

Plan Participant	Description of Outreach Efforts
Cedar City	Shared the public survey through website/social media posting.
Brian Head	Shared the public survey through website/social media posting.

Public Feedback Summary

Public survey results presented at the June 30, 2026, Risk Assessment Meeting included 51 responses. Respondents identified drought, extreme heat, wildfire, and high winds as leading concerns and emphasized public education and water conservation. Homes, neighborhoods, agricultural areas, critical infrastructure, and vulnerable populations were identified as at risk.

4 Risk Assessment

Methodology

The risk assessment evaluates the hazards that threaten the Five County AOG planning area and the potential impacts on people, property, infrastructure, the economy, natural resources, and community lifelines. The assessment was developed using guidance from the FEMA Local Mitigation Planning Policy Guide and draws on available local, state, and federal data sources identified during plan development. The methodology combines historical hazard information, geospatial analysis, stakeholder input, demographic and development data, and hazard-specific studies to assess risk across the planning area.

The assessment follows a four-step process:

1. Identify hazards that may affect the planning area.
2. Inventory assets that may be exposed to identified hazards.
3. Evaluate hazard probability, extent, and vulnerability.
4. Estimate potential impacts and losses where data and methodologies are available.

Because the Five County AOG planning area includes numerous jurisdictions with varying populations, topography, land uses, and development patterns, risk is not uniform throughout the region. The base plan provides a regional evaluation of hazards and vulnerabilities, while jurisdiction-specific annexes provide additional information regarding local exposure, development trends, critical facilities, and unique vulnerabilities.

Hazard Identification

Hazard identification is the first step in the risk assessment process. Hazards were identified through a comprehensive review of historical events, state and local planning documents, FEMA guidance, National Risk Index (NRI) datasets, previous hazard mitigation plans, stakeholder input, and public outreach efforts. Planning participants reviewed potential hazards and evaluated their relevance to the Five County AOG region based on historical occurrence, geographic applicability, future conditions, and potential consequences.

The planning team considered natural hazards for inclusion in the FEMA-approved mitigation plan. Human-caused hazards may be discussed for local planning purposes but are not the basis of FEMA approval under 44 CFR § 201.6. Natural hazards were retained for evaluation when available information indicated that they could affect the planning area. The basis for including or omitting each hazard is documented in this section and the jurisdiction-specific assessments.

Asset Identification

Understanding what is exposed to hazards is a critical component of risk assessment. Assets evaluated during this planning process include population, buildings, critical facilities, infrastructure systems, economic assets, environmental resources, and community lifelines. Asset inventories were developed using data from participating jurisdictions, federal and state datasets, geographic information systems (GIS), and previous planning efforts.

Assets considered in this assessment include the following:

- Population and vulnerable populations
- Residential, commercial, industrial, agricultural, and public buildings
- Critical facilities such as hospitals, schools, emergency response facilities, government buildings, dams, and utility facilities
- Transportation infrastructure, including highways, bridges, airports, and local road networks
- Water, wastewater, communications, electrical, and energy infrastructure
- Public lands, natural resources, watersheds, and recreation assets
- FEMA Community Lifelines, including Safety and Security; Food, Hydration, Shelter; Health and Medical; Energy; Communications; Transportation; Hazardous Materials; and Water Systems

Where available, GIS analysis was used to compare hazard areas with exposed populations and assets to better understand potential impacts and concentrations of risk throughout the planning area.

Potential Loss Estimates

Potential loss estimates provide an indication of the economic and physical impacts that could result from hazard events. Because hazard characteristics, available datasets, and modeling capabilities differ by hazard, loss estimation methodologies vary throughout this risk assessment.

Where available, loss estimates were derived from FEMA and NRI datasets and datasets from state agencies and local jurisdictions. For hazards with established loss methodologies, available estimates may include the following:

- Potential building damage
- Population exposure
- Critical facility exposure
- Infrastructure impacts
- Agricultural losses
- Economic disruption
- Environmental impacts
- Community lifeline disruptions

For hazards where quantitative loss estimates are not available, qualitative assessments were developed using historical impacts, documented disaster records, known vulnerabilities, and input from participating jurisdictions. As a result, loss estimates presented throughout this plan should be considered planning-level estimates intended to support mitigation decision-making rather than precise predictions of future damages.

Calculating Probability

Probability refers to the likelihood that a hazard will occur within a specified period. Probability estimates were developed, where supported by available information, using historical records, recurrence intervals, scientific literature, state and federal datasets, predictive models, and local knowledge provided by participating jurisdictions. Disaster declarations were used as evidence of past impacts, not as a complete record of hazard occurrence.

Because hazards vary considerably in frequency and predictability, probability determinations were made on a hazard-by-hazard basis using the best available information. For example, probabilities for weather-related hazards may rely heavily on historical event records, while probabilities for earthquakes may incorporate geologic studies and recurrence interval estimates. Future conditions, including changing climate patterns, prolonged drought, population growth, and development trends, were also considered where appropriate.

To improve consistency across hazard profiles, probability is categorized as Highly Likely, Likely, Occasional, or Unlikely using the classifications shown in Table 7.

Table 7: Probability Categories

Probability Category	Description
Highly Likely	Expected to occur one or more times per year (average recurrence interval of one year or less), based on the source and period of record identified in the applicable hazard profile
Likely	Expected to occur less than once per year but at least once in 10 years (annual probability of at least 10 percent but less than 100 percent), based on the source and period of record identified in the applicable hazard profile
Occasional	Expected to occur less than once in 10 years but at least once in 100 years (annual probability of at least 1 percent but less than 10 percent), based on the source and period of record identified in the applicable hazard profile
Unlikely	Expected to occur less than once in 100 years (annual probability of less than 1 percent), or available information is insufficient to support a higher category

National Risk Index

FEMA NRI data provides a national baseline for comparing relative natural hazard risk using expected annual loss, social vulnerability, and community resilience information at the county and census tract levels. FEMA's December 2025 NRI v1.20 dataset, released in January 2026, is available through the Resilience Analysis and Planning Tool and as downloadable data. NRI data provided an important baseline resource during development of this risk assessment and was used to help identify applicable hazards, understand regional trends, and support evaluation of potential impacts.

The NRI was not used as the sole basis for determining hazard significance. Rather, NRI findings were reviewed alongside local historical records, stakeholder input, jurisdictional knowledge, state hazard assessments, and hazard-specific technical studies. This approach helps the risk assessment reflect local conditions and hazards that may not be fully represented by a national baseline dataset. Table 8 documents how NRI hazards correspond to hazards addressed in this plan.

Table 8: NRI Hazard Review

Hazard	Included	Explanation
Avalanche	No	Although portions of the planning area contain high-elevation terrain and seasonal snowpack, avalanche risk is generally limited to remote backcountry areas and does not pose a significant threat to

Hazard	Included	Explanation
		populated areas, critical facilities, or infrastructure. It was not identified as a planning-priority hazard for participating jurisdictions.
Coastal Flooding	No	The Five County AOG region is located in southwestern Utah and has no coastline, tidal influences, estuaries, or exposure to storm surge. Coastal flooding is not applicable to the planning area.
Cold Wave	Yes	This hazard was included as Winter Storms. Extreme cold temperatures, heavy snow, and winter weather can affect transportation, utilities, agricultural operations, and vulnerable populations throughout portions of the planning area.
Drought	Yes	Drought is a recurring regional hazard that affects water supplies, agriculture, livestock operations, natural resources, recreation, and wildfire conditions throughout the five-county region.
Earthquake	Yes	The planning area is influenced by regional seismic sources associated with the Basin and Range Province and nearby fault systems. Earthquakes have occurred historically and remain capable of causing significant impacts.
Hail	Yes	Hail events occur throughout the region, particularly during spring and summer thunderstorms, and can damage structures, vehicles, crops, livestock, and solar infrastructure.
Heat Wave	Yes	This hazard was included as Extreme Heat. High temperatures occur annually and present risks to public health, infrastructure, agriculture, outdoor recreation, and energy demand.
Hurricane	No	The Five County AOG region is located far inland and is not exposed to hurricanes. Remnants of tropical systems may contribute to heavy rainfall and flooding but are addressed under the Flooding hazard profile.
Ice Storm	No	Freezing rain and significant ice accumulation events are uncommon within the planning area. Winter weather impacts are primarily associated with snowfall, blowing snow, cold temperatures, and winter storms rather than ice storms. Ice impacts are addressed under Winter Storms.
Landslide	Yes	Mountainous terrain, steep slopes, wildfire burn scars, intense precipitation, and seismic activity create conditions conducive to landslides, rockfalls, debris flows, and slope failures throughout parts of the region.
Lightning	Yes	This hazard was included as Thunderstorms and Lightning. Lightning occurs regularly during convective and monsoonal storms and poses threats to life safety, utility systems, recreation users, and structures and can ignite wildfires.

Hazard	Included	Explanation
Riverine Flooding	Yes	This hazard was included as Flooding. Flood hazards include riverine flooding, flash flooding, alluvial fan flooding, flooding in washes and canyon systems, and post-wildfire flooding and debris flows.
Strong Wind	Yes	This hazard was included as Damaging Winds. High winds, thunderstorm outflows, microbursts, and frontal wind events occur throughout the planning area and can damage structures, utilities, transportation networks, and agricultural resources.
Tornado	Yes	Although uncommon and generally weak, tornadoes have occurred in Utah and within the planning region. Due to their potential for localized damage and limited warning time, tornadoes were retained as a hazard of concern.
Tsunami	No	The planning area is inland and is not exposed to coastal tsunami inundation.
Volcanic Activity	No	Volcanic activity was not retained as a planning-priority hazard. There are no active volcanoes in the planning area.
Wildfire	Yes	Wildfire is a significant regional hazard due to extensive wildland vegetation, drought conditions, wildland-urban interface development, recreational use, and the potential for large, destructive fires.
Winter Weather	Yes	This hazard was included as Winter Storms. Snow, blowing snow, extreme cold, and winter storm conditions regularly affect portions of the region, particularly at higher elevations and in Beaver, Garfield, and Iron Counties.

How to Read the Hazard Profiles

Each hazard profile follows a standardized format to allow consistent comparison across hazards and jurisdictions. The profiles summarize hazard characteristics, historical impacts, future conditions, and vulnerabilities throughout the planning area. The information presented in each profile should be considered alongside jurisdiction-specific annexes, which provide additional details regarding local exposure, development patterns, and community concerns.

Each hazard profile contains the following elements:

- **Description:** Provides an overview of the hazard and explains the physical processes or conditions that cause the hazard to occur.
- **Location:** Describes the geographic areas where impacts are most likely to occur and identifies areas of elevated exposure within the planning area.
- **Magnitude and extent:** Describes the magnitude, severity, or intensity of a hazard event and the potential consequences associated with larger events.

- **Previous Occurrences:** Summarizes notable historical occurrences, including disasters, significant local events, and documented impacts.
- **Probability of Future Occurrences:** Evaluates the likelihood of future hazard occurrence and discusses trends that may influence future risk.
- **Vulnerability Assessment:** Identifies populations, buildings, infrastructure, community lifelines, natural resources, and economic sectors that may be affected by the hazard.
- **Impact Analysis and Cascading Impacts:** Describes the consequences a hazard may have on life safety, property, infrastructure, government services, environmental resources, and economic activity.

Dam Failure

A dam is a barrier constructed to impound or divert water. Dams and reservoirs support water supply, irrigation, flood-risk reduction, hydropower, recreation, and other public and private purposes. In Utah, winter snowpack is a major source of water supply, and reservoirs store runoff for use when natural streamflow does not match demand.⁴ Some facilities generate hydropower by routing water through turbines, and many reservoirs support boating, fishing, swimming, and other recreation.⁵

Dams also may reduce flood risk by storing runoff and releasing water in a controlled manner. Detention and flood-control structures may remain dry or retain little water except during runoff events. Their performance depends on design, operation, maintenance, available storage, and the magnitude of inflow.

Although dams provide substantial benefits, failure or misoperation can release stored water and cause rapid, destructive flooding downstream. Potential causes and contributing factors include the following:

- Internal erosion caused by embankment or foundation seepage, piping, vegetation, or animal burrows
- Extreme inflow, inadequate spillway or outlet capacity, and overtopping
- Design or construction deficiencies
- Improper operation, inadequate maintenance, or malfunctioning components
- Earthquake-related ground shaking or deformation
- Intentional physical or cyber-related disruption
- Failure or emergency release from an upstream dam on the same waterway

Downstream flooding also may result from operational or emergency releases made to preserve dam safety during high inflow. A controlled release is not a dam failure, but it still can affect downstream people, property, infrastructure, and access routes.

