tornado damaged a mobile home and storage sheds.
Apr. 23, 1990	Weber County	An F0 tornado was reported.
July 8, 1990	Duchesne County	An F0 tornado was reported.
Aug. 16, 1990	Salt Lake County	An F0 tornado was reported.
July 25, 1991	Tooele County	An F1 tornado was reported.
July 26, 1991	Emery County	Two F0 tornadoes were reported.
Sept. 7, 1991	Beaver County	An F0 tornado was reported.
Sept. 10, 1991	Brigham City	An F0 tornado severed power lines, uprooted trees and damaged buildings.
May 21, 1992	Beaver County	An F0 tornado was reported.
Aug. 30, 1992	near Kennecott mine	An F0 tornado was observed but no damage.
Aug. 31, 1992	Washington County	An F0 tornado was reported.
Sept. 23, 1992	Davis County	An F1 tornado was reported.
April 4, 1993	Caineville	An F1 tornado damaged a restaurant and motor home.
May 3, 1993	Erda	An F1 tornado destroyed a Tooele County drive-in.
May 5, 1993	Leota	An F0 tornado touched down.
Aug. 11, 1993	Uinta Mountains	An F3 strong tornado damaged 1,000 acres of trees, four cars and a truck.
Nov. 5, 1993	Emigration Canyon	An F0 tornado was reported.
July 29, 1995	Centerville	An F0 tornado was reported.
Dec. 5, 1995	Pleasant View	An F0 tornado was reported.
May 28, 1996	Delta	An F0 tornado was reported.
May 29, 1996	Syracuse	An F0 tornado was reported.
May 29, 1996	North Ogden	An F1 tornado was reported.
April 5, 1997	Cedar Valley	An F0 tornado was reported.
May 8, 1998	Magna	An F0 tornado was reported.
May 21, 1998	West Point	An F0 tornado was reported.
May 21, 1998	Roy	An F0 tornado was reported.

DATE	LOCATION	COMMENTS
Sept. 12, 1998	Emigration Canyon	An F0 tornado was reported.
Aug. 11, 1999	Salt Lake City	A strong tornado (F2), with winds up to 157 mph, whipped through downtown, killing one man, injuring 80 people and damaging or destroying 500 trees. Total damage was about \$170 million in a 4 1/4-mile path of damage.
Sept. 3, 1999	Vernal/Naples	An F1 tornado caused minor damage.
May 24, 2000	near Gunnison	A small tornado (F0) touched down but caused no damage.
May 25, 2000	Holladay	An F0 tornado damaged cars, a roof and uprooted trees.
Sept. 8, 2000	Panguitch	An F0 tornado was spotted near Panguitch on Highway 20 which goes from US-89 to I-15. The tornado stayed over open country for about 5 minutes before lifting. No damage was reported.
Sept. 8, 2000	Moab	A weak tornado (F0) was observed. The thunderstorm which produced this tornado had a dark green appearance.
July 25, 2001	Price	An F0 tornado was spotted over open country about 10 miles southwest of Price.
Aug. 8, 2001	Fairview	An F0 tornado touched down and lasted about 10 minutes and remained over open country.
Aug. 21, 2001	Dutch John	A narrow and long, rope-like F0 tornado was observed in Flaming Gorge National Recreation Area. The tornado picked up brush, branches, and tree limbs along its path through the forested land. Some of the debris was deposited on the roads.
Aug. 21, 2001	Sugar House	An F0 tornado briefly touched down in the Sugarhouse area of Salt Lake City. Other reports of the storm indicated a funnel cloud and strong thunderstorm winds. No damage or injuries were reported.
Sept. 4, 2001	Milford	A thunderstorm spawned a F0 tornado which touched down 6 miles southwest of Milford, then lifted up and touched down again in the foothills east of Milford. It finally moved to about 10 miles northeast of town before dissipating. The entire event lasted about 15 minutes over open country.
Sept. 8, 2002	Centerfield	An F0 tornado was spotted on the ground for a short time over open country 5 miles NNE of Centerfield.
Sept. 8, 2002	Manti	An F2 tornado with winds as high as 157 mph damaged a pioneer building, lumber business, trailers, and a residential area before dissipating. The distance traveled was 2.75 miles, and the width was 800 feet. Time on the ground was approximately 15 minutes. Estimated damage is around \$2,000,000.
Sept. 12, 2002	Ephraim	A small tornado (F0) was observed and moved slowly to the northeast over open country before dissipating. This tornado remained on the ground for only a few seconds, but the funnel cloud was visible for about 10 minutes.
Sept. 12, 2002	Hanksville	A small tornado (F0) was observed 20 miles southeast of Hanksville. It was on the ground over open country for a

DATE	LOCATION	COMMENTS
		short time, and debris from the ground was observed rising before the funnel dissipated.
June 9, 2003	Payson	A small tornado (FO) touched down and damaged about 100 feet of vinyl fence and lifted a small aluminum boat off of its trailer. The path of the tornado was about 100 yards.
Aug. 22, 2003	Levan	An FO tornado touched down near State Route 28 between Levan and Yuba Lake in Juab County. The tornado stayed on the ground for one minute, picking up rocks and shrubs before dissipating.
May 30, 2005	Lehi	A brief FO tornado touchdown along Utah Lake shore.
June 23, 2005	Duchesne	A brief FO tornado touchdown along HWY 40 near Duchesne.
June 25, 2005	Mt Pleasant	Brief FO tornado touchdown flipped over a motor home and blew the roof off a shed.
Aug. 2, 2005	Bountiful	An FO tornado touched down on the northern part of Antelope Island.
June 8, 2006	Green River	A ropelike FO tornado observed a few miles west of Green River. No damage was observed and the tornado was short lived.
Sept. 22, 2006	Moab	An FO traveled across open country and ripped branches off of juniper and pinyon pine trees.
July 25, 2007	Plymouth	An EFO tornado was reported along I-15 in Plymouth. The tornado moved through a field and did not impact any structures.
May 3, 2009	Willard	An EFO tornado touched down in Willard. The tornado path was one mile. The damage from the tornado included damaged siding, several uprooted trees, a couple of snapped trees, and a tossed empty snowmobile trailer.
May 24, 2009	Milford	An EFO tornado touched down 5 miles west of Milford in an uninhabited area and did no damage.
Aug. 6, 2009	Leota	A EFO tornado traveled across Pelican Lake and the on the east shore of the lake, the tornado tore up some trees and flipped over a trailer.
Aug. 6, 2009	Vernal	An EFO tornado tracked through a small section of Vernal, mostly staying between houses. A number of trees had large limbs broken off and some minor damage occurred to sheds. The tornado was seen by many area residents and photographed by at least three persons.
July 26, 2010	Carbon County Airport	An EFO tornado touched down near Wellington, with multiple members of the public seeing the tornado and taking pictures. The tornado damaged a trailer, rolling it over onto its side, and uprooted a few large trees.
Oct. 6, 2010	Hanksville	An EFO tornado touched down west of Canyonlands National Park, at the south end of Robbers Roost Flat. Approximately 30 juniper trees were either snapped or uprooted by the tornado. No monetary damage occurred as the tornado occurred in a rural area and no trees fell on the nearby dirt road, so no cleanup was necessary.
Aug. 24, 2011	Hurricane Airport	An EFO tornado touched down west of Apple Valley, Utah. The weak tornado was short-lived and caused no damage.

DATE	LOCATION	COMMENTS
Aug. 21, 2012	Newhouse	An EFO tornado was reported along the Utah/Nevada border.
Sept. 7, 2013	American Fork	An EFO small tornado was spotted and removed a metal roof from a barn and did minor damage to trees and other outbuildings in the area.
June 6, 2015	Mexican Hat	An EFO tornado initially touched down near Comb Ridge and traveled northeast near to Montezuma Creek before dissipating.
June 16, 2015	Dry Fork	An EFO tornado touched down for about 9 minutes on the ground.
Aug. 26, 2016	Panguitch	An EFO tornado briefly touched down near the town of Panguitch, but no damage was reported or found.
Sept. 22, 2016	Panguitch	A tornado touched down in Panguitch, producing an intermittent damage path, which included EFO damage to a business in town and EFO damage to several homes and numerous trees. The most significant damage occurred to a business where the tornado took off the roof of a building. The tornado also caused significant damage to numerous vehicles in the area and knocked down multiple power lines, leaving much of the community without power. No injuries were reported across the area.
Sept. 22, 2016	Roy	An EFO tornado touched down in Riverdale in Weber County. The tornado moved rapidly to the northeast but was not consistently on the ground. It skipped on several occasions in Riverdale, producing primarily EFO damage to trees and a several homes. The tornado then produced a more continuous swath of damage through Washington Terrace producing EFO damage to numerous homes, structures, as well as many trees. Finally, the tornado skipped briefly into South Ogden producing EFO damage before dissipating. One person suffered a head injury and took private transportation to a hospital. A few others were cut by flying glass, but were not hospitalized. The many downed trees across the area caused widespread power outages, with over 37,000 customers impacted. Approximately 12 homes in Washington Terrace were so damaged that they were deemed uninhabitable until repaired, and a total of about 30 homes were damaged across Weber County.
July 8, 2017	Hurricane Airport	An EFO tornado touched down east of St. George. No damage was reported or found.
July 10, 2017	Natch	An EFO tornado touched down east of Panguitch Lake. No damage was reported or found.
May 28, 2018	Snowville	A brief tornado touchdown was observed and photographed near Snowville. No damage was reported.
May 28, 2018	Wallsburg	A brief, weak tornado touchdown was reported and photographed by multiple individuals at Strawberry Reservoir. No damage was observed.
July 13, 2021	Mona	Public video showed a landspout tornado associated with a rain shower near Mona.

DATE	LOCATION	COMMENTS
July 14, 2021	Huntington	A video and photos of a landspout tornado near Huntington was sent to local broadcast media near Huntington.
July 28, 2021	Marriott	A weak, but well-formed, landspout tornado was observed in multiple videos shared via social media.
September 2, 2021	Bountiful	A tornado first touched down in North Salt Lake at Redwood Road and 900 W around 6:28 PM MDT. The tornado moved to the northeast through a mix of industrial and residential areas. The tornado produced EFO damage (winds 65 to 85 MPH) to numerous trees and several homes in the Cloverdale neighborhood. Large diameter tree limbs (in excess of 12 inches) were broken off and deposited throughout the area.
June 19, 2022	Fruitland	A tornado developed near the summit of US-191 and Argyle Canyon Road in remote southwestern Duchesne County. Almost all trees over a large hillside facing the road were violently blown down, snapped, or topped into a clearly convergent axis. Several treetops were deposited along the creek and road with no clear indication as to where they originated

Source: NCEI 1950-2022

Below is a photo from the June 19th tornado in Fruitland that resulted in significant tree blowdown in Duchesne County.