⁴Utah Division of Water Resources, "Snowpack," accessed October 9, 2026, <https://water.utah.gov/snowpack/>.

⁵Utah Division of Water Resources, "Dam Safety," "Why Do We Have Dams?" accessed October 9, 2026, <https://water.utah.gov/dam-safety/>.

The consequences of a dam incident or failure depend on the volume and rate of release, breach progression, warning time, downstream topography, channel geometry, and the number and type of exposed people and assets. Deep, high-velocity flow in confined canyons can be especially destructive. As flow spreads across broader valleys, depth and velocity may decrease, although inundation can extend over a wider area.

Dam incidents are commonly described as hydrologic, or “rainy-day,” events and nonhydrologic, or “sunny-day,” events. Hydrologic failures may occur when extreme inflow exceeds spillway or outlet capacity and causes overtopping or other distress. Sunny-day failures occur without a concurrent flood and may result from internal erosion, seepage, structural defects, operational problems, or other mechanisms. Either type can develop rapidly and provide limited warning.

The Utah State Engineer, who also serves as director of the Utah Division of Water Rights, regulates dam safety and oversees the state’s Dam Safety Section. The Dam Safety Section regulates nonfederal dams subject to state jurisdiction and provides technical review of dam design, construction, alteration, operation, maintenance, and inspection. The Utah Division of Water Resources, an affiliate agency, supports dam-safety projects through funding and project oversight but is not the state’s dam-safety regulator. Dam owners remain responsible for safely operating and maintaining their facilities and for completing required repairs or upgrades. Federal agencies regulate or manage federal dams under applicable federal requirements.

Dam ownership, jurisdiction, hazard-potential classification, condition information, and inspection status are distinct attributes. This profile uses publicly releasable inventory and mapping information for planning purposes and does not treat hazard-potential classification or inspection frequency as evidence that a particular dam is unsafe or likely to fail.

Location

The Utah Division of Water Rights Dam Safety Section maintains dam inventory information. Figures 1 through 5 show mapped dam locations and available planning-level inundation information in Beaver, Garfield, Iron, Kane, and Washington Counties. The point symbols portray the condition-rating categories shown in the map legend, while the shaded areas portray available dam-inundation scenarios. Condition rating, hazard-potential classification, and inspection status are separate concepts. Because the source inventory includes different record types and the map products do not support a reliable reconciliation of all inventory-status categories, the captions do not report county totals. The maps identify the regional location of the hazard; jurisdiction-specific exposure and vulnerability should be read with the applicable annex.

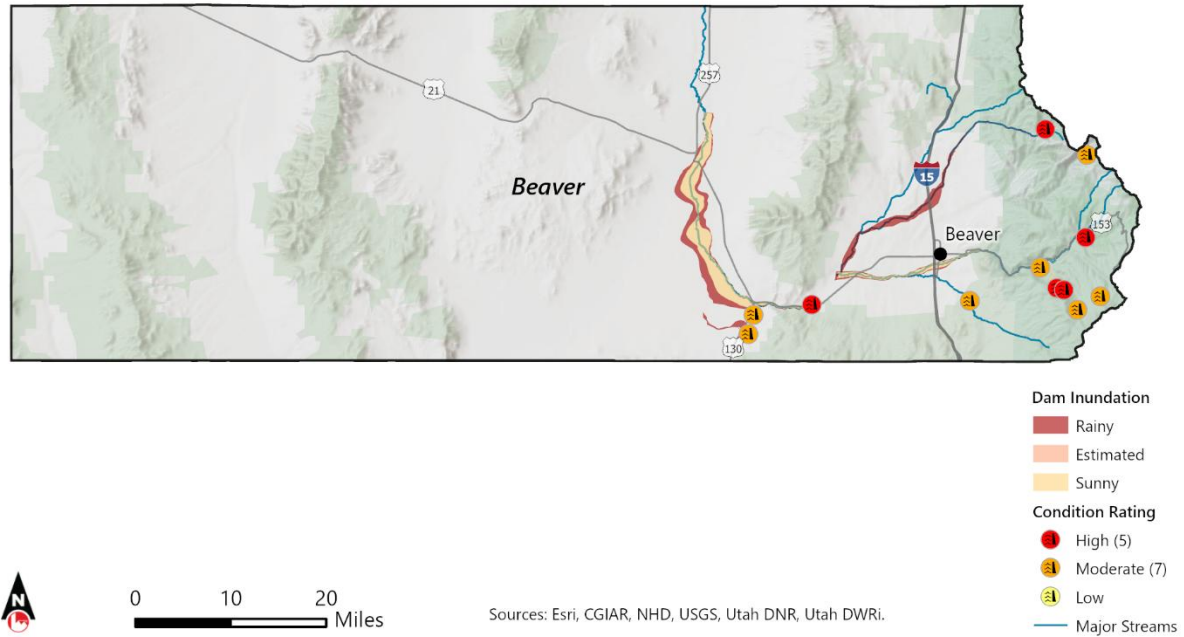


Figure 1: Beaver County Dam Locations and Available Inundation Areas

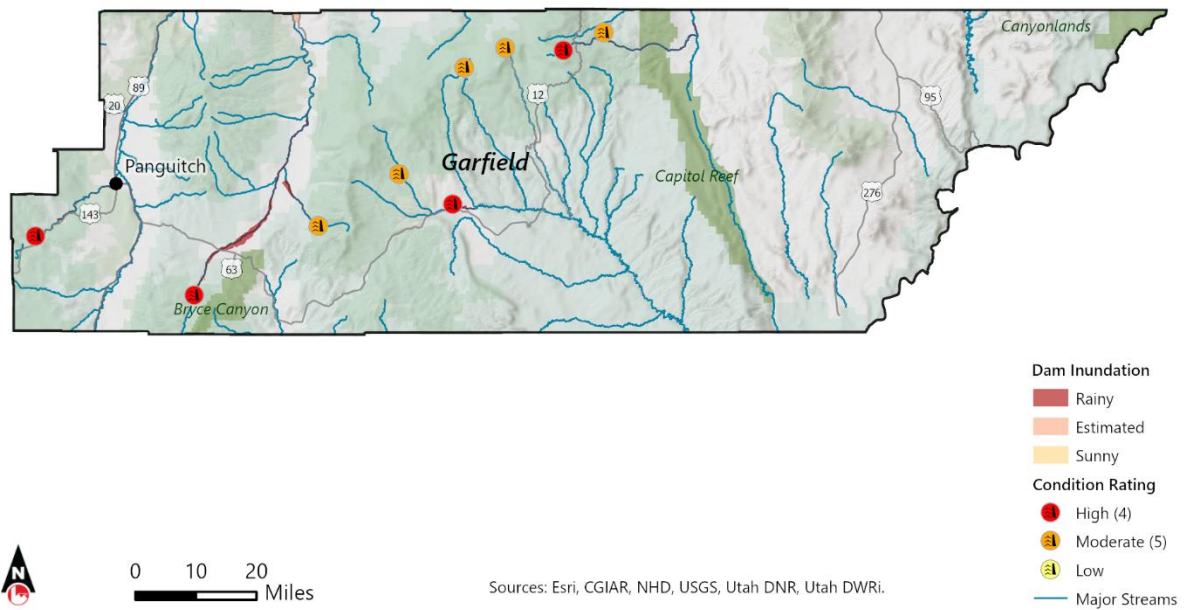


Figure 2: Garfield County Dam Locations and Available Inundation Areas

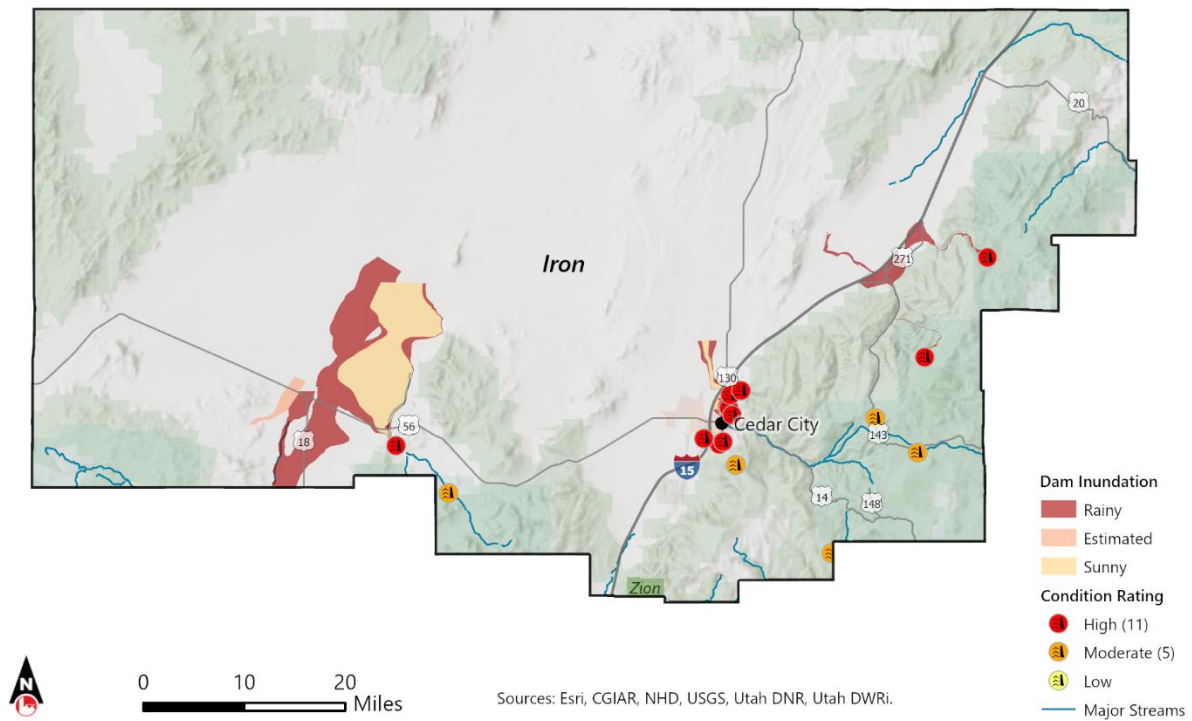


Figure 3: Iron County Dam Locations and Available Inundation Areas

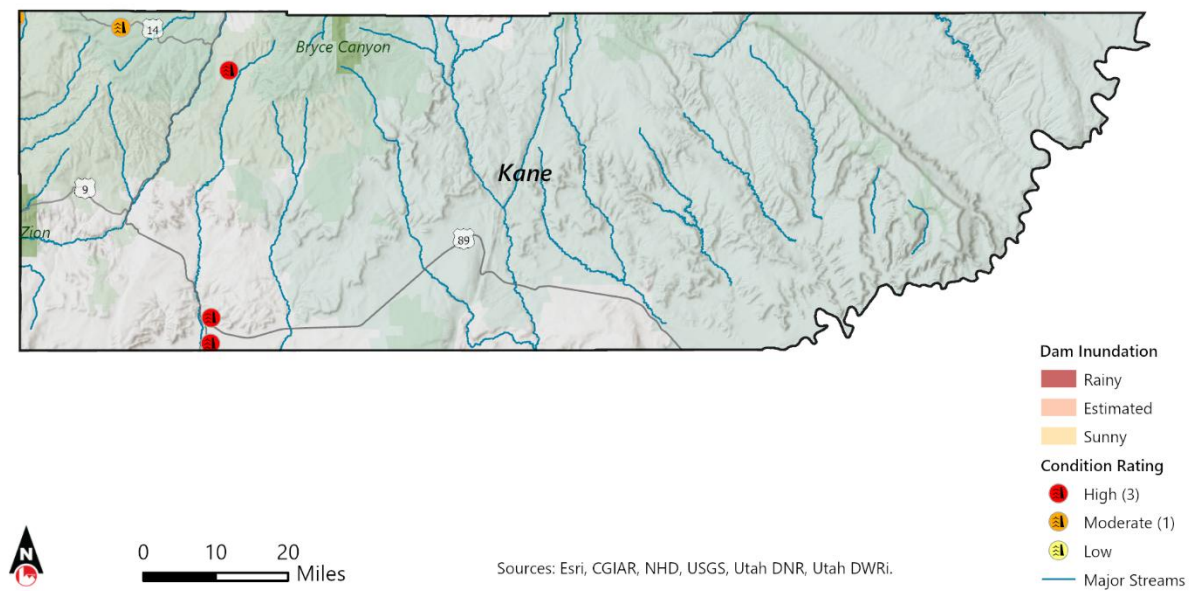


Figure 4: Kane County Dam Locations and Available Inundation Areas

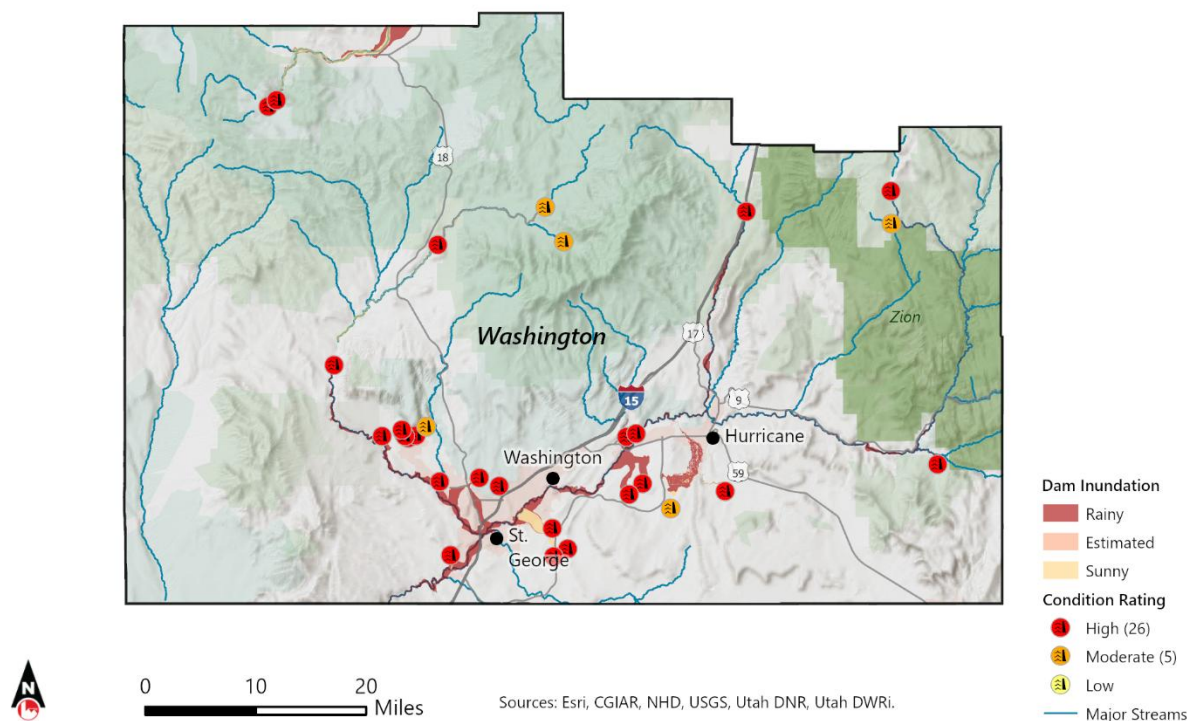


Figure 5: Washington County Dam Locations and Available Inundation Areas

The mapped inundation areas represent modeled scenarios based on assumptions concerning breach formation, reservoir level, routing, and downstream conditions. They do not depict every possible dam incident or operational release and should not be interpreted as a prediction that a dam will fail. Publicly releasable map information indicates that potential downstream effects are concentrated along reservoir outlets, stream channels, washes, canyon corridors, and adjoining low-lying areas. More detailed emergency action plans, breach studies, and inundation products may contain sensitive information and should be incorporated or summarized only in coordination with the Utah Division of Water Rights, dam owners, and emergency-management officials.

Magnitude and Extent

Utah and federal dam-safety practice classify dams by hazard potential according to the anticipated consequences of failure or misoperation. Hazard-potential classification is independent of a dam's physical condition and does not estimate failure probability.

- **High-hazard-potential dams** are those for which failure or misoperation would probably cause loss of human life.
- **Significant-hazard-potential dams** are those for which failure or misoperation is not expected to cause loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities, or other substantial impacts.

- **Low-hazard-potential dams** are those for which failure or misoperation is not expected to cause loss of human life and would result in low, generally limited losses.

The consequences of a dam incident may range from localized erosion or short-term service disruption to rapid inundation with life-safety consequences. Relevant measures of extent include potential inundation depth and velocity, arrival time, warning time, breach discharge, geographic reach, population at risk, and the number and function of exposed structures, critical facilities, infrastructure systems, and community lifelines. These measures are specific to the dam and the scenario. The available regional information does not support a single quantitative magnitude value for all dams in the planning area.

Previous Occurrences

Documented failures and serious incidents provide context for warning, evacuation, emergency response, and long-term risk reduction. The following events are included because authoritative sources identify effects within the planning area. Events for which the available record does not support a sufficiently reliable facility name, cause, impact estimate, or declaration relationship are omitted rather than presented as confirmed occurrences.

- **Quail Creek Dike Failure (1989):** Quail Creek Reservoir in Washington County includes a main dam and a separate dike. The dike failed shortly after midnight on January 1, 1989. The Association of State Dam Safety Officials case study attributes the failure to foundation seepage associated with design and construction deficiencies.⁶

Contemporary case-study information indicates that warning and evacuation occurred before the breach reached downstream development, preventing loss of life. The flooding damaged homes, apartments, roads, bridges, utilities, and agricultural property. FEMA issued Major Disaster Declaration DR-820-UT for the event. The incident prompted changes to Utah dam-safety oversight and remains a regional example of the importance of design review, seepage monitoring, warning, and evacuation planning.⁷

- **Panguitch Lake Dam Incident (2024):** The original Panguitch Lake Dam in Garfield County was constructed in 1872. The dam was raised with a concrete cap in 1942, buttressed with zoned earthfill and capped with grouted riprap in 1975, and received a replacement outlet gate and controls in 2011. In April 2024, ice damaged the upper portion of the dam and raised concern about an uncontrolled release. Local, state, and federal officials; engineers; emergency responders; the dam owner; and the community implemented the emergency action plan, lowered the reservoir, stabilized the structure, constructed an emergency spillway, closed affected transportation access, and prepared downstream notification and evacuation measures. These actions prevented an uncontrolled release. The incident

⁶ Association of State Dam Safety Officials, "Quail Creek Dike (Utah, 1989)," Dam Failures and Lessons Learned case study.

⁷ U.S. Geological Survey, *Flood on the Virgin River, January 1989, in Utah, Arizona, and Nevada*, Water-Resources Investigations Report 94-4159 (1995).

subsequently led to construction of a replacement dam downstream of the original structure. This event is treated as a serious dam incident and near-failure, not as a completed breach.⁸

Table 9: Previous Federal Dam-Failure Disaster Declaration

Year	Declaration Number	Declaration Type	Title and Description
1989	DR-820-UT	Federal	Quail Creek Dike Failure and Flooding

Probability of Future Occurrences

Using the plan-wide probability categories, dam failure is rated **Unlikely** at the regional level. The available record documents a small number of failures or serious incidents over more than a century, and available public information does not support a defensible annualized regional failure rate. Under the plan methodology, the Unlikely rating applies when an event is expected less often than once in 100 years or when available information is insufficient to support a higher category. This regional rating does not characterize the condition or likelihood of failure of any individual dam and does not reduce the significance of potential consequences from high-hazard-potential dams.

Future risk may change through both loading and consequence pathways. Extreme precipitation, rapid snowmelt, post-wildfire runoff and debris, seismic loading, aging components, operational conditions, and deferred maintenance can affect dam performance, but the direction and magnitude of change are facility specific. Population growth and development downstream can increase the population and assets exposed even if the probability of failure does not change, a process often described as hazard creep. Future dam-safety evaluations should use current hydrologic and seismic criteria, dam-specific performance studies, updated precipitation information, and current downstream-development data. This profile does not infer a county-scale change in failure probability from regional climate projections alone.

Vulnerability Assessment

This planning-level assessment identifies people, structures, critical facilities, infrastructure, economic assets, natural and cultural resources, and community activities that may be susceptible to dam failure or an uncontrolled release. Exposure is concentrated within mapped inundation areas and plausible downstream flow paths, including reservoir outlets, stream channels, washes, canyon corridors, low-lying valley areas, and transportation crossings. Actual consequences would depend on the dam and incident scenario, including breach progression, warning and arrival time, depth and velocity, debris, route availability, and the location and characteristics of exposed populations and assets. Figures 1 through 5 and the applicable jurisdictional annexes should be used with current dam-specific emergency information where authorized and available.

⁸ Association of State Dam Safety Officials, "Panguitch Lake Dam (Utah, 2024)," Dam Failures and Lessons Learned case study.

BEAVER COUNTY

Beaver County's dam-failure vulnerability is concentrated downstream of the dams and available inundation areas shown in Figure 1. People who live, work, travel, farm, or recreate along affected waterways may face rapidly changing conditions, limited warning, and difficult evacuation, particularly in confined channels or locations with few alternate routes. Potentially exposed assets include residences, agricultural and accessory structures, businesses, public facilities, and recreation sites; susceptibility varies with inundation depth and velocity, scour, debris, construction type, elevation, and local topography.

Roads, bridges, culverts, irrigation works, water and wastewater components, power and communications facilities, and emergency-access routes may be damaged or made inaccessible. Direct losses could extend to crops, equipment, public infrastructure, and private property, while closures or utility interruptions could affect emergency response, commerce, agriculture, recreation, and access to services beyond the inundated area. Streams, riparian areas, habitat, historic properties, archaeological resources, and other culturally important places may also be affected by erosion, channel change, sediment, debris, or contamination.

Cascading impacts: Flooding, rapid snowmelt, wildfire-related runoff and debris, landslides, or earthquakes could initiate or worsen a dam emergency. A release could then sever transportation and utility links, isolate rural areas, impede evacuation, and mobilize sediment, ash, sewage, fuel, or agricultural materials. Damage to reservoir storage, irrigation conveyance, or access infrastructure could prolong effects on water supply, agriculture, recreation, and fire-suppression capability after floodwaters recede.

Changes in development: New residential, agricultural, commercial, or infrastructure development within downstream flow paths can increase the number of people and assets at risk even if the probability of dam failure is unchanged. Redevelopment, road improvements, utility extensions, and changes in recreational use may also alter evacuation demand and consequence estimates. Beaver County and participating jurisdictions should use current inundation information, land-use data, building inventories, and emergency routes when reviewing development and should coordinate updates with dam owners and the Utah Division of Water Rights.

GARFIELD COUNTY

Garfield County's vulnerability is concentrated along the dam locations, available inundation areas, reservoir outlets, and downstream waterways shown in Figure 2. Residents, visitors, travelers, recreationists, and workers may be exposed, and seasonal visitation or unfamiliarity with local warning and evacuation procedures can complicate protective actions. Homes, businesses, public buildings, agricultural improvements, and recreation facilities in downstream corridors may be damaged by inundation, high-velocity flow, scour, sediment, and debris.

Potentially affected infrastructure includes highways and local roads, bridges, culverts, water and wastewater systems, irrigation facilities, power and communications assets, and emergency-access routes. Closures in canyon or rural settings may lengthen detours, delay response, and temporarily restrict access

to communities, public lands, or visitor destinations. The April 2024 Panguitch Lake Dam incident demonstrates the importance of emergency action planning, reservoir drawdown capability, transportation control, downstream notification, and coordinated local, state, federal, owner, and community response.

Cascading impacts: Severe storms, rapid snowmelt, ice, wildfire-related runoff and debris, landslides, or earthquakes may compound dam-safety concerns. A dam emergency could close key routes, interrupt utilities and communications, isolate communities or recreation areas, and mobilize sediment, ash, sewage, fuel, or other contaminants into downstream waters. Loss of storage or conveyance capacity could also affect water supply, irrigation, recreation, aquatic resources, and fire-response capability.

Changes in development: Growth or redevelopment downstream of dams can increase population-at-risk, property exposure, traffic demand, and evacuation complexity without changing the likelihood of failure. Additional visitor accommodations, recreation use, utilities, and roadway improvements may create both new exposure and opportunities for safer access and warning. Garfield County and participating jurisdictions should periodically compare current development, seasonal occupancy, critical facilities, and evacuation routes with authorized inundation information and incorporate findings into land-use review and emergency planning.