Figure 4-101 June 2022 Tornado Blowdown in Duchesne County



Straight-line Winds

The table below summarizes significant tornado events in the state from 1955 to August of 2022. The events in this table have resulted in \$50,000 in damages or more, with the most damaging event recorded in May of 1994. This event resulted in an estimated \$50 million in property damages.

Table 4-80 Thunderstorm Wind Events by Cost \$50,000 and Above 1955 to August 2022

DATE	LOCATION	COUNTY	MAGNITUDE (MPH)	INJURIES	PROPERTY DAMAGE EST.	CROP DAMAGE EST.
7/22/2022	Erda	Tooele	70.15	0	\$80,000	\$0
7/24/2021	Rockville	Washington	64.4	0	\$80,000	\$0
7/22/2021	Murray	Salt Lake	64.4	0	\$250,000	\$0
7/22/2021	Midvale	Salt Lake	70.15	0	\$75,000	\$0
7/22/2021	Bennion	Salt Lake	59.8	0	\$50,000	\$0
7/14/2021	Canyonlands	Grand	70.15	0	\$50,000	\$0
9/14/2017	Glen Canyon	Kane	70.15	3	\$500,000	\$0
5/6/2017	Taylor	Weber	70.15	0	\$60,000	\$0
2/21/2017	Amalga	Cache	59.8	0	\$60,000	\$0
6/11/2016	Francis	Summit	69	0	\$75,000	\$0
6/1/2015	Bothwell	Box Elder	62.1	1	\$50,000	\$0
8/12/2014	Saltair	Salt Lake	58.65	0	\$50,000	\$0
9/7/2013	Provo Airport	Utah	58.65	0	\$100,000	\$0
8/5/2013	Dalton	Salt Lake	80.5	0	\$300,000	\$0
6/12/2013	Salt Lake No 2 Arp	Salt Lake	65.55	0	\$50,000	\$0
7/9/2011	Richmond	Cache	59.8	0	\$55,000	\$0
4/21/2011	Pleasant View	Weber	77.05	0	\$60,000	\$0
8/22/2010	Salt Lake City	Salt Lake	75.9	0	\$200,000	\$0
8/22/2010	Randall	Davis	64.4	0	\$100,000	\$0
7/19/2008	Myton	Duchesne	59.8	0	\$80,000	\$0
8/1/2006	Countywide	Utah	92	0	\$4,000,000	\$0

DATE	LOCATION	COUNTY	MAGNITUDE (MPH)	INJURIES	PROPERTY DAMAGE EST.	CROP DAMAGE EST.
8/1/2006	Provo Muni Airport	Utah	105.8	0	\$3,000,000	\$0
8/1/2006	Countywide	Salt Lake	86.25	0	\$2,000,000	\$0
7/26/2006	Salt Lake City	Salt Lake	57.5	2	\$50,000	\$0
6/7/2006	Blanding	San Juan	63.25	0	\$175,000	\$0
8/22/2003	Mendon	Cache	69	0	\$50,000	\$0
8/22/2003	Countywide	Tooele	72.45	0	\$100,000	\$0
8/3/2003	South Ogden	Weber	69	0	\$100,000	\$20,000
7/26/2002	Provo	Utah	71.3	0	\$50,000	\$10,000
6/21/2002	Price	Carbon	57.5	0	\$300,000	\$0
8/21/2001	Salt Lake City	Salt Lake	73.6	0	\$50,000	\$5,000
6/12/2001	Countywide	Salt Lake	73.6	1	\$500,000	\$50,000
6/12/2001	Countywide	Utah	74.75	0	\$250,000	\$25,000
6/12/2001	Countywide	Tooele	78.2	0	\$200,000	\$25,000
6/12/2001	Countywide	Davis	63.25	0	\$100,000	\$10,000
4/28/2001	Trenton	Cache	80.5	0	\$100,000	\$5,000
5/24/2000	Gunnison	Sanpete	59.8	0	\$50,000	\$2,000
8/26/1998	Kaysville	Davis	70.15	0	\$400,000	\$100,000
8/26/1998	Ogden	Weber	59.8	0	\$100,000	\$20,000
7/5/1998	Salt Lake City	Salt Lake	66.7	8	\$50,000	\$800
7/16/1996	Provo	Utah	85.1	0	\$100,000	\$0
7/16/1996	Salt Lake City	Salt Lake	64.4	1	\$100,000	\$0
5/29/1996	Clearfield	Davis	80.5	0	\$300,000	\$0
7/5/1994	Woods Cross	Davis	80.5	0	\$50,000	\$0
5/31/1994	Tooele	Tooele	80.5	0	\$500,000	\$0
5/31/1994	Lakeshore	Utah	0	0	\$500,000	\$0

DATE	LOCATION	COUNTY	MAGNITUDE (MPH)	INJURIES	PROPERTY DAMAGE EST.	CROP DAMAGE EST.
5/31/1994	Salt Lake City	Salt Lake	62.1	0	\$500,000	\$0
5/31/1994	Salt Lake City	Salt Lake	80.5	0	\$500,000	\$0
5/31/1994	Provo	Utah	104.65	15	\$50,000,000	\$0
5/7/1994	Salt Lake City	Salt Lake	0	0	\$50,000	\$0
5/3/1993	Farr West	Weber	0	0	\$50,000	\$0

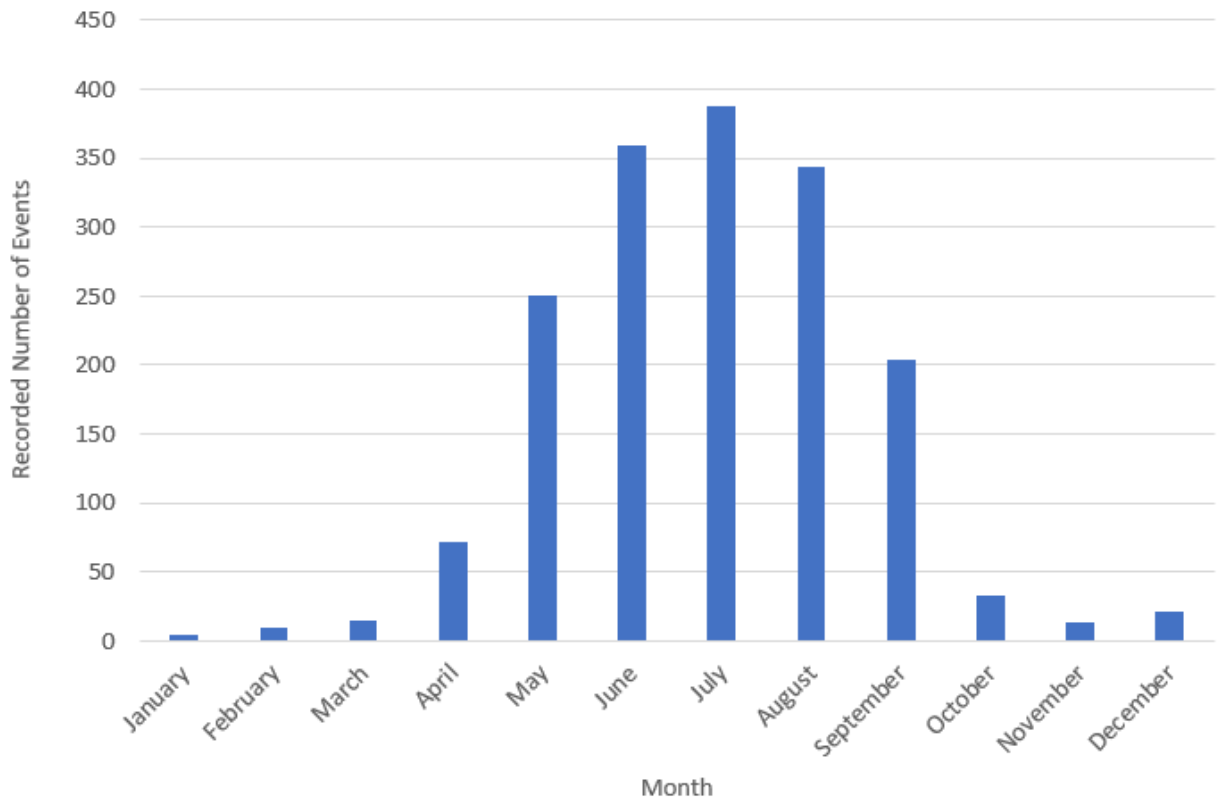
Source: NCEI 1955-2022

There have been six thunderstorm wind events with over \$50,000 in damages in the State since the previous plan update. The NCEI reports details on several significant wind events in the State:

- **July 17th, 2015:** Strong wind caused a group of paddle boarders on the reservoir at Rockport State Park in Summit County to separate and resulted in one paddle boarder drowning.
- **July 14th, 2021:** Strong wind broke 5 to 6 powerlines in Grand County near the Canyonlands Airport, resulting in \$50,000 in damages.
- **July 22nd, 2021:** Trees blown over by thunderstorm winds caused extensive damages to homes near Midvale in Salt Lake County. Damages were estimated to be \$75,000.
- **July 22nd, 2022:** Strong winds near Erda in Tooele County resulted in damages to roofs, fences, homes, and a center-pivot irrigation system.

Figure 4-102 shows the number of recorded thunderstorm wind events in Utah by month of the year. The highest number of thunderstorm wind events occurred in the summer months, with a peak number of events in July. The NCEI dataset also recorded most thunderstorm wind events occurring in the afternoon into the night, between the hours of 12:00 and 21:00.

Figure 4-102 Utah Thunderstorm Wind Events 1955 - 2022



Source: NCEI, 1955-2022. Figure by: WSP

Synoptic Wind Events

Table 4-81 High/Strong Winds at Least \$50,000 in Damages 1996 to 2022

DATE	AREA	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	WIND SPEED (MPH)
10/22/2022	Great Salt Lake Desert	0	0	\$50,000	\$0	73.6
3/21/2022	S. Central Utah	0	0	\$200,000	\$0	70.2
9/8/2020	N. Wasatch Front	0	8	\$4,300,000	\$0	99.0
9/8/2020	Salt Lake & Tooele Valleys	1	12	\$4,300,000	\$0	88.6
4/16/2018	Salt Lake & Tooele Valleys	0	0	\$50,000	\$0	72.5
6/11/2017	Great Salt Lake Desert & Mountains	0	1	\$50,000	\$0	76.0
4/13/2017	Salt Lake & Tooele Valleys	0	0	\$50,000	\$0	81.7
4/13/2017	S. Wasatch Front	0	0	\$50,000	\$0	71.3
3/5/2017	Salt Lake & Tooele Valleys	0	0	\$100,000	\$0	77.1
3/5/2017	S. West Utah	0	10	\$80,000	\$0	70.2

DATE	AREA	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	WIND SPEED (MPH)
3/5/2017	S. Wasatch Front	0	0	\$60,000	\$0	65.6
5/1/2016	N. Wasatch Front	0	0	\$1,000,000	\$0	90.9
4/30/2016	N. Wasatch Front	1	0	\$1,000,000	\$0	90.9
2/18/2016	N. Wasatch Front	0	0	\$50,000	\$0	64.4
2/18/2016	S. Mountains	0	0	\$50,000	\$0	87.5
2/18/2016	Wasatch Mountain Valleys	0	0	\$150,000	\$0	59.8
2/17/2016	Salt Lake & Tooele Valleys	0	0	\$200,000	\$0	73.6
4/14/2015	Great Salt Lake Desert	1	25	\$150,000	\$0	81.7
4/14/2015	Salt Lake & Tooele Valleys	0	0	\$150,000	\$0	80.6
4/14/2015	N. Wasatch Front	0	0	\$150,000	\$0	64.4
12/29/2014	N. Wasatch Front	0	0	\$75,000	\$0	78.3
11/1/2014	Salt Lake & Tooele Valleys	0	0	\$75,000	\$0	76.0
4/22/2014	Salt Lake & Tooele Valleys	0	0	\$500,000	\$0	86.3
4/22/2014	Cache Valley/Utah	0	0	\$250,000	\$0	64.4
4/22/2014	N. Wasatch Front	0	1	\$150,000	\$0	72.5
3/17/2014	Cache Valley/Utah	0	0	\$80,000	\$0	57.5
3/17/2014	Salt Lake & Tooele Valleys	0	0	\$80,000	\$0	80.6
3/17/2014	Castle Country	0	0	\$80,000	\$0	57.5
11/21/2013	N. Wasatch Front	0	0	\$300,000	\$0	85.2
4/8/2013	N. Wasatch Front	0	0	\$85,000	\$0	74.8
12/31/2011	S. Wasatch Front	0	0	\$50,000	\$0	65.6
12/1/2011	N. Wasatch Front	0	3	\$82,000,000	\$0	102.4
12/1/2011	Salt Lake & Tooele Valleys	0	1	\$250,000	\$0	69.0
5/28/2010	Sanpete/Sevier Valleys	0	1	\$80,000	\$0	59.8
4/27/2010	Great Salt Lake Desert	0	0	\$250,000	\$0	82.9
4/27/2010	Salt Lake & Tooele Valleys	0	0	\$60,000	\$0	82.9
8/6/2009	Salt Lake & Tooele Valleys	0	0	\$80,000	\$0	71.3
3/29/2009	Great Salt Lake Desert	0	0	\$50,000	\$0	72.5
3/29/2009	Castle Country	0	0	\$50,000	\$0	59.8

DATE	AREA	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	WIND SPEED (MPH)
1/4/2008	Salt Lake & Tooele Valleys	0	0	\$500,000	\$0	74.8
7/9/2004	NW Cache	0	0	\$60,000	\$0	88.6
11/13/2003	W Utah	0	0	\$50,000	\$50,000	101.3
4/2/2003	Salt Lake & Toole Valleys	0	0	\$200,000	\$0	80.6
4/2/2003	Gr& Flat & Arches	0	4	\$100,000	\$0	55.2
2/16/2003	W Salt Lake	0	0	\$100,000	\$0	66.7
2/16/2003	NE Box Elder	0	0	\$200,000	\$0	78.3
1/5/2003	SC Washington	0	0	\$100,000	\$0	72.5
4/15/2002	NW Kane	0	10	\$2,000,000	\$100,000	86.3
5/2/2001	NE Box Elder	0	0	\$1,500,000	\$100,000	77.1
5/2/2001	W Salt Lake	0	0	\$1,500,000	\$300,000	73.6
3/20/2000	N. Wasatch Front	0	0	\$1,200,000	\$100,000	115.1
3/20/2000	Utah's Dixie & Zion National Park	0	0	\$100,000	\$10,000	80.6
3/20/2000	Salt Lake & Toole Valleys	0	0	\$1,000,000	\$50,000	100.1
3/20/2000	Wasatch Plateau/Book Cliffs	0	1	\$200,000	\$10,000	74.8
2/14/2000	W Utah	1	0	\$50,000	\$10,000	64.4
4/22/1999	W Salt Lake	0	0	\$100,000	\$10,000	-
4/22/1999	NE Box Elder	0	0	\$11,000,000	\$100,000	-
11/23/1998	Beaver	0	0	\$100,000	\$0	-
6/16/1998	Utah's Dixie & Zion National Park	0	0	\$700,000	\$200,000	80.6
9/25/1997	NW Kane	0	1	\$50,000	\$50,000	74.8
4/2/1997	N. Wasatch Front	0	20	\$4,250,000	\$0	88.6
2/24/1997	N. Wasatch Front	0	3	\$4,250,000	\$0	64.4
12/27/1996	Salt Lake & Toole Valleys	0	0	\$50,000	\$0	64.4
12/16/1996	Wasatch Mountains	0	6	\$100,000	\$0	110.5
4/24/1996	S. Wasatch Front	0	0	\$100,000	\$0	59.8
3/5/1996	W. Uinta Mountains	0	0	\$100,000	\$0	57.5
Total		4	107	\$126,345,000	\$1,090,000	N/A

Source: NCEI 1996-2022

The NCEI recorded 246 synoptic wind events in the state since the previous plan update in May 2017. There have been six thunderstorm wind events with over \$50,000 in damages in the State since the previous plan update, two of which were recorded in different locations on the same day in September of 2020. The NCEI reported 1,015 wind events across the state in total and provided details on several recent wind events in the State:

- **October 22nd, 2022:** Several high-profile vehicles were blown over on Interstate 80 when wind gusts reached 74 miles per hour. \$50,000 was reported in estimated damages.
- **March 21st, 2022:** The roof of Water Canyon Elementary School in Hildale, UT was partially ripped off. \$200,000 was reported in estimated damages.
- **September 8th, 2020:** Strong winds resulted in over 180,000 power outages along the Wasatch Front, with some locations taking days to around a week to have power restored. Salt Lake City schools had to close for three days due to damages. The Capitol Complex was closed due to extensive tree damage, as were numerous parks, golf courses & recreation areas. Many COVID-19 testing sites were damaged and had to close, including all University of Utah testing sites. The only known fatality for the event occurred in S. Salt Lake, when a 61-year-old truck driver unloading his truck was blown over by the wind, striking his head. \$4.3 million was reported in estimated damages, along with 20 injuries and 1 fatality.
- **April 16th, 2018:** Wind gusts blew down multiple trees and one fell on a house in Murray. Trampolines became airborne and landed in yards, over fences, and on the roof of a home. More than 7,500 power outages were reported. Damages were reported to total \$50,000.
- **June 11th, 2017:** Four semitrailers were knocked over by the high winds along Interstate 80, closing the highway and causing delays in both directions. One of these accidents resulted in minor injuries for the semitruck driver.
- **December 1st, 2011:** a significant downslope windstorm event originating from the northern Wasatch Front, resulting in extreme wind gusts at 102 mph in Centerville, 92 mph in West Bountiful, and 86 mph in Farmington. The impact of this windstorm was significant, with the most extensive damage observed between North Salt Lake and South Ogden. The estimated infrastructure damage amounted to approximately \$6.5 million, with the majority of losses concentrated in Davis County. Private insured losses exceeded \$75 million.

Figure 4-103 Damage to Salt Lake City after 2020 Windstorm



Source: The Salt Lake Tribune, Francisco Kjolseth, 2020

Winter Storms and Extreme Cold

The table below summarizes significant winter weather events in the state from 1967 to August of 2022. The events in this table have resulted in \$50,000 in damages or more, with the most damaging event recorded in January of 1997. This event resulted in an estimated \$40 million in property damages.

Table 4-82 Winter Storms by Cost Above \$50,000, 1955 - 2022

HAZARD DATE	COUNTY	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE	REMARKS
10/12/2021	Southwest Utah	0	0	\$100,000	\$0	Winter Storm
10/11/2021	Cache	0	0	\$250,000	\$0	Winter Storm
5/10/2014	Cache	0	0	\$100,000	\$0	Winter storm
11/9/2012	Salt Lake, Tooele, Washington	0	0	\$1,000,000	\$0	Winter storm
11/9/2012	Utah	0	0	\$70,000	\$0	Winter storm
11/9/2012	Statewide	0	0	\$170,000	\$0	Heavy snow
3/24/2005	Box Elder	7	1	Unknown	\$0	Winter storm
3/24/2005	Millard	1	1	Unknown	\$0	Winter storm

HAZARD DATE	COUNTY	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE	REMARKS
11/27/2004	Rich, Cache, Weber, Morgan	6	0	\$250,000	\$0	Heavy snow
12/28/2003	Box Elder, Weber	0	0	\$100,000	\$0	Winter storm
12/28/2003	Salt Lake Tooele	0	0	\$100,000	\$0	Winter storm
12/25/2003	Statewide	0	0	\$1,500,000	\$0	Winter storm
12/25/2003	Box Elder	0	0	\$500,000	\$0	Winter storm
12/25/2003	Salt Lake	0	0	\$400,000	\$0	Winter storm
12/25/2003	Utah	0	0	\$300,000	\$0	Winter storm
12/25/2003	Cache	0	0	\$100,000	\$0	Winter storm
11/21/2003	Statewide	0	0	\$550,000	\$0	Winter storm
11/21/2003	Salt Lake	0	0	\$200,000	\$0	Winter storm
11/21/2003	Box Elder	0	0	\$150,000	\$0	Winter storm
11/21/2003	Utah	0	0	\$150,000	\$0	Winter storm
12/29/2002	Salt Lake, Tooele	0	0	\$100,000	\$0	Winter storm
3/7/2002	Salt Lake, Tooele	35	2	\$140,000	\$0	Winter storm
1/27/2002	Statewide	40	0	\$720,000	\$0	Winter storm
1/27/2002	Salt Lake	0	0	\$500,000	\$0	Winter storm
1/27/2002	Box Elder, Weber	0	0	\$100,000	\$0	Winter storm
12/2/2001	Salt Lake	0	0	\$50,000	\$10,000	Winter storm
11/29/2001	Juab	1	2	\$20,000	\$0	Winter storm
11/29/2001	Millard	1	12	\$50,000	\$0	Winter storm
11/24/2001	Statewide	1	0	\$600,000	\$50,000	Winter storm
11/24/2001	Salt Lake	0	0	\$200,000	\$0	Winter storm
11/24/2001	Box Elder, Weber, Davis	0	0	\$100,000	\$0	Winter storm
11/24/2001	Rich, Cache, Weber, Morgan	0	0	\$100,000	\$0	Winter storm
11/24/2001	Weber, Morgan, Summit	0	0	\$100,000	\$0	Winter storm
11/24/2001	Utah, Juab	0	0	\$100,000	\$0	Winter storm
11/22/2001	Statewide	0	0	\$560,000	\$0	Winter storm
11/22/2001	Salt Lake	0	0	\$300,000	\$0	Winter storm
4/7/2001	Salt Lake, Tooele	10	1	\$100,000	\$0	Heavy Snow
12/15/2000	Box Elder, Weber, Davis	1	1	\$20,000	\$0	Winter storm
11/14/2000	Box Elder, Weber, Davis	6	0	\$50,000	\$0	Heavy snow