IRON COUNTY

Iron County's vulnerability is concentrated within the dam locations, available inundation areas, drainage corridors, and downstream low-lying areas shown in Figure 3. Exposed populations may include residents, workers, students, travelers, and recreationists, including people who need transportation, medical, mobility, language, or other assistance to evacuate. Residential, commercial, institutional, agricultural, and accessory structures may be susceptible to inundation, velocity, scour, erosion, sediment, and debris, with consequences shaped by local terrain and warning time.

Critical exposure may include roads and bridges, emergency-response and medical access, schools and government facilities, water and wastewater systems, irrigation infrastructure, energy and communications assets, and other community lifelines. Damage or loss of access could delay warning, evacuation, response, and restoration while disrupting employment, education, commerce, agriculture, and recreation. Streams, riparian areas, habitat, historic properties, archaeological sites, and cultural landscapes in downstream corridors may experience erosion, deposition, contamination, or physical loss.

Cascading impacts: Extreme precipitation, rapid snowmelt, wildfire and post-wildfire runoff, landslides, or seismic shaking may contribute to a dam emergency. Released water and debris could then impair transportation, power, communications, water, wastewater, and hazardous-materials management, producing simultaneous lifeline disruptions and complicating evacuation. Reduced reservoir or conveyance function could create longer-term effects on municipal and agricultural water service, recreation, and wildfire response.

Changes in development: Continued residential, commercial, institutional, and infrastructure development downstream of dams may increase exposure and emergency-management demands even

where dam condition and failure probability remain unchanged. Changes in density, road networks, utility service, and occupancy can alter both consequence estimates and evacuation times. Iron County and participating jurisdictions should use updated parcel, structure, population, critical-facility, and transportation data when reviewing development in potential inundation corridors and when updating emergency procedures.

KANE COUNTY

Kane County's vulnerability is concentrated along the dam locations, available inundation areas, stream channels, washes, canyon corridors, and reservoir outlets shown in Figure 4. Residents, visitors, recreationists, workers, and travelers may be exposed, sometimes in remote areas where warning coverage, communications, route redundancy, and emergency access are limited. Buildings, campgrounds, visitor facilities, agricultural improvements, and public infrastructure in downstream flow paths may be affected by deep or fast-moving water, scour, erosion, sediment, and debris.

Roads, bridges, culverts, water and wastewater components, energy and communications systems, and emergency-access routes may be directly damaged or rendered inaccessible. Disruption may affect public safety, tourism and recreation access, local commerce, agriculture, and delivery of essential services beyond the inundated area. Natural and cultural resources—including riparian habitat, springs, archaeological sites, historic properties, trails, and culturally important landscapes—may be vulnerable to erosion, channel change, deposition, contamination, or physical loss.

Cascading impacts: Flash flooding, severe storms, rapid snowmelt, wildfire-related runoff and debris, landslides, or earthquakes may increase loading or complicate dam operations. A release could isolate remote communities and recreation areas, close canyon or highway routes, interrupt communications and utilities, and transport sediment, ash, sewage, fuel, or hazardous materials. Loss of reservoir storage or access may also affect water availability, recreation, ecosystem conditions, and fire-suppression capability during recovery.

Changes in development: New homes, visitor facilities, transportation improvements, utilities, and recreation use within downstream corridors can increase the number and diversity of people and assets requiring warning and evacuation. Seasonal and transient populations may change faster than permanent-population estimates indicate. Kane County and participating jurisdictions should compare current land use, visitor patterns, critical facilities, and access routes with authorized inundation information and avoid relying on older mapping or population data when evaluating proposed development.

WASHINGTON COUNTY

Washington County's vulnerability is concentrated downstream of the dams, reservoir outlets, washes, river corridors, and available inundation areas shown in Figure 5. Residents, workers, visitors, motorists, and recreationists may be exposed, and short-warning conditions could require rapid notification and evacuation. Residential and commercial development, public facilities, agricultural property, utilities, and

recreation assets in downstream flow paths may be susceptible to inundation, velocity, scour, erosion, sediment, and debris.

The 1989 Quail Creek Dike failure illustrates the county's potential for damage to homes, apartments, roads, bridges, utilities, and agricultural property, while also demonstrating the life-safety value of warning and evacuation. Current exposure may include emergency facilities, transportation routes, water and wastewater systems, energy and communications assets, and other community lifelines. Disruption could affect public safety, commerce, tourism, housing, agriculture, and essential services well beyond the directly inundated area.

Cascading impacts: Extreme precipitation, rapid runoff, wildfire-related debris, landslides, earthquakes, or upstream operational conditions could initiate or intensify a dam emergency. A breach or emergency release could damage key roads and utilities, impede evacuation, create hazardous rescue conditions, and mobilize sediment, ash, sewage, fuel, or agricultural chemicals. Loss of reservoir storage, conveyance, power, or access could produce continuing effects on water supply, irrigation, recreation, economic activity, and fire response.

Changes in development: Population growth and continued residential, commercial, and infrastructure development downstream of dams can substantially increase consequences even if failure probability remains unchanged. Greater density, traffic, utility dependence, and visitor activity may increase warning, evacuation, sheltering, and recovery demands, while new roads and communications systems may improve response if designed with redundancy. Washington County and participating jurisdictions should routinely reconcile current development, critical facilities, population and occupancy, and evacuation routes with authorized inundation information and dam emergency plans.

Damaging Winds

Damaging wind includes non-tornadic winds capable of causing damage, including thunderstorm straight-line winds, downbursts, microbursts, and synoptic or pressure-gradient wind events. Because National Oceanic and Atmospheric Administration (NOAA) Storm Events categories use different reporting thresholds, this profile relies on the event categories and definitions identified in the supporting datasets rather than a single universal wind threshold.

NOAA uses "straight-line wind" for thunderstorm wind not associated with tornado rotation. These winds commonly develop when a thunderstorm downdraft reaches the ground and spreads outward, although several convective processes can produce damaging winds.

People in thunderstorm-prone areas of Utah may be exposed to straight-line winds generated by thunderstorm outflow. Manufactured homes and other lightly constructed or inadequately anchored structures are especially susceptible to wind damage, structural failure, and windborne debris.

The following types of wind have the potential to cause damage (tornadic winds are profiled separately):

- **Thunderstorm Winds or 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 downdraft with an outflow area 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.
- **Derecho:** Pronounced similar to “deh-REY-cho” in English, this is a widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. Although a derecho can produce destruction similar to that of tornadoes, the damage typically is directed in one direction along a relatively straight swath. As a result, the term “straight-line wind damage” sometimes is used to describe derecho damage. If the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) along most of its length, then the event may be classified as a derecho.⁹

Location

Damaging wind events affect all five counties in the planning area, with spatial patterns influenced by topography, land cover, and development.

- In Beaver County, damaging winds most frequently occur across open valley floors and along major transportation corridors where unobstructed terrain allows strong pressure-gradient winds and frontal systems to accelerate, particularly during spring and fall transition seasons.
- In Garfield County, damaging winds are widely distributed but are most pronounced in higher-elevation plateaus, canyon corridors, and exposed communities where terrain-driven funneling increases wind speeds during frontal passages and windstorm outflows.
- In Iron County, damaging winds are most pronounced across the Cedar Valley, along Interstate 15 and other exposed north–south transportation corridors, and near canyon outlets and higher terrain where frontal winds, pressure-gradient winds, and thunderstorm outflows can intensify.
- In Kane County, damaging winds occur across exposed plateaus, desert basins, mesas, and canyon corridors, with localized acceleration near canyon openings and open travel routes; arid surfaces also increase the potential for blowing dust and reduced visibility.

⁹ National Oceanic and Atmospheric Administration, National Severe Storms Laboratory, “Severe Weather 101 Thunderstorms, Thunderstorm Types,” 2026, <https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/types/>.

- In Washington County, damaging winds affect developed valleys, desert basins, canyon mouths, and major transportation corridors, including the Interstate 15 corridor, where thunderstorm outflows, downbursts, and regional pressure-gradient winds can affect densely developed communities and exposed infrastructure.

Magnitude and Extent

Damaging winds occur throughout southwestern Utah and can disrupt roads, utilities, communications, structures, agriculture, and emergency access. Typical effects include downed trees and power lines, roof and siding damage, windborne debris, reduced visibility from blowing dust, roadway delays or closures, and power outages. Older adults, people who rely on electrically powered medical equipment, residents of manufactured housing, travelers, outdoor recreation users, and people in remote areas may experience disproportionate consequences when outages or access disruptions occur.

The Beaufort Wind Scale (see Table 10) was developed to estimate wind speeds based on their effects via visual observations. Initially used by sailors based on sea conditions, it is still in use today to estimate wind strengths.

Table 10: Beaufort Wind Scale¹⁰

Force	Speed (mph)	Speed (knots)	Description	Specifications
0	0–1	0–1	Calm	Calm; smoke rises vertically.
1	1–3	1–3	Light Air	Direction of wind shown by smoke drift, but not by wind vanes.
2	4–7	4–6	Light Breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
3	8–12	7–10	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	13–18	11–16	Moderate Breeze	Raises dust and loose paper; small branches are moved.
5	19–24	17–21	Fresh Breeze	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25–31	22–27	Strong Breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32–38	28–33	Near Gale	Whole trees in motion; inconvenience felt when walking against the wind.

¹⁰ National Weather Service, "The Beaufort Wind Scale," 2026, <https://www.weather.gov/mfl/beaufort>.

Force	Speed (mph)	Speed (knots)	Description	Specifications
8	39–46	34–40	Gale	Breaks twigs off trees; generally impedes progress.
9	47–54	41–47	Severe Gale	Slight structural damage occurs (chimney-pots and slates removed).
10	55–63	48–55	Storm	Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	64–72	56–63	Violent Storm	Very rarely experienced; accompanied by widespread damage.
12	73+	64+	Hurricane	Devastation occurs.

The most significant secondary hazards linked with damaging winds are falling and downed trees, and downed power lines and associated power outages. Power outages usually last anywhere from a few minutes to a few hours. In some extreme cases, power outages have lasted a few days or even a few weeks. Severe-weather-induced power failures can come from the following sources:

- High and moderate winds lead to power outages by blowing objects into power lines and other components, causing them to break.
- Momentary outages may occur if an object, such as a tree limb, is blown onto a power line and then falls off.
- Both high winds (more than 55 mph) and moderate winds (35 to 55 mph) may be sufficient to cause power outages.

If damaging wind coincides with warm temperatures and low humidity, it can pose an increased risk of fire danger. A Red Flag Warning may be issued to warn fire officials, firefighters, and the public of potentially dangerous fire weather conditions.

Previous Occurrences

Previous occurrences of damaging winds in southwestern Utah demonstrate that this hazard is recurrent, geographically widespread, and capable of producing both localized and regionally significant impacts. Across Beaver, Garfield, Iron, Kane, and Washington Counties, damaging wind events have included high winds, strong winds, and dust storm conditions that have disrupted transportation, damaged structures and utilities, caused power outages, and created hazardous travel conditions, particularly along exposed valley corridors, mesas, and desert landscapes. Although these events have not typically resulted in federal or statewide declarations in the region, historical records show that damaging winds have caused measurable property and crop losses, as well as injuries and fatalities, underscoring the importance of continued preparedness, response coordination, and mitigation planning.

FEDERAL DECLARATIONS

A review of FEMA disaster declarations for Beaver, Garfield, Iron, Kane, and Washington Counties from 2000 through 2025 did not identify a declaration with “damaging wind” or “high wind” as the named incident type. This does not establish that wind impacts were absent from other federally declared incidents.

STATE DECLARATIONS

The planning team did not identify a statewide Utah emergency or disaster declaration issued specifically for damaging wind or high wind from 2000 through 2025.

NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION DATABASE

According to the NOAA National Centers for Environmental Information (NCEI) Storm Events Database query used for this plan, the five-county planning area had 135 days with events categorized as High Wind, Strong Wind, or Dust Storm from 2000 through 2025, with \$668,000 in reported property damage, \$10,000 in reported crop damage, 1 reported death, and 10 reported injuries. Storm Events losses are reported estimates and may be incomplete; they are not a comprehensive accounting of actual losses. Table 11 provides specific data for damaging winds from 2021 to 2025 at 60 knots and over in the Five County AOG planning area.