HAZARD DATE	COUNTY	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE	REMARKS
12/2/1999	Utah, Juab	2	0	\$200,000	\$0	Heavy snow
4/1/1999	Weber, Morgan, Summit	0	0	\$50,000	\$0	Winter storm
4/1/1999	Salt Lake, Tooele	0	0	\$100,000	\$0	Winter storm
1/26/1999	Box Elder, Weber, Davis	0	0	\$50,000	\$0	Winter storm
12/19/1998	Washington	0	0	\$100,000	\$0	Winter storm
12/4/1998	Box Elder, Weber, Davis	0	0	\$50,000	\$0	Winter storm
11/8/1998	Statewide	10	0	\$500,000	\$0	Winter storm
11/8/1998	Beaver	0	0	\$500,000	\$0	Winter storm
10/15/1998	Iron	0	0	\$100,000	\$0	Winter storm
4/12/1998	Cache	0	0	\$30,000	\$3,000	Winter storm
3/27/1998	Box Elder, Weber, Davis	5	0	\$80,000	\$6,000	Heavy snow
3/17/1998	Washington	0	0	\$15,000	\$5,000	Winter storm
3/5/1998	Cache	0	0	\$95,000	\$5,000	Winter storm
2/21/1998	Statewide	40	0	\$900,000	\$200,000	Winter storm
2/21/1998	Cache	0	0	\$500,000	\$0	Winter storm
2/7/1998	Cache	20	0	\$80,000	\$20,000	Heavy snow
1/19/1998	Cache	0	0	\$30,000	\$5,000	Winter storm
1/11/1998	Salt Lake, Rich	0	4	\$140,000	\$20,000	Winter storm
1/11/1998	Box Elder	0	0	\$140,000	\$0	Winter storm
12/23/1997	Utah	0	0	\$80,000	\$0	Winter storm
12/7/1997	Box Elder, Weber, Davis	0	1	\$200,000	\$0	Winter storm
4/4/1997	Salt Lake & Tooele	2	0	\$50,000	\$0	Heavy snow
3/31/1997	Statewide	60	3	\$2,000,000	\$0	Winter storm
3/2/1997	Statewide	30	0	\$500,000	\$0	Heavy snow
2/26/1997	Statewide	20	0	\$500,000	\$0	Heavy snow
2/17/1997	Salt Lake & Tooele	4	0	\$80,000	\$0	Heavy snow
2/5/1997	Salt Lake & Tooele	10	0	\$200,000	\$0	Heavy snow
2/2/1997	Wasatch, Hunstville, Park City	5	0	\$50,000	\$0	Heavy snow
1/25/1997	Salt Lake, Rich	20	1	\$300,000	\$0	Winter storm
1/25/1997	Wasatch	0	0	\$300,000	\$0	Winter storm
1/11/1997	Statewide	50	3	\$40,000,000	\$0	Blizzard

HAZARD DATE	COUNTY	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE	REMARKS
12/20/1996	Wasatch	3	0	\$50,000	\$0	Heavy snow
12/5/1996	Cache	20	0	\$300,000	\$0	Heavy snow
12/1/1996	Salt Lake	0	0	\$1,000,000	\$0	Winter storm
11/28/1996	Salt Lake & Tooele	8	0	\$100,000	\$0	Heavy snow
10/24/1996	Statewide	20	0	\$1,000,000	\$0	Winter storm
1/6/1993	Davis, Juab, Salt Lake, Tooele, Utah, Weber	18	1	\$5,000,000	\$0	Heavy snow
12/29/1990	Statewide	0	0	\$500,000	\$0	Extreme cold
12/21/1990	Statewide	5	1	\$5,000,000	\$0	Extreme cold
12/18/1990	Statewide	45	7	\$500,000	\$0	Heavy snow
10/18/1984	Salt Lake	20	0	\$500,000	\$0	Snow
3/25/1975	Statewide	0	0	\$517,857	\$0	Heavy snowstorms
3/21/1973	Box Elder, Weber	0	0	\$500,000	\$0	Heavy wet snow
3/29/1967	Statewide	0	0	\$500,000	\$0	Wind and snow

Source: Hazards & Vulnerability Research Institute (2011). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from <http://www.sheldus.org>
NCEI 1996-2022

Table 4-83 Utah Major Wind Chill Events 1996 - 2022

DATE	LOCATION	PROPERTY DAMAGE	CROP DAMAGE	COMMENTS
12/9/2013	Northern Wasatch Front (Zone)	\$40,000	-	Following a deep winter storm, very cold temperatures settled into Utah. Some property damage was reported due to these temperatures, primarily across the northern Wasatch Front.
12/4/2005	Eastern Utah	-	-	Arctic Air spilled down mainly into the lower elevations of eastern Utah in early December and remained trapped for about two weeks. Some of the coldest temperatures recorded in eastern Utah during this time period included minus 21 degrees at the Flaming Gorge dam, minus 17 degrees at Manila, minus 6 degrees at Vernal, and minus 1 degree just east of Monticello.
3/26/2005	Statewide	-	-	Very cold air behind a departing winter storm allowed temperatures to plunge to record levels. Cedar City broke a 34-year record for the date with a low of 15 degrees. Randolph in northern Utah dropped to a daily record of 10 degrees.

DATE	LOCATION	PROPERTY DAMAGE	CROP DAMAGE	COMMENTS
11/30/2004	Beaver, Iron, Salt Lake, Tooele	-	-	Clear skies and fresh snow cover combined to produce record breaking cold temperatures in portions of southwest and north central Utah. The following cities and towns reported record cold for the morning of November 30th: Cedar City -6 F, Milford -4 F, Ferron -2 F, Fillmore 3 F, and Spanish Fork 2 F.
4/1/1999	Utah's Dixie and Zion National Park	-	\$100,000	-
12/21/1998	Statewide	\$20,000	-	Bitterly cold arctic air swept over the state, bringing sub-zero readings to most areas. The coldest readings recorded during the arctic blast were -40 at Greenville, -34 at Roosevelt, -30 in Milford, -29 at Woodruff, -27 at Manti, -26 at Randolph, -25 in Joseph and Delta, -24 in Richfield and -23 at Duchesne.

Source: NCEI 1996-2022

There have been no blizzard or extreme cold/wind chill events since the previous plan update in May 2017. There have been 2 dense fog events, one ice storm event, 94 winter storm events (totaling \$370,000 in property damages) and 123 winter weather reported in the state since the previous plan update in May 2017. The NCEI reports details on several significant wind events in the State:

- **October 12, 2021:** Storm total snow amounts included 11.9 inches in Cedar City and 10 inches in New Harmony. Heavy wet snow on fully leafed trees brought down numerous tree limbs in Cedar City and New Harmony. Damages were estimated to be \$100,000.
- **October 11, 2021:** Storm total snow reports included 12 inches in Providence, 11 inches in Logan, and 8 inches in Hyrum. Heavy wet snow brought down numerous fully leafed trees and limbs, caused property damage, knocked out power to thousands of customers, and caused the delay and cancellation of multiple schools. Damages were estimated to be \$250,000.
- **September 28th, 2019:** Areas of dense fog limited visibility to motorists traveling along Interstate 80 between Laramie and Cheyenne. With visibility under quarter of a mile, at least 10 vehicles were involved in crashes that subsequently forced the shutdown of the interstate for several hours.
- **January 9th, 2019:** Patchy freezing rain was reported across the West Desert producing slick roads near the U.S. Army Dugway Proving Ground.
- **March 2nd, 2018:** Storm total snowfall included 15 inches at Bountiful Bench, 14 inches in Bountiful, 12.5 inches in Woods Cross, 12 inches in North Salt Lake, and 9.5 inches in Centerville. Interstate 15 saw over 50 accidents in Davis, Weber, and Box Elder counties through the event, including two semitrailer rollovers; one of these rollovers blocked all southbound lanes of Interstate 15 for two hours early on March 4th. Damages were estimated to be \$20,000.

Extreme Heat

The table below summarizes significant extreme heat events in the state which have caused fatalities. The event data ranges from 1996 to 2022 and have cumulatively resulted in nine deaths throughout the state.

Table 4-84 Heat Fatality Events 1996 – 2022

DATE	AREA	FATALITIES	NARRATIVE
7/21/2021	Utah Valley	1	A 9-year-old boy was found dead in a vehicle in American Fork on Wednesday, July 21, at around 1:45 p.m. It is believed the child was inside the car for approximately two hours before he was discovered. Temperatures in the vicinity of American Fork at the time were generally in the 90 to 95-degree Fahrenheit range.
8/13/2019	Southern Wasatch Front	1	A 6-month-old boy died of pediatric vehicular heatstroke on August 13 in Santaquin.
7/31/2018	South Central Utah	1	A 49-year-old man from Belgium was hiking The Wave with his son when he became disoriented. His son went toward the trailhead to find help. When rescuers found the victim, he was already deceased. Temperatures were in the 90s.
8/15/2013	San Rafael Swell	1	A 56-year-old woman and her husband were hiking the Brimhall Double Bridge Trail in Capitol Reef National Park on August 15, when the woman became ill. The man went to get help, but she had passed away by the time medical personnel arrived. The cause of death was heat exhaustion, with temperatures exceeding 90 degrees. The time listed is approximate.
7/21/2013	South Central Utah	1	A 27-year-old Arizona woman was hiking The Wave with her husband on July 22, when they got lost and spent several hours trying to find their way back to their vehicle. Around 2 p.m., the woman collapsed, and her husband left to get help. When help arrived, she was already in cardiac arrest, and she passed away that afternoon, as emergency responders were unable to revive her.
7/1/2013 - 7/4/2013	South Central Utah	3	Hot temperatures contributed to the deaths of three hikers in southern Utah. On July 3, an elderly couple from California received permits to hike The Wave, a popular destination in far southern Utah. Both victims were found on the morning of July 4, and it is believed that they died during the afternoon of the 3rd, when temperatures were close to 100 degrees. The third victim, a 35-year-old female from Denver, passed away on the 4th of July. She was hiking with a friend near Spooky Gulch in the Grand Staircase-Escalante National Monument. The two women became lost for a couple hours, before other hikers found them and helped them back toward the trailhead. The victim was struggling in the heat and ran out of water near the trailhead, so her friend ran to find help. When she returned, the victim had no pulse, and all efforts to revive her were unsuccessful.
7/12/2005	Glen Canyon/Lake Powell	1	Excessive heat likely led to the death of a hiker in Glen Canyon. Temperatures reached 110 degrees during the afternoon.

Source: NCEI 1996-2022

4.11.5 Probability

The likelihood of future severe weather events varies by hazard and by county across the state. The FEMA NRI data on annualized frequency has been mapped at the county level for the seven severe weather hazards in the two figures that follow and illustrates how likelihood of certain hazards varies across the state and jurisdictions. For example, hail is more prevalent in the northern part of the state, whereas lightning is more frequent in the southeast. Heat waves are most common in the desert regions in southern Utah.

While almost all severe weather events are likely to occur somewhere in the state at least once per year, it is less likely that these events will result in property losses, injury, or death. Table 4-85 below summarizes the frequency of past events and their associated losses by hazard. Additionally, the table displays the likelihood of a future occurrence statewide. Winter storm events have the greatest likelihood of future occurrence, with an average of nearly 18 injuries due to winter storm events annually in the state.

The effect of climate change on the probability of severe weather is discussed in Section 4.11.6, *Climate Change Considerations*. Discussion of the populations likely to be most severely impacted is provided in Section 4.11.8, *Potential Vulnerability of Jurisdictions*, specifically in the subsection titled *Population Impacts*.

Figure 4-104 NRI Annualized Frequency – Hail, Heat Wave, Lightning

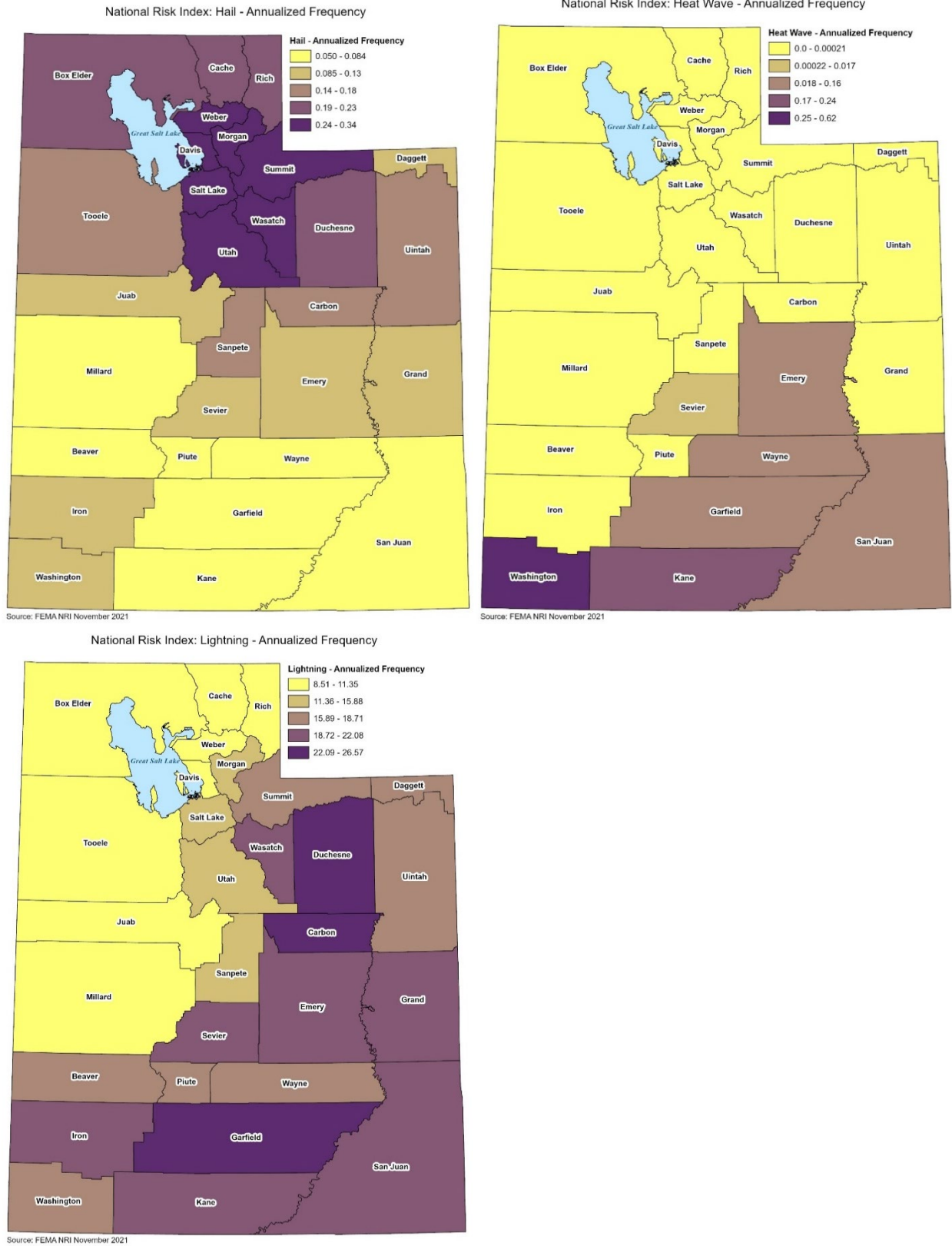


Figure 4-105 NRI Annualized Frequency – Cold Wave, Tornado, Strong Wind, Winter Storm

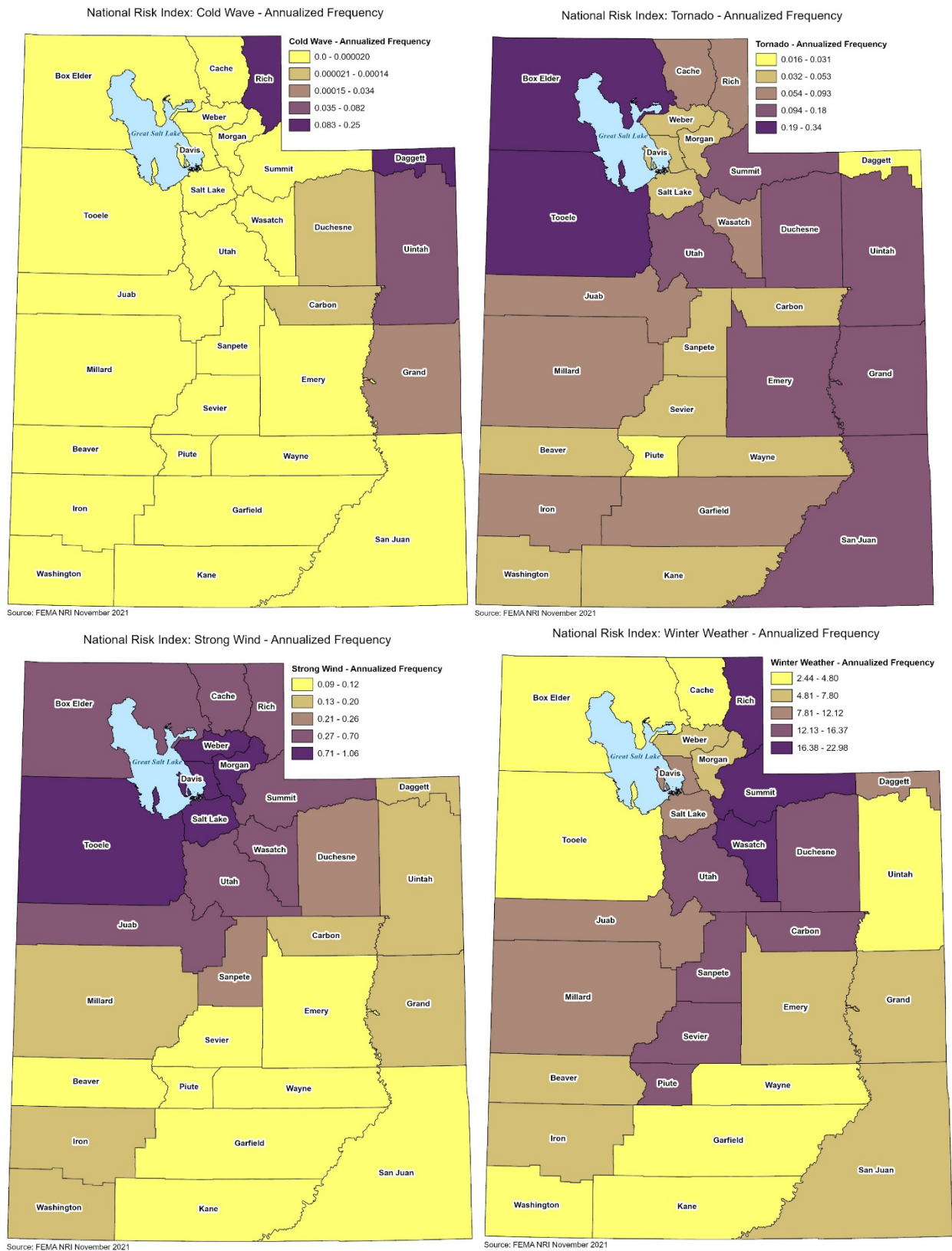


Table 4-85 Recurrence Intervals and Annualized Loss by Hazard based on NCEI Data

HAZARD	YEARS	NUMBER OF EVENTS	YEARS IN RECORD	RECURRENCE PER YEAR	HAZARD PROBABILITY/ YEAR	Average Annualized Losses (\$ per year)
Lightning (fatalities)	1996-2022	21	26	.81	80.8%	\$67,392
Lightning (injuries)	1996-2022	42	26	1.62	161.5%	
Thunderstorm Wind Events (> \$50,000 in damage)	1955-2022	66	67	0.99	98.5%	\$998,101
Tornadoes (observed)	1869-2022	138	153	0.90	90.2%	\$2,466,601
High/Strong Wind Events (>\$50,000 in damage)	1996-2022	66	26	2.54	253.8%	\$1,902,015
Hail Events (recorded damage)	1955-2022	30	67	0.45	44.8%	\$99,910
Winter Storms (injuries)	1996-2022	467	26	17.96	1796.1%	\$1,098,684
Winter Storms (fatalities)	1996-2022	23	26	0.88	88.6%	
Winter Storms (>\$50,000 in damage)	1996-2022	84	26	3.23	323.1%	
Dense Fog Events	1996-2022	142	26	5.46	546.1%	N/A
Wind Chill Events (major)	1996-2022	6	26	0.23	23.1%	N/A
Heat Events (fatalities)	1996-2022	9	26	0.35	34.6%	N/A

Source: WSP analysis on NCEI 1996-2022

4.11.6 Climate Change Considerations

The impact of climate change on severe weather in Utah is mixed. Relevant academic literature ranges from very concerning to relatively muted with regard to many types of severe weather. In many cases, research is general and not specific to Utah. Often, the confidence is low in projecting future effects of climate change on severe weather. Much of the literature on climate change impacts on severe weather is effectively summarized in the 4th National Climate Assessment ^{20, 21}, specifically in Volume 1 Chapter 9 (Extreme Storms)²² and Volume 2 Chapter 25 (Southwest Region)²³.