Table 11: NCEI Storm Events Database for Damaging Winds 60 Knots or Greater

Date	Event Type	Location	Magnitude (knots)	Fatalities	Injuries	Property Damage	Crop Damage
3/21/2022	High Wind	Southwest Utah (Zone)	60	0	0	\$0	\$0
3/28/2022	High Wind	Southwest Utah (Zone)	62	0	0	\$0	\$0
4/11/2022	High Wind	Southwest Utah (Zone)	61	0	0	\$0	\$0
6/17/2022	High Wind	Southwest Utah (Zone)	63	0	0	\$0	\$0
11/8/2022	High Wind	Southwest Utah (Zone)	63	0	0	\$0	\$0
12/2/2022	High Wind	Southwest Utah (Zone)	61	0	0	\$0	\$0
2/22/2023	High Wind	Southwest Utah (Zone)	63	0	0	\$0	\$0

Date	Event Type	Location	Magnitude (knots)	Fatalities	Injuries	Property Damage	Crop Damage
2/22/2023	High Wind	Lower Washington County (Zone)	66	0	0	\$0	\$0
3/1/2024	High Wind	Southwest Utah (Zone)	68	0	0	\$0	\$0
5/5/2024	High Wind	Southwest Utah (Zone)	62	0	0	\$0	\$0

Probability of Future Occurrences

Damaging wind is categorized as **Likely** under the Five County AOG probability methodology because wind-related events recur across the planning area and multiple events are documented during most years of the period of record. The NOAA/NCEI Storm Events Database query used for this plan identified 135 event days categorized as High Wind, Strong Wind, or Dust Storm between 2000 and 2025. This historical record supports continued occurrence but does not, by itself, establish an increasing trend in frequency or intensity.¹¹

- **Beaver County:** Damaging wind is Likely. Open valleys, transportation corridors, and exposure to frontal and pressure-gradient winds contribute to recurring impacts, including transportation disruption, infrastructure damage, and power outages.
- **Garfield County:** Damaging wind is Likely. Frontal winds and thunderstorm outflows—the intended wind mechanism—can be intensified locally by higher-elevation, plateau, and canyon terrain.
- **Iron County:** Damaging wind is Likely. The county’s wind corridors, exposed valleys, transportation routes, and developed areas remain subject to recurring frontal winds, pressure-gradient winds, and thunderstorm outflows. County-specific claims of recurrent 70–80+ mph gusts are not retained because Table 11 does not document Iron County events and no separate supporting source was identified.
- **Kane County:** Damaging wind is Likely. Thunderstorm outflows and regional pressure-gradient winds can affect exposed plateaus, desert basins, mesas, and canyon corridors; arid surfaces can contribute to blowing dust and reduced visibility.
- **Washington County:** Damaging wind is Likely. Recurrent high winds, thunderstorm outflows, and downbursts can affect population centers, infrastructure, and major transportation corridors. The unsupported statement that gusts over 70 mph caused fatalities is not retained; the regional Storm Events record documents one fatality but does not establish that county-specific causal claim in the material reviewed.

¹¹ [NOAA National Centers for Environmental Information, Storm Events Database](#)

Future changes in damaging wind frequency and intensity remain uncertain and vary by wind-producing process. The Fifth National Climate Assessment does not provide a county-scale projection that supports a specific increase in damaging straight-line, thunderstorm-outflow, or pressure-gradient wind frequency in southwestern Utah. The plan therefore assumes continued occurrence at the **Likely** level rather than an increase in hazard probability. Future risk may nevertheless grow as development and infrastructure exposure increase and as wind events interact with extreme heat, drought, wildfire, blowing dust, transportation disruption, and power outages.¹²

Table 12 summarizes qualitative county-level probability and future-conditions findings. “Likely” is the plan-assigned probability category for each county; the regional event record does not establish separate quantitative annual probabilities or a defensible increasing trend for individual counties.

Table 12: Probability and Future Conditions – Damaging Winds and High Winds

County	Probability of Future Events	Primary Wind Types	Typical and Anticipated Intensity	Future Conditions and Location-Specific Risk
Beaver County	Likely. Recurring damaging and high wind events are documented within the regional record.	High winds; frontal winds; localized thunderstorm outflows	Damaging gusts are possible during strong frontal, pressure-gradient, and thunderstorm-outflow events; event intensity varies.	Open valleys and transportation corridors increase exposure. Continued occurrence is expected, but available assessments do not support a county-scale projection of increasing frequency.
Garfield County	Likely. Recurring damaging wind events are documented within the regional record.	Thunderstorm straight-line winds; frontal winds	Damaging gusts are possible, with localized acceleration in canyon, plateau, and higher-elevation terrain; event intensity varies.	Complex terrain creates localized wind-acceleration zones. Continued occurrence is expected, but available assessments do not support a county-scale projection of increasing frequency.
Iron County	Likely. Recurring damaging wind events are documented within the regional record.	High wind events; thunderstorm straight-line winds; downbursts	Damaging gusts are possible during high-wind, straight-line-wind, and downburst events; the reviewed record does not substantiate	Wind corridors, exposed valleys, and developed areas increase exposure. Continued occurrence is expected, but available assessments do not support a county-scale

¹² [U.S. Global Change Research Program, Fifth National Climate Assessment](#), 2023.

County	Probability of Future Events	Primary Wind Types	Typical and Anticipated Intensity	Future Conditions and Location-Specific Risk
			recurrent county-specific gusts of 70–80+ mph.	projection of increasing frequency.
Kane County	Likely. Recurring damaging wind events are documented within the regional record.	Thunderstorm outflow winds; strong winds	Damaging gusts are possible during thunderstorm-outflow and strong-wind events; event intensity varies.	Arid surfaces, exposed routes, and limited visibility during blowing dust increase consequences. Continued occurrence is expected, but available assessments do not support a county-scale projection of increasing frequency.
Washington County	Likely. Recurring damaging wind events are documented within the regional record.	Thunderstorm straight-line winds; downbursts; high wind events	Damaging gusts are possible during straight-line-wind, downburst, and high-wind events; the reviewed material does not substantiate a county-specific claim linking 70+ mph gusts to fatalities.	Population centers, infrastructure, and major travel corridors increase exposure. Continued occurrence is expected, but available assessments do not support a county-scale projection of increasing frequency.

Vulnerability Assessment

Southwestern Utah is vulnerable to damaging winds because population centers, transportation corridors, utility systems, public facilities, agricultural operations, and recreation assets are widely distributed across exposed valleys, desert basins, mesas, canyon systems, and higher-elevation terrain where frontal wind events, pressure-gradient winds, thunderstorm outflows, and localized downbursts can produce damaging conditions. Across Beaver, Garfield, Iron, Kane, and Washington Counties, vulnerability is influenced by the concentration of development in open and wind-exposed settings, reliance on overhead utilities and long transportation links, and the presence of lightweight structures, manufactured housing, tourism infrastructure, and agricultural facilities that are susceptible to roof damage, broken windows, debris impacts, power outages, access disruptions, and hazardous travel conditions. Although the extent of potential losses varies by county, damaging winds have the capacity to affect people, structures, critical facilities, and essential services throughout the region, with the greatest consequences typically occurring where high winds intersect dense development, exposed infrastructure, wildfire-prone landscapes, or major travel corridors.

BEAVER COUNTY

Beaver County is vulnerable to damaging winds because its communities, infrastructure, and economic activity are concentrated in open valleys and along exposed transportation corridors where frontal winds, pressure-gradient winds, and thunderstorm outflows can accelerate. Beaver, Milford, Minersville, and surrounding unincorporated areas contain residences, agricultural buildings, businesses, public facilities, utility lines, and transportation assets susceptible to roof and siding damage, broken windows, fallen trees, debris impacts, and service interruptions.

Vulnerability is heightened along Interstate 15, State Route 21, and local roads, where crosswinds, blowing dust, and debris can reduce visibility, disrupt freight and emergency access, and contribute to crashes. Overhead utilities, older or lightly constructed buildings, manufactured housing, agricultural and ranching facilities, airport assets, and other locations dependent on uninterrupted power and access are among the county's most vulnerable assets.

Damaging winds can damage roofs, manufactured housing, barns, sheds, fences, signs, irrigation equipment, and overhead utilities. Blowing dust, airborne debris, and downed lines can create hazardous travel and road closures, delay emergency response, and interrupt agriculture, businesses, freight movement, and public services, particularly in the Milford area and along State Route 21.

Cascading Impacts: Power and communications outages can disrupt water and wastewater operations, fuel access, traffic control, schools, healthcare, and business continuity. Debris-blocked roads can isolate travelers and delay emergency response and utility repairs, while high winds during hot, dry conditions can increase wildfire potential and compound threats to residents, rangeland, and infrastructure.

Changes in Development: Continued residential, commercial, and infrastructure development in Beaver, Milford, Minersville, along Interstate 15, and near other exposed transportation and utility corridors may increase the number and value of assets subject to damaging winds. New manufactured housing, agricultural facilities, utility extensions, and development at the wildland–urban interface may also increase outage, debris, access, and wildfire-related consequences unless current wind-resistant construction, anchoring, vegetation management, and utility-protection practices are applied.

GARFIELD COUNTY

Garfield County is vulnerable to damaging winds because its communities, transportation corridors, utilities, and visitor-serving facilities are widely dispersed across exposed plateaus, open valleys, canyon systems, and high-elevation terrain where topographic funneling and limited windbreaks can increase wind intensity. In communities such as Panguitch, Escalante, Boulder, Tropic, Hatch, Cannonville, and surrounding unincorporated areas, residences, schools, public buildings, lodging, campgrounds, small businesses, agricultural facilities, and utility infrastructure may be affected by roof and siding damage, broken windows, damaged signs, impacts to outbuildings, and service interruptions during high-wind events.

Garfield County's vulnerability is also shaped by its dependence on long transportation links and destination travel, including U.S. Highway 89, State Route 12, and roads serving Bryce Canyon National Park, Grand Staircase–Escalante National Monument, and Lake Powell access areas, where damaging winds can create hazardous driving conditions, blow debris into roadways, reduce visibility, and interrupt emergency access, tourism activity, and freight movement. Overhead electrical distribution, communications systems, and isolated facilities are especially susceptible to disruption where access is limited and repair times may be extended by distance, weather, or terrain. Agricultural lands, ranch infrastructure, fences, irrigation equipment, recreation sites, and lightweight or older structures in exposed locations are among the most vulnerable assets.

In Garfield County, damaging winds can damage residences, lodging, public buildings, agricultural facilities, signs, outbuildings, and overhead utilities. Windblown debris and reduced visibility can disrupt travel on U.S. Highway 89, State Route 12, and recreation access roads, delaying emergency response and interrupting visitor-serving businesses. Dispersed development and long travel distances can complicate restoration of services.

Cascading Impacts: Power and communications outages can interrupt utility-dependent public services and business operations. Road debris and access restrictions can delay utility repairs and emergency response to isolated facilities and recreation areas. When winds coincide with hot, dry conditions, increased wildfire potential can compound these disruptions.

Changes in Development: Future development is expected to remain concentrated in and around established communities and visitor-serving corridors, while recreation-related facilities and dispersed rural development may expand in exposed plateau, valley, and canyon settings. Additional housing, lodging, utility extensions, and transportation improvements may increase exposed assets and service dependencies, particularly where long access routes and limited redundancy can prolong outages or repairs.

IRON COUNTY

Iron County's dispersed residences, manufactured homes, agricultural buildings, public facilities, communications sites, utilities, and transportation corridors are vulnerable to damaging winds. Cedar City concentrates homes, businesses, schools, Southern Utah University, healthcare and public safety facilities, airport and industrial assets, and utilities. Enoch's neighborhoods, schools, municipal facilities, construction sites, and developing areas are also exposed. In Brian Head, lodging, resort facilities, ski-area infrastructure, utilities, forested slopes, and the limited State Route 143 access corridor are susceptible to high winds. Kanarraville, Paragonah, and Parowan contain exposed homes, agricultural assets, utilities, and community facilities.

Damaging winds could damage roofs, outbuildings, signs, trees, vehicles, agricultural equipment, and power and communications infrastructure. Debris and downed lines could block county roads, state highways, Interstate 15 access routes, and State Route 143, disrupting emergency response, education, healthcare, business activity, agricultural operations, airport operations, and visitor travel.

Cascading Impacts: Utility outages and blocked transportation routes can extend wind impacts beyond directly damaged buildings. Disruption of power, communications, and access can interrupt public services and delay restoration, while downed trees or lines along the limited Brian Head access corridor can restrict movement of residents, visitors, responders, and utility crews.

Changes in Development: Continued growth in Cedar City, Enoch, and other communities, together with new residential subdivisions, commercial and industrial development, campus and airport-area investment, and expansion of recreation and resort facilities, may increase exposure to wind damage and utility interruption. Development along Interstate 15, State Route 143, and other constrained or exposed corridors may also increase the consequences of debris, crosswinds, blocked access, and service outages unless new construction and infrastructure incorporate appropriate wind-resistant design and redundancy.