Climate models consistently indicate that increased convective storms are a likely outcome of climate change. Fundamentally, this is an indicator of bad things to come. However, the details

20 <https://science2017.globalchange.gov/>

21 <https://nca2018.globalchange.gov/>

22 Kossin, J.P., T. Hall, T. Knutson, K.E. Kunkel, R.J. Trapp, D.E. Waliser, and M.F. Wehner. 2017. The Fourth National Climate Assessment, Volume 1 Chapter 9: Extreme Storms.

23 Gonzalez, P, G Garfin, D Breshears, K Broks, E Elias, N Huntly, JK Maldonado, NJ Mantua, HG Margolis, and S McAfee. 2018. The Fourth National Climate Assessment, Volume 2 Chapter 25: Southwest.

of what increased convective storm activity means to hail, wind, and lightning, especially in Utah specifically, remains vague. An ongoing trend in worsening tornado activity especially in this century is clearer, but little information exists to describe likely consequences for Utah.

Strong evidence exists that extreme heat will continue to increase with worsening climate change. Extreme heat is already a hazard with serious consequences, future decades may become significantly worse. Impacts of climate-change driven extreme heat on current and future human health, agriculture, and ecosystems are widely documented in academic studies and National Ecosystem Reports. Sometimes relevant impacts come not from increased extreme heat, but from reduced cold. For example, the climate-change associated increase in winter cold temperatures has notoriously led to more extensive infestations of Bark Beetles in Western conifer forests and consequently in massive tree die-offs in Western forests. The underlying message for planning to mitigate future hazards is that climate change is here, its effects are complex, and improving our understanding of how these effects may play out here in Utah is needed.

4.11.7 Vulnerability of State Assets

The vulnerability of state assets to severe weather is dependent on the type, location, construction, height, and age of state assets. If these qualities remain constant through time, vulnerability will also be stable.²⁴ The assessment of state asset vulnerability assumes that the nature of state assets is consistent with what has existed over the past decade and provides a measure of the vulnerability of state assets to severe weather in the near future. This approach also provides a foundation for future analysis to fill key information gaps, such as identifying the relative vulnerability of specific state assets.

The Utah Division of Risk Management has recorded losses for the last 10 years (2012-2022) due to weather events by State Agency. In total, over \$5 million was recorded in losses, with the greatest losses impacting the University of Utah (nearly \$2.1 million in damages), followed by Utah State University (\$1.1 million in damages). The data indicate an average annualized loss of \$500,000 to state assets due to severe weather. This could be the expected magnitude of loss to state assets in the future, though trends in average annual losses should be periodically revisited, particularly in the era of climate change but also to account for mitigation efforts. The table below summarizes losses by State Agency due to weather events in the State of Utah over the past decade. See Section 4.2 and 4.3 for more information on state-owned facilities in the State of Utah, as well as critical facilities by county in the state.

Table 4-86 Weather Related Losses by State Agency (over the past 10 years)

STATE AGENCY	TOTAL LOSS CLAIMS
Corrections - Utah State Prison	\$0
Davis Technical College	\$30,614
Dixie Technical College	\$2,000
Environmental Quality Department	\$21,160
Facilities Construction & Management (DFCM) - Maint	\$58,650
Human Services - Juvenile Justice Center	\$0
Human Services Department	\$111,773
Natural Resources - Parks	\$493,314

²⁴ It is acknowledged that vulnerability may remain stable while risk changes as exposure to hazards changes.

STATE AGENCY	TOTAL LOSS CLAIMS
Natural Resources - Wildlife Resources	\$71,708
Natural Resources Department	\$67,945
Navajo Trust Fund	\$2,722
Public Safety Department	\$915
Salt Lake Community College	\$11,028
School for the Deaf and Blind	\$6,300
Snow College	\$9,231
Southern Utah University	\$200,514
Southwest Education Developmental Center	\$9,415
Transportation (UDOT)	\$120,636
Uintah Basin Technical College	\$6,647
University of Utah	\$2,084,791
Utah Communications Authority	\$90,900
Utah National Guard	\$21,792
Utah State Fairpark	\$62,077
Utah State University	\$1,125,047
Utah Tech University	\$1,100
Veterans Affairs	\$26,221
Weber State University	\$365,072
Total	\$5,001,573

Source: Utah Division of Risk Management

Additionally, the Utah Division of Risk Management recorded losses due to wind events for State Agencies over the past decade. Wind events account for nearly half (over \$2.2 million) of all weather-related damages to State Agencies in the State of Utah. The table below summarizes damages from only wind events in the State of Utah by State Agency over the past decade. Damages to university property and Natural Resources Department have been the greatest.

Table 4-87 Wind Damages by State Agency (over the past 10 years)

STATE AGENCY	TOTAL LOSS CLAIMS
Corrections - Utah State Prison	\$0
Davis Technical College	\$30,614
Dixie Technical College	\$2,000
Environmental Quality Department	\$0
Facilities Construction & Management (DFCM) - Maint	\$58,650
Human Services - Juvenile Justice Center	\$0
Human Services Department	\$31,457
Natural Resources - Parks	\$390,869
Natural Resources - Wildlife Resources	\$66,310
Natural Resources Department	\$67,945
Public Safety Department	\$915

STATE AGENCY	TOTAL LOSS CLAIMS
Salt Lake Community College	\$11,028
School for the Deaf and Blind	\$6,300
Snow College	\$9,231
Southern Utah University	\$6,702
Southwest Education Developmental Center	\$9,415
Transportation (UDOT)	\$120,636
University of Utah	\$673,270
Utah Communications Authority	\$90,900
Utah National Guard	\$21,792
Utah State Fairpark	\$62,077
Utah State University	\$149,777
Utah Tech University	\$1,100
Veterans Affairs	\$26,221
Weber State University	\$365,072
Total	\$2,202,283

Source: Utah Division of Risk Management

The two greatest losses of state assets to severe weather, including wind, in the past decade were to higher education facilities and to parks. Losses to educational facilities are costly and disruptive to daily routines. There is relatively little risk of cascading effects, as would be the case if major damage occurred to transportation or power generation. In terms of lifelines, immediate impacts are largely limited to public and community safety caused by the severe weather. Following the immediate impact, considerable repair of damaged educational facilities exists. Similarly, losses to parks are costly and disruptive. The nature of disruption is different and affects primarily recreation opportunity, but the potential for cascading effects is similarly modest. In terms of lifelines, impacts are similarly limited to public safety in the short term and repair of facilities in the longer term.

The approach taken in the above analysis of projecting future loss of state assets based on a linear projection of historic losses has shown particularly useful insight into loss patterns, and spotlights the opportunity for continued use of insured loss data in future updates. Much can be learned about the vulnerability of assets from a deeper analysis of which state assets account for the greatest loss. As of this ESHMP update it is uncomfortably speculative to place dollar values on vulnerability of state assets under future climate scenarios, other than to say it will likely increase unless tempered by efforts of the State to mitigate impacts.

4.11.8 Vulnerability of Jurisdictions

The vulnerability of jurisdictions to severe weather is dependent on the type, location, construction, height, and age of assets. Vulnerability of personal and community well-being is an additional concern relative to the previous section on state assets and depends on issues affecting safety from severe weather and continuity of public services and community lifelines. If these qualities remain constant through time, vulnerability will also be stable.

The assessment of jurisdiction vulnerability assumes that the nature of jurisdiction assets and public safety is consistent with what has existed in the recent past and provides a measure of

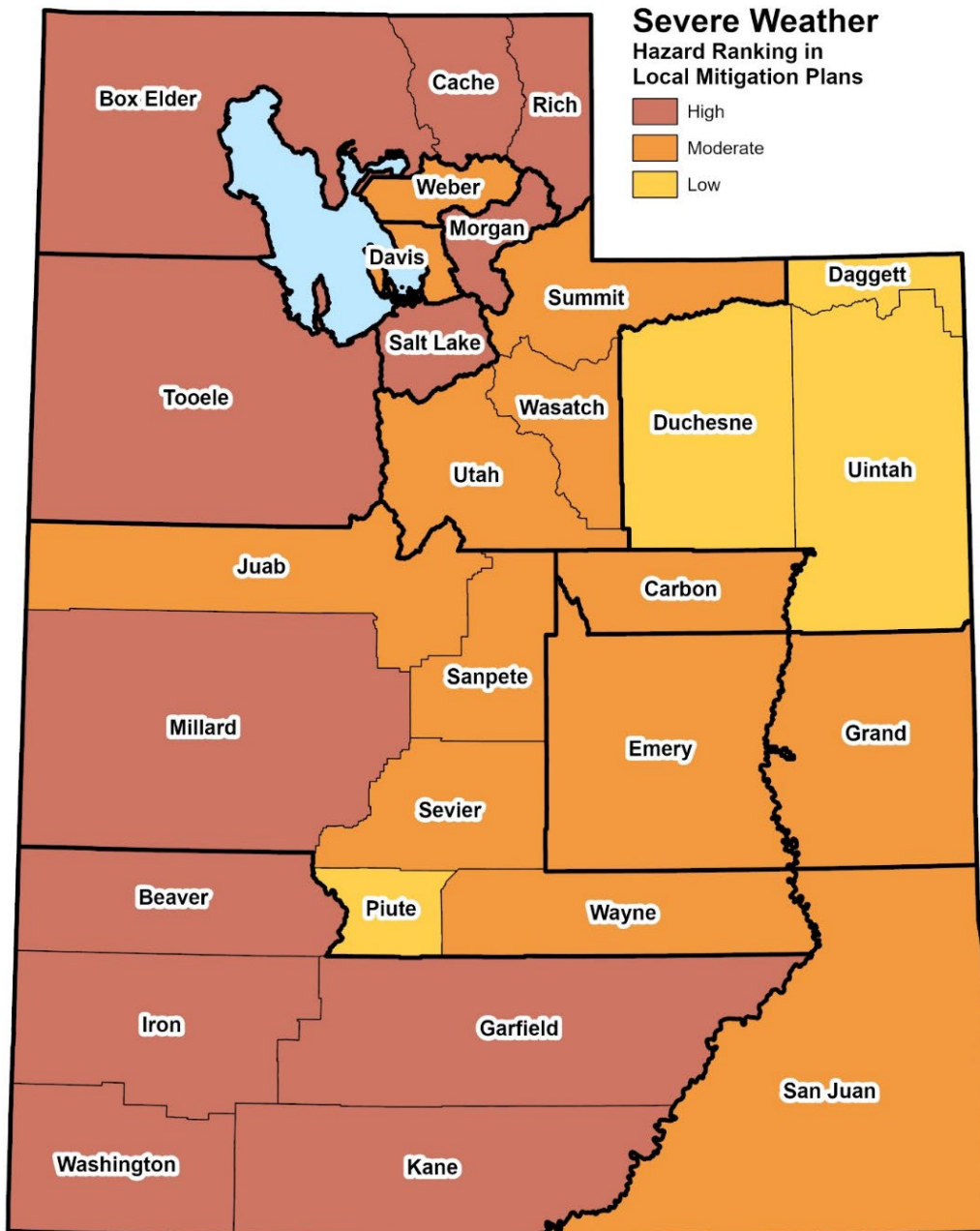
vulnerability in the near future. A key part of jurisdiction vulnerability considers the consequences of losing vulnerable assets and the resulting impacts on community lifelines.

The following analysis considers multiple data sources, some relatively coarse and others more detailed. When combined, a story emerges and supports conclusions on the vulnerability of jurisdictions to severe weather.

Local Hazard Mitigation Plan Assessment

An assessment of Local Hazard Mitigation Plans (LHMP) was conducted which examined how each jurisdiction ranked the frequency and severity of severe weather hazards for overall hazard significance. A map was created that combines the frequency and severity ranking for every county in Utah, displayed in the figure below. Counties generally ranked it has high or moderate significance.

Figure 4-106 Severe Weather Hazard Rankings from LHMPs



Source: Bear River AOG 2021, Carbon 2018, Davis 2022, Emery 2018, Five County AOG 2022, Grand 2018, Mountainland AOG 2022, Morgan 2022, San Juan 2018, Six County AOG 2021, Salt Lake 2020, Tooele 2022, Uintah Basin 2019, and Weber 2016.

National Risk Index Assessment

The FEMA National Risk Index (NRI) was also used for the basis of assessing relative vulnerability by jurisdiction. Hail risk generally is higher in the highly populated Wasatch Front counties, and similarly for strong wind and winter storms. Heat Wave risk stands out in Washington County in the southwest corner.

Figure 4-107 NRI Risk Index Rating - Hail, Heat Wave, Lightning

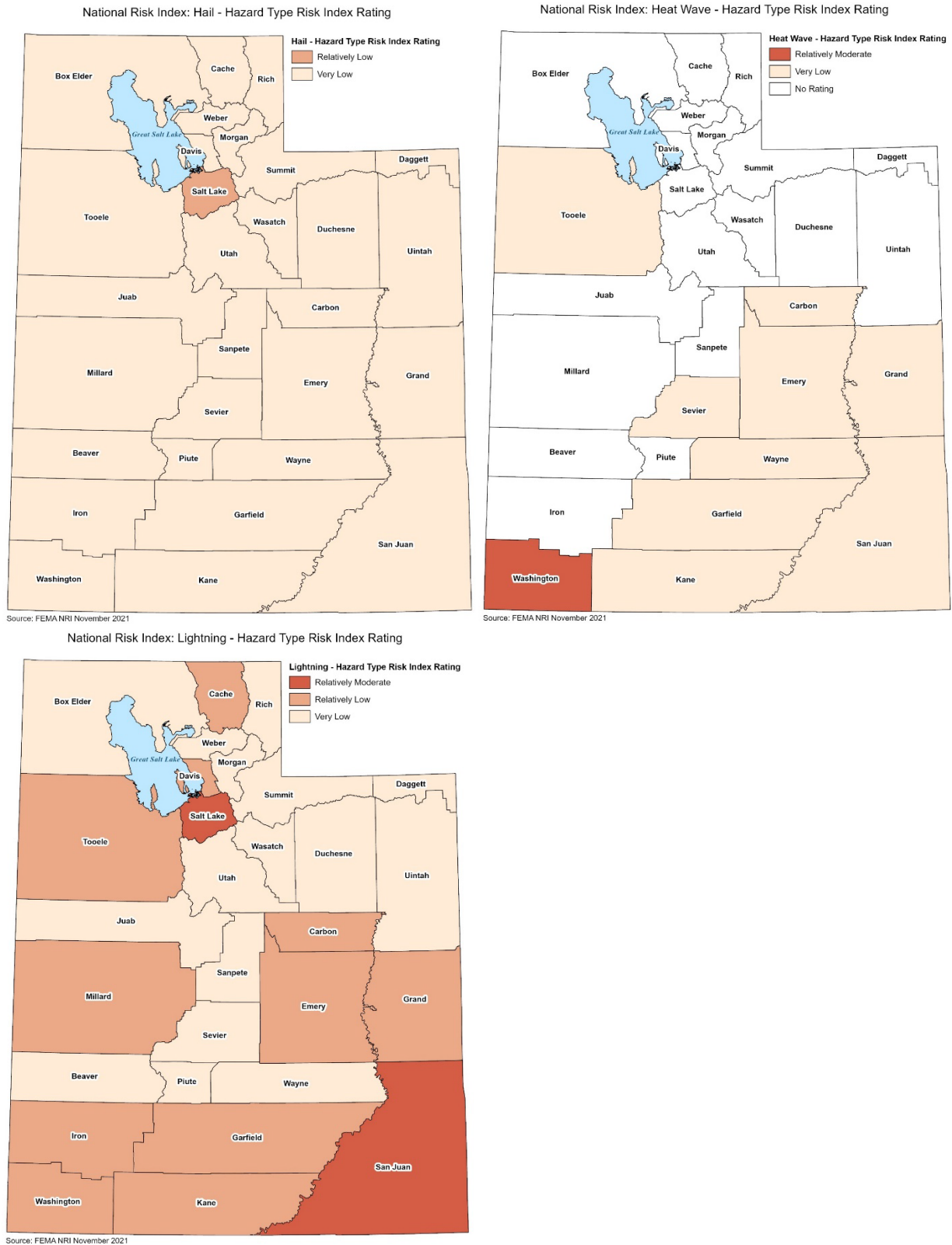
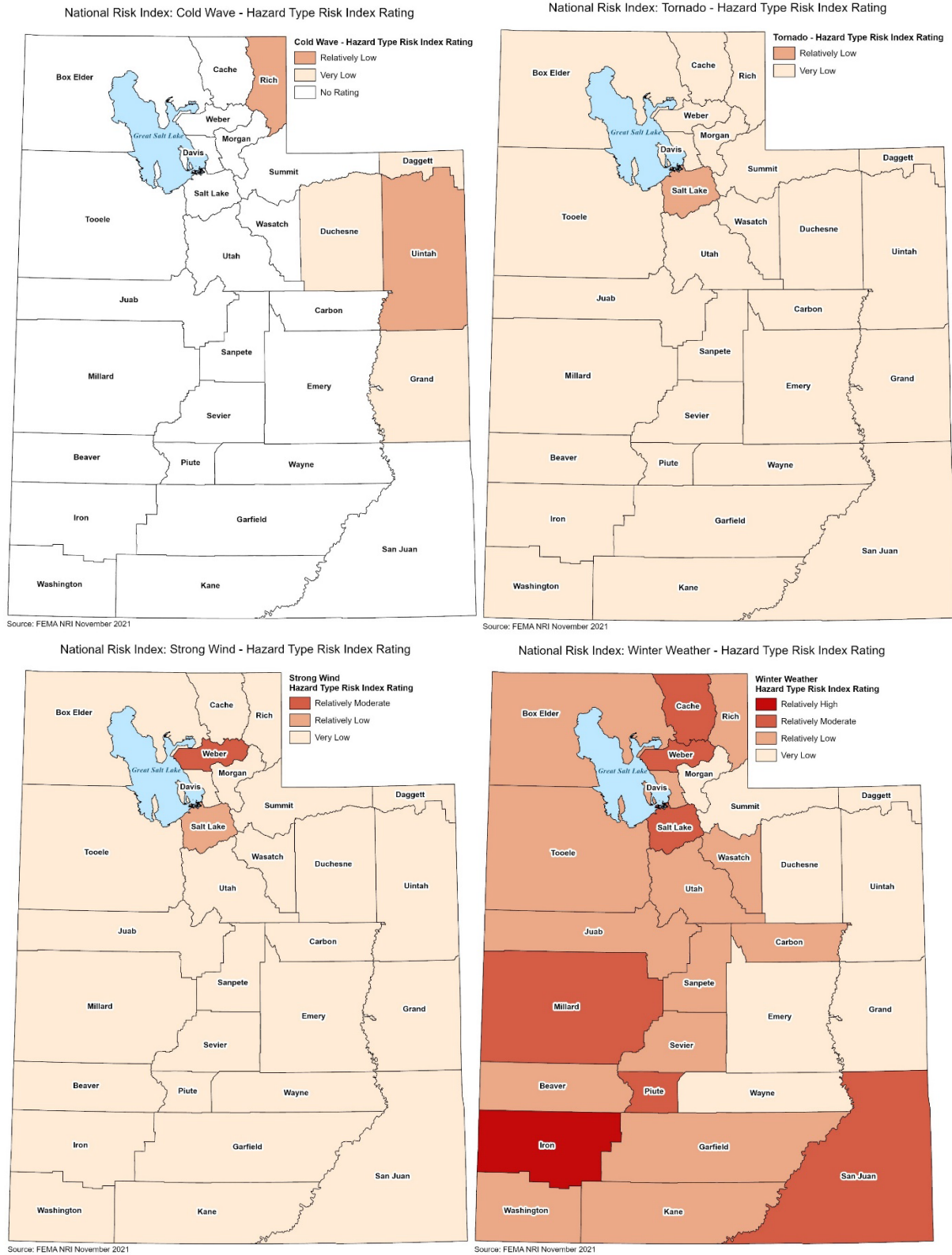


Figure 4-108 NRI Risk Index Rating – Cold Wave, Tornado, Strong Wind, Winter Storm



Local HMP risk assessments lack loss detail or rely on NCEI data, which makes it challenging to summarize risk details for a consistent and meaningful analysis. Section 4.11.4 Past Occurrences includes NCEI summary tables from 1955-2022 to sum up events by county for eight different hazards and provides a more comprehensive and consistent analysis. In addition, the NRI-based maps for Expected Annual Loss are shown in the following figures and generally reflect lightning, tornado, wind and winter weather to have greater losses in the Wasatch Front and surrounding counties. Additionally, the NCEI database reported that counties with greatest past losses due to severe weather are Salt Lake, Cache, Utah, Davis, and Weber Counties. The average annualized losses by hazard, based on the analysis of NCEI data, is captured in Table 4-85 in Section 4.11.5. Based on this analysis, tornadoes and high winds events have the highest annualized losses, followed by winter storms. It is expected that these losses will be of similar magnitude in future years, thus indicative of future annual losses, but annualized losses should be reviewed periodically for trends particularly in the era of climate change. Tables with annualized losses detailed by county and by severe weather hazards can be referenced in Appendix F.