KANE COUNTY

Kane County's exposed desert basins, mesas, canyon systems, and open plateaus contain dispersed housing, utilities, recreation sites, agricultural and ranching assets, and visitor-serving facilities vulnerable to thunderstorm outflows, pressure-gradient winds, blowing dust, and debris. Long utility lines and limited alternate routes increase sensitivity to service interruptions. Kanab concentrates residents, businesses, schools, public buildings, and community services, while Alton, Big Water, Glendale, Orderville, and unincorporated areas contain exposed homes, local roads, utilities, and agricultural or recreation-related assets.

Damaging winds could damage roofs, manufactured housing, sheds, barns, fences, signs, utility lines, and recreation facilities. Crosswinds, blowing dust and sand, debris, and downed lines could create hazardous travel, road closures, power and communications outages, and delays in emergency response. These disruptions could interrupt tourism, recreation, agriculture, businesses, and access to remote areas.

Cascading Impacts: Power and communications interruptions can disrupt fuel access, visitor services, and community operations. Debris-blocked roads and limited alternate routes can delay emergency response and service restoration, extending consequences for dispersed residents, travelers, and recreation users.

Changes in Development: Growth in Kanab and other communities, expansion of visitor-serving and recreation facilities, and dispersed residential development may increase the number of people and structures exposed to damaging winds, blowing dust, and service interruption. New utility extensions and development along highways or remote access routes may further increase dependence on long, exposed infrastructure systems and limited alternate routes unless wind-resistant construction, anchoring, and infrastructure redundancy are incorporated.

WASHINGTON COUNTY

Washington County's neighborhoods, roads, bridges, overhead utilities, public safety facilities, schools, parks, agricultural lands, and recreation assets are vulnerable in exposed valleys, desert basins, canyon

mouths, and travel corridors. St. George's concentrated residential and commercial development, medical facilities, airport-related infrastructure, and regional services increase potential consequences. Washington City and Hurricane contain growing development and exposed infrastructure, while smaller communities and Zion gateway communities contain homes, visitor-serving facilities, utilities, and constrained access routes susceptible to wind damage and debris.

Damaging winds can down trees and power lines, damage roofs and outbuildings, disrupt utilities and communications, and create hazardous travel on Interstate 15 and regional roads. Potentially affected facilities include St. George Regional Hospital, the St. George 911 Communications Center, schools, public safety and government buildings, St. George Regional Airport, and water and wastewater systems. Impacts can include emergency response and service-delivery interruptions, business and agricultural losses, recreation access restrictions, and debris removal and repair costs.

Cascading Impacts: Power outages and transportation disruptions can affect healthcare access, emergency communications, schools, businesses, and other regional services. In constrained gateway corridors, debris and utility damage can interrupt visitor access and local commerce. Strong winds during hot, dry conditions can increase wildfire potential and compound service and access disruptions.

Changes in Development: Rapid residential, commercial, institutional, and infrastructure growth in St. George, Washington City, Hurricane, and surrounding communities is increasing the number and value of assets exposed to damaging winds. Continued development along Interstate 15, near canyon mouths, in desert basins, and within visitor gateway corridors may increase demands on utilities, transportation systems, emergency services, and debris management. Applying current wind-resistant construction, anchoring, utility-protection, and access-planning practices can help limit growth in future vulnerability.

Drought

Drought is a slow-onset hazard caused by an extended period of below-normal precipitation or other moisture deficits that reduce water availability. Drought can affect precipitation, soil moisture, snowpack, streamflow, reservoir storage, groundwater, vegetation, agriculture, and water-dependent communities and economies. Meteorological, agricultural, hydrologic, and socioeconomic effects may emerge at different times and recover at different rates.

Meteorological drought refers primarily to precipitation deficits relative to local climate. Agricultural drought occurs when soil moisture and available water are insufficient for crops, rangelands, or livestock. Hydrologic drought reflects reduced streamflow, snowpack, reservoir storage, spring discharge, or groundwater levels and may persist after precipitation returns closer to normal. Socioeconomic drought occurs when water shortage affects the supply of goods, services, or activities that depend on water.

Utah's water supply depends substantially on winter mountain precipitation, snowpack accumulation, spring runoff, reservoir storage, and groundwater. Reduced snowpack, altered runoff timing, low reservoir carryover, and groundwater decline can therefore contribute to prolonged hydrologic effects.

Location

Drought can occur throughout Utah and must be evaluated relative to local climate and water-supply conditions. In the five-county planning area, drought is a regional hazard rather than one confined to a single community or watershed. Severity and impacts vary by elevation, precipitation pattern, snowpack, soil moisture, streamflow, reservoir and groundwater conditions, water-source redundancy, and seasonal demand.

Southwestern Utah's arid baseline climate, precipitation variability, population and development patterns, irrigated agriculture, tourism, recreation, and dependence on surface-water and groundwater systems shape drought exposure. Prolonged precipitation deficits and high evaporative demand can reduce soil moisture, forage, streamflow, spring discharge, reservoir inflow, and groundwater recharge while increasing demand during warm periods. Drought may also compound wildfire, smoke, dust, ecosystem, and water-quality stresses.

BEAVER COUNTY

Beaver County is broadly exposed to drought across valley and upland areas. Potential effects are concentrated in irrigated agricultural areas, rangelands, livestock operations, municipal and domestic water systems, groundwater-dependent uses, watersheds, and communities with limited supply redundancy. Weekly U.S. Drought Monitor conditions provide dated snapshots of location and intensity; they are not treated as permanent population or asset counts in this profile.

Figure 6 presents a long-term precipitation-based drought indicator for Beaver County. It illustrates substantial variation between wet and dry periods but does not, by itself, measure reservoir storage, groundwater, water demand, agricultural loss, or community impact.

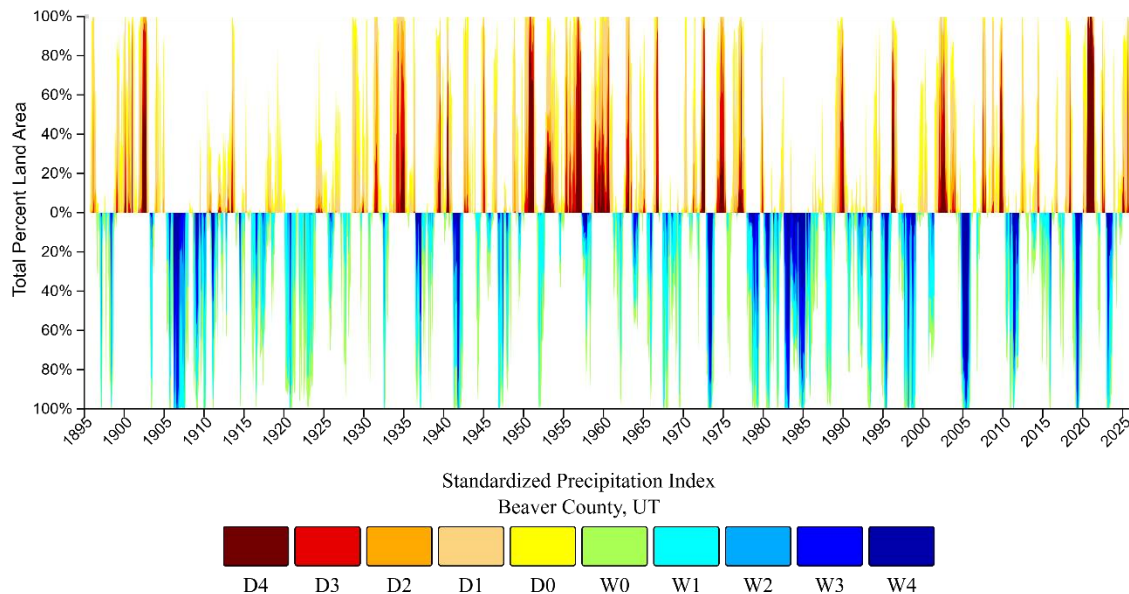


Figure 6: Standardized Precipitation Index for Beaver County, 1895–2025

GARFIELD COUNTY

Garfield County is broadly exposed to drought across high-elevation watersheds, valleys, communities, rangelands, and agricultural areas. Reduced snowpack and runoff can affect streamflow, springs, soil moisture, irrigation supply, grazing conditions, recreation resources, and small water systems. The 2022 Census of Agriculture identifies 297 farms, 85,397 acres in farms, and 15,721 irrigated acres, illustrating the county's agricultural exposure to water shortage.

Hydrologic effects may lag meteorological drought because snowpack, reservoirs, streams, springs, and groundwater respond and recover at different rates. Drought impacts in Garfield County should therefore be evaluated using multiple indicators and alongside local water-supply and land-management information.

IRON COUNTY

Iron County is broadly exposed to drought across developed valleys, agricultural areas, rangelands, upland watersheds, and groundwater-dependent systems. Water-supply reliability depends on the performance and management of stored surface water, groundwater, springs, and delivery infrastructure. The 2022 Census of Agriculture identifies 542 farms, 475,348 acres in farms, and 64,987 irrigated acres, indicating substantial agricultural exposure to prolonged shortage.

KANE COUNTY

Kane County is broadly exposed to drought across upland watersheds, rangelands, communities, and recreation landscapes. Reduced winter precipitation and snowpack can contribute to lower runoff, diminished soil moisture, stressed vegetation, and reduced reliability of surface-water, spring, and groundwater supplies. Weekly drought-monitoring products show intensity at a point in time and should not be interpreted as fixed population exposure.

Figure 7 presents a long-term precipitation-based drought indicator for Kane County. It provides historical context but does not independently measure water supply, agricultural losses, or community consequences.

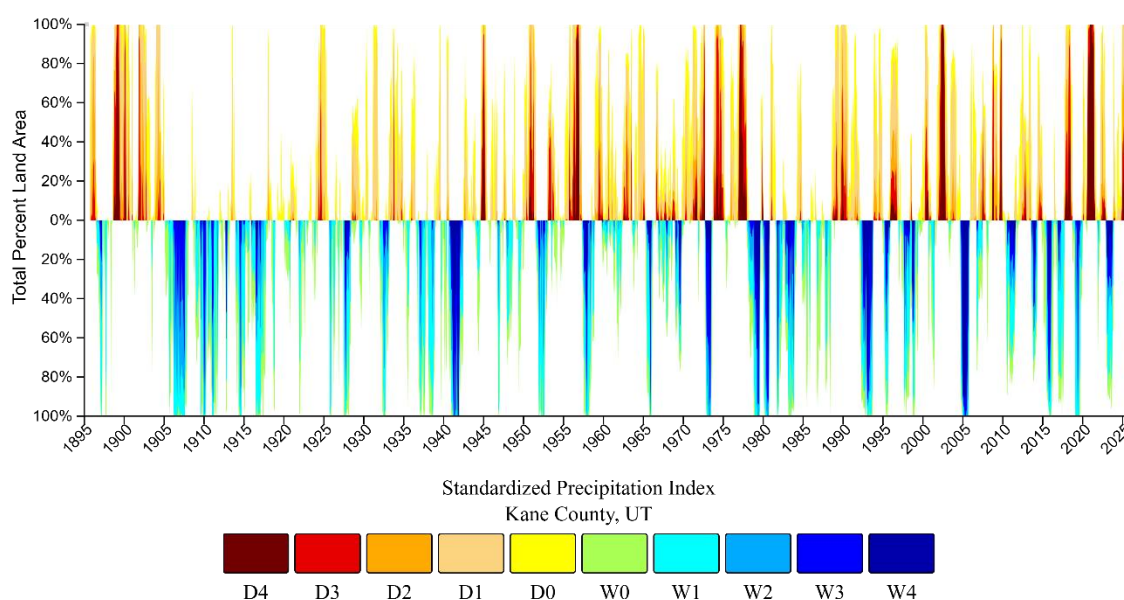


Figure 7: Standardized Precipitation Index for Kane County, 1895–2025

The 2022 Census of Agriculture identifies 189 farms, 125,662 acres in farms, and 6,436 irrigated acres in Kane County. These data indicate exposure of agricultural and grazing systems to reduced forage, stock-water limitations, and irrigation shortages. Drought may also affect visitor-serving communities, recreation access, wildfire conditions, and natural resources.

WASHINGTON COUNTY

Washington County is broadly exposed to drought across the Virgin River Basin, developed communities, agricultural areas, recreation resources, and desert ecosystems. The Washington County Water Conservancy District's regional conservation planning identifies the area's aridity, dependence on basin water supplies, seasonal irrigation demand, and population growth as important water-management considerations. Drought risk reflects both reduced supply and elevated demand.

Reduced snowpack and runoff, high evapotranspiration, low reservoir carryover, groundwater stress, and sustained warm-season demand can affect municipal water reliability, landscaping, agriculture, recreation, ecosystems, and fire-suppression capability. Conservation, reuse, storage, source diversification, and demand management can reduce vulnerability but do not eliminate exposure to prolonged regional drought.

Magnitude and Extent

Drought extent is characterized with the U.S. Drought Monitor categories D0 through D4 and, where available, supporting precipitation, snowpack, soil-moisture, streamflow, reservoir, and groundwater indicators. D0 represents abnormal dryness and is not a drought category; D1 through D4 represent Moderate, Severe, Extreme, and Exceptional Drought. Because impacts vary by sector and water system, the U.S. Drought Monitor is used for consistent regional characterization rather than as a stand-alone estimate of physical or economic loss.

D1 conditions can signal emerging moisture deficits and stress to vegetation or water supplies. D2 conditions indicate more persistent deficits and increasing agricultural or water-supply impacts. D3 conditions are associated with major, widespread impacts, and D4 represents exceptional and extensive drought impacts. These categories communicate relative intensity; local consequences depend on season, duration, antecedent conditions, water storage, groundwater, demand, and management capacity.

Previous Occurrences

Utah has experienced recurrent drought over the instrumental record, including prolonged episodes in the twentieth and early twenty-first centuries. The 2024 Utah Enhanced State Hazard Mitigation Plan identifies 1999 to 2006 as a long modern statewide drought and describes severe statewide impacts during the early 2000s. These events demonstrate that drought may persist across multiple seasons and affect the entire planning area even when local intensity varies.

FEDERAL DECLARATIONS

A review of FEMA disaster declarations did not identify a major disaster declaration issued specifically for drought in the five-county planning area. This does not mean drought impacts were absent or ineligible for other federal or state assistance, because agricultural disaster designations and drought-response authorities use different programs and criteria.

U.S. Department of Agriculture (USDA) agricultural disaster designations have included one or more of the five counties during recent drought periods.

STATE DECLARATIONS

Utah governors have issued drought-related executive orders during recent statewide drought periods. These orders document state response and coordination but are not used as a complete occurrence inventory or as the sole basis for the regional probability rating.

Table 13: Utah Drought Executive Orders Affecting the Planning Area

Year	State Executive Order Number	Title and Description
2026	2026-02	Severe Drought in 29 Counties, 22 Counties in Extreme Drought
2025	2025-04	Washington, Iron, Beaver, Garfield, Kane Counties in Extreme or Severe Drought
2022	2022-04	All 29 counties under severe drought
2021	2021-07	Statewide extreme drought
2021	2021-13	Statewide extreme drought

Probability of Future Occurrences

Drought is a recurring regional hazard. Its likelihood is evaluated using the plan-wide probability categories, historical drought records, repeated U.S. Drought Monitor coverage, state drought response, and agricultural disaster designations. A single week's drought footprint is not used to estimate annual probability or permanent population exposure.

Future conditions may increase drought severity and water-supply stress even where long-term precipitation projections remain uncertain. The Fifth National Climate Assessment identifies warming, reduced western snowpack, greater evaporative demand, and declining summer soil moisture as relevant western and southwestern risks. In the planning area, these influences may affect runoff timing, reservoir and groundwater recovery, agricultural demand, ecosystem stress, wildfire conditions, and peak municipal demand. The effect on any particular water system depends on source, storage, redundancy, conservation, infrastructure, and operating rules.

The probability rating for future occurrences is **Highly Likely**. Drought conditions occur repeatedly within the planning area and may develop in any year. This rating describes regional occurrence under the Five County AOG methodology and does not imply that every county or water system will experience the same intensity or consequences in a given year.

The probability rating is supported by the long historical record, repeated U.S. Drought Monitor observations, state drought actions, and USDA agricultural designations.

Vulnerability Assessment

Drought vulnerability in the five-county planning area is determined by the interaction of water shortage with exposed people, water systems, agriculture, critical facilities, infrastructure, economies, and natural resources. Buildings are generally affected indirectly through water-use restrictions, subsidence where groundwater decline occurs, reduced fire-flow capability, landscape loss, or interruption of water-dependent operations. More sensitive systems include small or single-source water systems, power-dependent wells and pumps, irrigation delivery systems, livestock watering facilities, fire-protection water supplies, healthcare and congregate-care facilities, and communities with limited financial or technical capacity.

BEAVER COUNTY

Beaver County's principal drought vulnerabilities include irrigated agriculture, livestock and grazing operations, municipal and domestic water supplies, groundwater-dependent users, irrigation delivery, fire-protection water, and drought-stressed rangelands and watersheds. The 2022 Census of Agriculture identifies 267 farms, 119,496 acres in farms, and 26,787 irrigated acres. Drought can reduce yields and forage, increase feed and pumping costs, constrain stock water, stress small water systems, and increase wildfire and dust impacts. County-specific actions and capabilities should be read with the Beaver County and participating-jurisdiction annexes.

- **Hay and Corn Production Acreage:** An estimated 31,858 acres of hay and 2,140 acres of corn were within drought-affected areas.
- **Livestock Inventory:** An estimated 14,735 cattle and 638 sheep were within drought-affected areas, indicating exposure to forage loss and stock-water limitations.¹³
- **County Agricultural Land Base:** USDA 2022 Census of Agriculture data indicate 267 farms and approximately 119,496 acres in farms in Beaver County, including about 26,787 irrigated acres that may be especially sensitive to prolonged water shortage.¹⁴
- **Water-Dependent Infrastructure and Systems:** Municipal and domestic water systems, irrigation delivery systems, livestock watering infrastructure, and groundwater-dependent supplies are vulnerable even where direct structural damage is limited.
- **Natural Resource Assets:** Rangelands, watersheds, stream corridors, habitat areas, and drought-stressed vegetation are vulnerable to productivity loss, ecological stress, and elevated wildfire conditions.

Beaver County agricultural impacts arise because crop production, pasture, hay, and livestock operations depend on reliable seasonal water supplies, soil moisture, and forage conditions. County conditions reported by Drought.gov estimate that 31,858 acres of hay, 2,140 acres of corn, 14,735 cattle, and 638

¹³ Drought.gov, "Drought Conditions for Beaver County," 2026, <https://www.drought.gov/states/utah/county/beaver>.

¹⁴ United States Department of Agriculture, "2022 Census of Agriculture County Profile, Beaver County, Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49001.pdf.

sheep were located in drought-affected areas in Beaver County as of May 2026.¹⁵ These figures demonstrate that drought can affect a substantial share of the county's agricultural base at the same time, increasing the likelihood of reduced yields, poorer forage quality, increased feed costs, stock-water stress, and economic losses for producers. Rural households and communities are also vulnerable where water systems rely on limited surface water, springs, or groundwater sources that may decline during prolonged dry periods.

Water shortages can interrupt drinking water supply, irrigation delivery, livestock watering, dust control, and fire suppression even where buildings remain physically intact.

Cascading Impacts: Reduced soil moisture and streamflow can stress vegetation, lower rangeland productivity, degrade habitat conditions, and increase susceptibility to erosion and invasive species establishment. Drought can also elevate wildfire potential by drying fuels and extending the period during which ignition and fire spread are more likely. Reduced water availability may constrain fire protection, interrupt agricultural and water-dependent operations, increase pumping and operating costs, and place added pressure on transportation and emergency access where wildfire or dust conditions worsen. At the county scale, these impacts are magnified by Utah's dry baseline climate and dependence on winter snowpack and spring runoff, which the 2024 Utah Enhanced State Hazard Mitigation Plan identifies as key controls on hydrologic drought and lagged recovery.

Changes in Development: Future vulnerability may increase where new homes, businesses, agricultural uses, or infrastructure add demand to limited municipal, domestic, groundwater, or irrigation supplies. Conversely, conservation, water-system improvements, source redundancy, protective development standards, and land-use decisions that account for available supply may reduce vulnerability. Where the location or scale of future development is uncertain, drought exposure should be reassessed as growth and water-management projects proceed.

GARFIELD COUNTY

Garfield County's principal drought vulnerabilities include ranching and grazing, irrigated agriculture, small community and domestic water supplies, springs and groundwater-dependent systems, visitor-serving communities, recreation resources, rangelands, and upland watersheds. The 2022 Census of Agriculture identifies 297 farms, 85,397 acres in farms, and 15,721 irrigated acres. Limited alternate supplies and long distances can increase operational consequences where drought affects water availability, wildfire conditions, or access to recreation resources.

- **Hay and Haylage Production Acreage:** An estimated 12,611 acres of hay and 237 acres of haylage were within drought-affected areas.¹⁶

¹⁵ Drought.gov, "Drought Conditions for Beaver County," 2026, <https://www.drought.gov/states/utah/county/beaver>.

¹⁶ Drought.gov, "Drought Conditions for Garfield County," 2026, <https://www.drought.gov/states/utah/county/garfield>.

- **Livestock Inventory:** An estimated 10,229 cattle and 652 sheep were within drought-affected areas, indicating exposure to forage loss and stock-water limitations.¹⁷
- **County Agricultural Land Base:** Approximately 297 farms and 85,397 acres in farms, including about 15,721 irrigated acres, may be sensitive to prolonged water shortage.¹⁸
- **Water-Dependent Infrastructure and Systems:** Municipal and domestic water systems, irrigation delivery systems, livestock watering infrastructure, springs, and groundwater-dependent supplies are vulnerable even where direct structural damage is limited.
- **Natural Resource and Recreation Assets:** Rangelands, watersheds, stream corridors, habitat areas, drought-stressed vegetation, and tourism-dependent landscapes are vulnerable to productivity loss, ecological stress, and elevated wildfire conditions.

Garfield County ranching, grazing, and irrigated agriculture are affected because livestock operations, hay production, and irrigated lands depend on reliable seasonal water supplies, soil moisture, and forage conditions. County conditions reported by Drought.gov estimate that 12,611 acres of hay, 237 acres of haylage, 10,229 cattle, and 652 sheep were located in drought-affected areas in Garfield County in May 2026.¹⁹ These figures demonstrate that drought can affect a substantial share of the county's agricultural base at the same time, increasing the likelihood of reduced yields, poorer forage quality, increased feed costs, stock-water stress, and economic losses for producers. Rural households, small communities, and visitor-oriented areas are also vulnerable where water systems rely on limited surface water, springs, or groundwater sources that may decline during prolonged dry periods.

In Garfield County, reduced water availability can limit drinking water supply, irrigation delivery, livestock watering, dust control, landscaping, and fire suppression without directly damaging buildings.

Cascading Impacts: Reduced soil moisture and streamflow can stress vegetation, lower rangeland productivity, degrade habitat conditions, and increase susceptibility to erosion and invasive species establishment. Drought can also elevate wildfire potential by drying fuels and extending the period during which ignition and fire spread are more likely. Water shortages may interrupt agricultural and visitor-serving operations, constrain fire-protection supplies, affect recreation access, and increase economic pressure on producers and communities. These impacts are magnified by Garfield County's dependence on seasonal runoff, limited local water supplies in some areas, and the importance of scenic and recreation-based landscapes to the county economy.

Changes in Development: Growth or redevelopment in communities and visitor-serving areas may increase seasonal water demand and reliance on small or limited-source systems. Expansion of transportation, recreation, utility, or water infrastructure may either increase exposure or improve reliability, depending on design and available supply. Conservation, source redundancy, infrastructure

¹⁷ Drought.gov, "Drought Conditions for Garfield County," 2026, <https://www.drought.gov/states/utah/county/garfield>.

¹⁸ U.S. Department of Agriculture, "2022 Census of Agriculture County Profile, Garfield County, Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49017.pdf.

¹⁹ Drought.gov, "Drought Conditions for Garfield County," 2026, <https://www.drought.gov/states/utah/county/garfield>.

upgrades, and development standards aligned with demonstrated water availability may reduce future vulnerability.

IRON COUNTY

Iron County's principal drought vulnerabilities include irrigated agriculture, livestock operations, groundwater-dependent municipal and domestic supplies, pumping and conveyance infrastructure, growing developed areas, rangelands, and watersheds. The 2022 Census of Agriculture identifies 542 farms, 475,348 acres in farms, and 64,987 irrigated acres. Prolonged drought can increase competition among uses, pumping and treatment costs, agricultural losses, ecosystem stress, and wildfire risk. Growth and new development can increase demand, while recharge, conservation, reuse, storage, and infrastructure projects may reduce vulnerability where implemented.