Figure 4-109 NRI Expected Annual Loss Rating - Hail, Heat Wave, Lightning

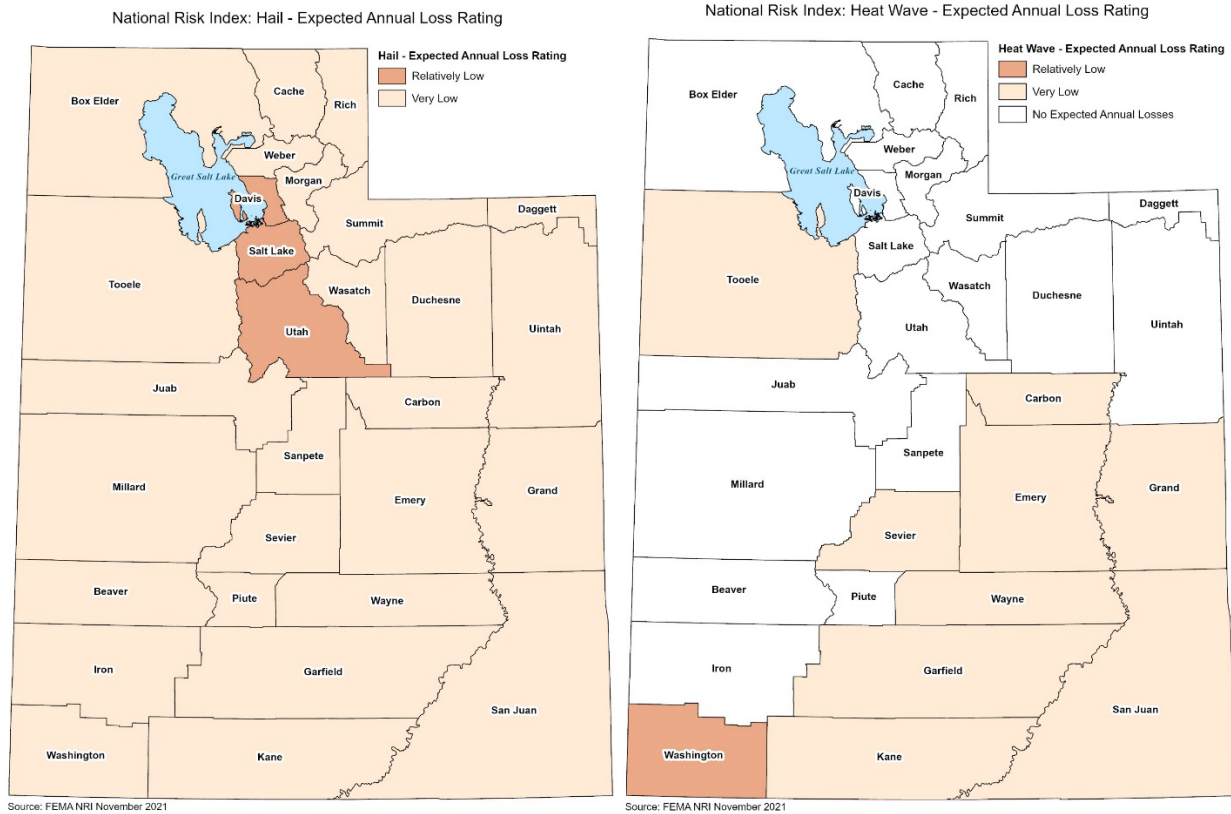
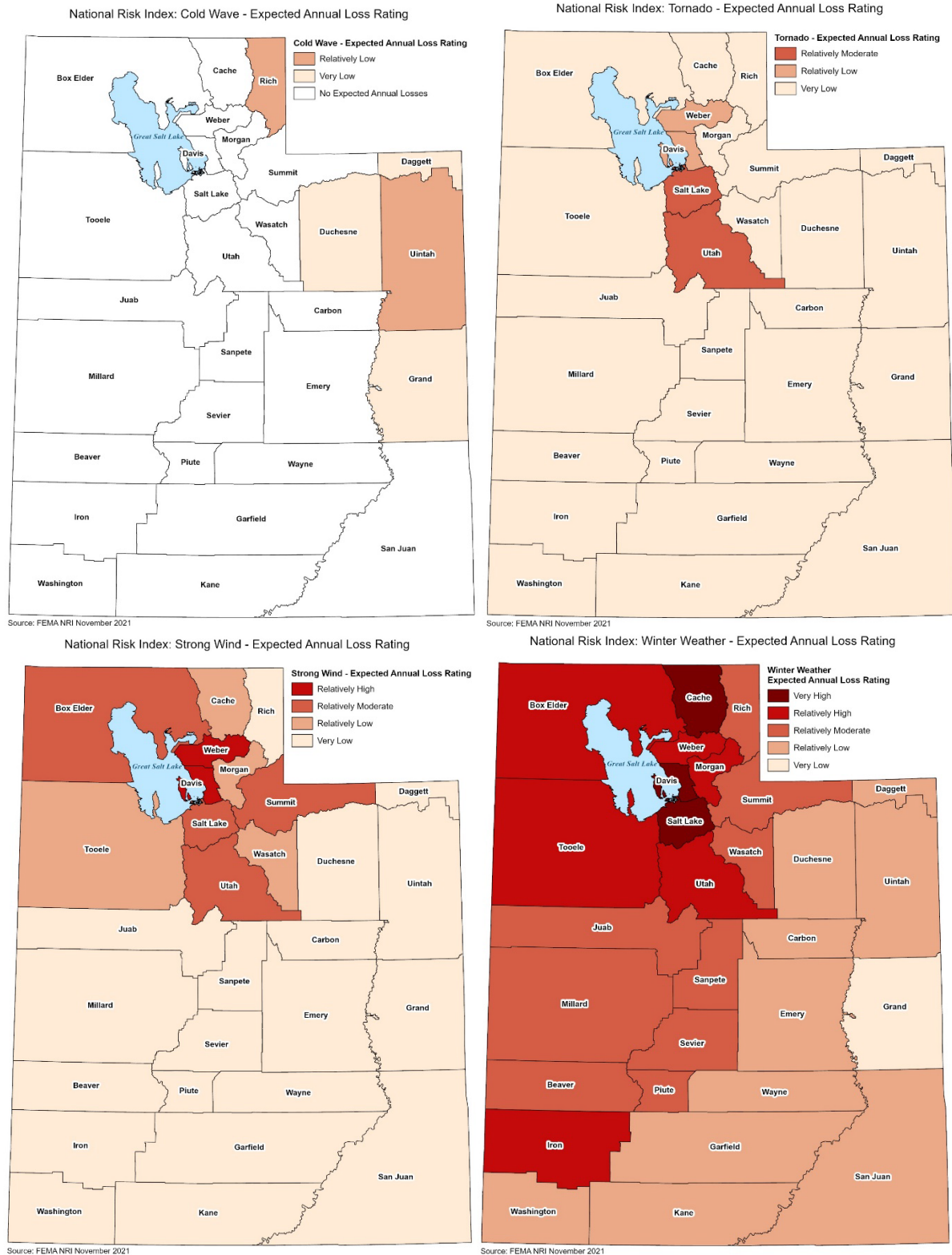


Figure 4-110 Expected Annual Loss Rating - Cold Wave, Tornado, Wind, Winter Storm



Population Impacts

Blizzards/severe winter storms and lightning are the deadliest severe weather events in Utah, cumulatively killing more people than any other hazard and injuring roughly twice as many people as any other severe weather hazard. Power outages, often related to severe winter storms, disrupt the lives of many thousands or tens of thousands of people in Utah.

Severe weather typically affects people outdoors. In the case of heat, people without access to air conditioning are affected. Populations such as the homeless are highly vulnerable to severe weather hazards. In the case of tornadoes, people living in less-wind resistant housing, such as mobile homes, are notoriously vulnerable. Figure 3-6 provides a county-scale map of social vulnerability index that may be useful to understand vulnerability related to state assets and services. As is the case with other hazards, counties with high social vulnerability are more likely to be affected by severe weather hazards and to experience severe weather impacts more severely (see Section 3.5.1).

Of the two most deadly severe weather hazards, blizzards/winter storms and lightning, a handful of counties are notable for having relatively high exposure to severe weather and relatively high social vulnerability. For severe winter weather, Duchesne, Rich, Summit, and Wasatch Counties stand out as especially vulnerable. For lightning hazards, Duchesne & Garfield are the most vulnerable, with Carbon, Grand, Iron, and San Juan Counties close behind.

Additional study at a local level will very likely enable better hazard mitigation for vulnerable populations. The state-level analysis in this section is useful to identify counties that are likely at increased risk from severe weather. However, local analysis can provide far more actionable information, such as *why* these counties are at risk and *how* to mitigate those vulnerabilities. In addition, local analyses are able to evaluate much finer scales, such as which populations within the county are most vulnerable, and how to mitigate risk for those populations. In many cases, vulnerable populations exist outside of the counties identified as especially vulnerable in the ESHMP. In the case of severe weather, reducing the vulnerability of unhoused persons can be addressed more effectively in the local plans of counties throughout the state.

As LHMPs evolve to be more inclusive of social vulnerability analysis this will provide a potential opportunity to roll up key information or trends into future ESHMP updates. In future ESHMP updates, the role of the state-level vulnerability analysis will expand to verifying that local level analyses appropriately evaluate vulnerabilities and possibly to facilitating such analysis.

Community Lifelines and Infrastructure

Winter Storms cause the most deaths and roughly twice as many injuries in Utah of any other hazard. This poses a substantial, direct challenge to the safety and security lifeline. Winter storms also notoriously impact transportation systems, especially road transportation, and arguably impact the health and medical lifeline by impairing patient movement and access to medical care. The most severe risk, however, is of a cascading disaster if a winter storm were to cause widespread, prolonged power outages due to power line infrastructure impacts.

Other severe weather hazards pose similar problems to community lifelines and infrastructure. Lightning, tornadoes, wind, and heat create their own challenges to community lifelines. For example, tornadoes and strong winds are well known for damaging power distribution infrastructure; extreme heat and lightning can also cause sporadic power outages. Ensuring critical facilities have backup power is one method that has been utilized by communities in Utah to build resilience to power infrastructure impacts from severe weather hazards.

4.11.9 Changes in Development

In general, as the fastest growing state in the country in terms of percent increase, more and more people and assets are being exposed to severe weather hazards thus potentially increasing vulnerability to certain hazards. For example, rapid growth and development are occurring throughout the Wasatch Front region. Utah County and Salt Lake County are especially notable as the fastest growing counties in Utah. This same area is particularly prone to damage from large hail. It is reasonable to assume that increasing the assets in harm's way will increase losses due to hail in this area.

Washington County, in the southwest corner of the state, is also expected to grow substantially in coming decades. This county also experiences the most frequent and severe heat waves of any Utah county and has relatively high social vulnerability. Taken together, this is a recipe for higher impacts from extreme heat in coming years.

Development and population increase go hand-in-hand, and as the population increases it is reasonable to assume more people will be spending time outdoors. This will effectively increase the exposure of people to severe weather such as extreme heat.

Development can also, by itself, increase the severity of certain severe weather hazards. For example, as development progresses, urban heat islands can form. Heat generated over paved surfaces can increase air temperatures and associated impacts. Development is often associated with decreasing urban tree canopy, decreasing shade refuges and further amplifying the effects of extreme heat.