- **Population and Households Dependent on Reliable Water Supply:** Approximately 46,163 residents were located in drought-affected areas as of May 2026.²⁰
- **Hay, Haylage, and Corn Production Acreage:** An estimated 58,661 acres of hay, 3,171 acres of haylage, and 1,506 acres of corn were within drought-affected areas.²¹
- **Livestock Inventory:** An estimated 42,525 sheep and 23,165 cattle were within drought-affected areas, indicating exposure to forage loss and stock-water limitations.²²
- **County Agricultural Land Base:** Approximately 542 farms and 475,348 acres in farms, including about 64,987 irrigated acres, may be sensitive to prolonged water shortage.²³
- **Water-Dependent Infrastructure and Systems:** Municipal and domestic water systems, irrigation delivery systems, livestock watering infrastructure, groundwater-dependent supplies, and small community water systems are vulnerable even where direct structural damage is limited.
- **Natural Resource Assets:** Rangelands, watersheds, stream corridors, habitat areas, and drought-stressed vegetation are vulnerable to productivity loss, ecological stress, and elevated wildfire conditions.

Iron County agricultural impacts reflect the dependence of production on water: hay, haylage, corn, pasture, and livestock operations depend on reliable seasonal water supplies, soil moisture, and forage conditions. County conditions reported by Drought.gov estimate that 58,661 acres of hay, 3,171 acres of haylage, 1,506 acres of corn, 42,525 sheep, and 23,165 cattle were located in drought-affected areas in Iron County in May 2026.²⁴ These figures demonstrate that drought can affect a substantial share of the county's agricultural base at the same time, increasing the likelihood of reduced yields, reduced forage quality, increased feed costs, stock-water stress, and economic losses for producers. Residents, rural

²⁰ Drought.gov, "Drought Conditions for Iron County," 2026, <https://www.drought.gov/states/utah/county/iron>.

²¹ Drought.gov, "Drought Conditions for Iron County," 2026, <https://www.drought.gov/states/utah/county/iron>.

²² Drought.gov, "Drought Conditions for Iron County," 2026, <https://www.drought.gov/states/utah/county/iron>.

²³ United States Department of Agriculture, "2022 Census of Agriculture County Profile, Iron County, Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49021.pdf.

²⁴ Drought.gov, "Drought Conditions for Iron County," 2026, <https://www.drought.gov/states/utah/county/iron>.

households, and communities are also vulnerable where water systems rely on limited surface water, springs, or groundwater sources that may decline during prolonged dry periods.

Iron County infrastructure can remain physically intact while shortages reduce the reliability of drinking water, irrigation, livestock watering, landscaping, dust control, and fire suppression.

Cascading Impacts: Reduced soil moisture and streamflow can stress vegetation, lower rangeland productivity, degrade habitat conditions, and increase susceptibility to erosion and invasive species establishment. Drought can also elevate wildfire potential by drying fuels and extending the period during which ignition and fire spread are more likely. Declining supplies may increase pumping demands and utility costs, constrain fire protection and water-dependent operations, and compound transportation or emergency-access limitations during wildfire and dust events. These impacts are magnified by Iron County's dependence on snowpack-driven runoff, groundwater supplies, and a large agricultural land base that is sensitive to prolonged water shortages.

Changes in Development: Continued growth and infrastructure expansion in developed valleys may increase municipal, domestic, and landscaping demand and place additional pressure on groundwater-dependent systems. Agricultural conversion or changes in irrigation practice may alter where and when water demand occurs. Recharge, conservation, reuse, storage, conveyance improvements, source diversification, and water-sensitive development standards may reduce vulnerability where they are implemented and maintained.

KANE COUNTY

Kane County's principal drought vulnerabilities include ranching and grazing, limited irrigated agriculture, springs and small water systems, groundwater-dependent users, visitor-serving communities, recreation resources, rangelands, and watersheds. The 2022 Census of Agriculture identifies 189 farms, 125,662 acres in farms, and 6,436 irrigated acres. Drought can reduce forage and stock water, increase operating costs, constrain small supplies, stress recreation landscapes, and compound wildfire, dust, and public-health concerns.

- **Population and Households Dependent on Reliable Water Supply:** Approximately 7,125 residents were located in drought-affected areas as of late April 2026, reflecting the county-specific Drought.gov reporting date.
- **Hay Production Acreage:** An estimated 3,331 acres of hay were within drought-affected areas.²⁵
- **Livestock Inventory:** An estimated 5,675 cattle and 353 sheep were within drought-affected areas, indicating exposure to forage loss and stock-water limitations.²⁶

²⁵ Drought.gov, "Drought Conditions for Kane County," 2026, <https://www.drought.gov/states/utah/county/kane>.

²⁶ Drought.gov, "Drought Conditions for Kane County," 2026, <https://www.drought.gov/states/utah/county/kane>.

- **County Agricultural Land Base:** Approximately 189 farms and 125,662 acres in farms, including about 6,436 irrigated acres, may be sensitive to prolonged water shortage.²⁷
- **Water-Dependent Infrastructure and Systems:** Municipal and domestic water systems, springs, small community water systems, irrigation delivery infrastructure, and groundwater-dependent supplies are vulnerable even where direct structural damage is limited.
- **Natural Resource and Tourism-Dependent Assets:** Rangelands, watersheds, stream corridors, habitat areas, drought-stressed vegetation, park gateway communities, and recreation-oriented landscapes are vulnerable to ecological stress, reduced water availability, and elevated wildfire conditions.

In Kane County, ranching, grazing, and limited irrigated agriculture are affected because livestock operations, hay production, and irrigated lands depend on reliable seasonal water supplies, soil moisture, and forage conditions. County conditions reported by Drought.gov estimate that 3,331 acres of hay, 5,675 cattle, and 353 sheep were located in drought-affected areas in Kane County in late April 2026.²⁸ These figures demonstrate that drought can affect a meaningful share of the county's agricultural base at the same time, increasing the likelihood of reduced forage quality, higher feed costs, stock-water stress, and economic losses for producers. Residents, rural households, and gateway communities are also vulnerable where water systems rely on limited surface water, springs, or groundwater sources that may decline during prolonged dry periods.

Kane County water-dependent services may be disrupted as supplies for drinking water, irrigation, livestock watering, dust control, landscaping, and fire suppression decline. Natural resources are similarly vulnerable. Reduced soil moisture and streamflow can stress vegetation, lower rangeland productivity, degrade habitat conditions, and increase susceptibility to erosion and invasive species establishment. Drought also elevates wildfire potential by drying fuels and extending the period during which ignition and fire spread are more likely. These impacts are magnified by Kane County's dependence on variable snowpack and seasonal runoff, limited local water supplies in some communities, and the importance of recreation and tourism to the county economy.

Cascading Impacts: In Kane County, water shortage can set off interconnected environmental, economic, and operational impacts. Prolonged dry conditions can increase wildfire likelihood and severity, reduce air quality through smoke and windblown dust, affect wildlife and habitat conditions, disrupt recreation access and visitor-serving activity, and place additional pressure on emergency response and public health systems. Economic effects can compound as ranchers and producers absorb higher operating costs, utilities and small systems manage tighter supplies, and communities face increased conservation and drought-response demands. Transportation and emergency access may also be constrained when wildfire, smoke, or dust affects travel conditions.

²⁷ United States Department of Agriculture, "2022 Census of Agriculture County Profile, Kane County, Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49025.pdf.

²⁸ Drought.gov, "Drought Conditions for Kane County," 2026, <https://www.drought.gov/states/utah/county/kane>.

Changes in Development: Growth or redevelopment in gateway communities and visitor-serving areas may increase seasonal demand on springs, groundwater, and small community water systems. Expansion of recreation, transportation, utility, or water infrastructure may increase exposure if it relies on constrained supplies, but may reduce vulnerability when it improves redundancy, storage, efficiency, or emergency access. Land-use and development decisions that account for demonstrated water availability and wildfire-related access needs may limit future vulnerability.

WASHINGTON COUNTY

Washington County's principal drought vulnerabilities include municipal and domestic water demand, Virgin River Basin supplies, storage and conveyance systems, irrigation and landscaping demand, agriculture, recreation and tourism, fire-protection water, and desert and riparian ecosystems. The 2022 Census of Agriculture identifies 553 farms, 105,541 acres in farms, and 11,366 irrigated acres. Continued growth can increase exposure and demand; conservation, reuse, storage, source diversification, and updated development standards can reduce vulnerability. The Washington County Water Conservancy District conservation plan provides additional locally specific context.

- **Crop and Livestock Exposure:** An estimated 8,288 acres of hay, 220 acres of haylage, 8,583 cattle, and 766 sheep were within drought-affected areas, indicating exposure to reduced forage, higher feed costs, and stock-water limitations.
- **County Agricultural Land Base:** Approximately 553 farms and 105,541 acres in farms, including about 11,366 irrigated acres, may be sensitive to prolonged water shortage.²⁹
- **Water-Dependent Infrastructure and Systems:** Municipal and domestic water systems, irrigation delivery systems, groundwater-dependent supplies, regional water infrastructure, and landscaping irrigation systems are vulnerable even where direct structural damage is limited.
- **Natural Resource and Tourism-Dependent Assets:** Rangelands, watersheds, stream corridors, habitat areas, parks, outdoor recreation areas, and drought-stressed vegetation are vulnerable to reduced water availability, ecological stress, and elevated wildfire conditions.

Washington County municipal water supply and demand management are affected because the county is highly arid, population growth continues to increase demand, and irrigation and landscaping uses place additional pressure on limited supplies during hot, dry periods. Agriculture remains vulnerable as well. County conditions reported by Drought.gov estimate that 8,288 acres of hay, 220 acres of haylage, 8,583 cattle, and 766 sheep were located in drought-affected areas in Washington County in May 2026.³⁰ These figures demonstrate that drought can affect a meaningful share of the county's agricultural base at the same time, increasing the likelihood of reduced forage quality, higher feed costs, stock-water stress, and economic losses for producers. Residents, businesses, visitor-serving areas, and communities are also

²⁹ United States Department of Agriculture, "2022 Census of Agriculture County Profile, Washington County, Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49053.pdf.

³⁰ Drought.gov, "Drought Conditions for Washington County," 2026, <https://www.drought.gov/states/utah/county/washington>.

vulnerable where water systems rely on limited supplies from the Virgin River Basin and associated storage and conveyance systems.

In Washington County, shortages can constrain drinking water, irrigation, landscaping, dust control, cooling, and fire suppression even without direct building damage. Natural resources are similarly vulnerable. Reduced soil moisture and streamflow can stress vegetation, degrade habitat conditions, and increase susceptibility to erosion and invasive species establishment. Drought also elevates wildfire potential by drying fuels and extending the period during which ignition and fire spread are more likely. These impacts are magnified by Washington County's arid baseline climate, dependence on limited basin supplies, and strong seasonal demand pressures.

Cascading Impacts: Washington County can experience secondary environmental, economic, and operational consequences as drought persists. Prolonged dry conditions can increase wildfire likelihood and severity, reduce air quality through smoke and windblown dust, affect outdoor recreation and tourism conditions, constrain fire-protection water, and place additional pressure on emergency response and public health systems. Economic effects can compound as utilities and water providers face increased conservation and operating demands, producers absorb higher costs, businesses experience interruption, and communities confront tighter water-management decisions during peak season. Wildfire, smoke, or dust may also disrupt transportation and emergency access.

Changes in Development: Continued population growth, redevelopment, and expansion of housing, businesses, recreation facilities, and supporting infrastructure may increase municipal, landscaping, cooling, and seasonal water demand. Additional storage, reuse, conservation, source diversification, conveyance improvements, and updated development standards may reduce future vulnerability where they produce reliable capacity and demand reductions. Land-use patterns and project approvals that account for available water supply, fire-flow needs, and long-term system reliability may further limit exposure.

Earthquake

An earthquake is the sudden release of energy in Earth's crust when rocks rupture and slip along a fault. Seismic waves generated by this movement can cause ground shaking, surface fault rupture, liquefaction, lateral spreading, landslides, rockfall, and other ground failure. Consequences may include deaths and injuries; structural and nonstructural building damage; hazardous-material releases; and disruption of transportation, water, wastewater, electric power, natural gas, fuel, and communications systems.

The Five County AOG planning area lies within the Intermountain Seismic Belt, a broad zone of earthquake activity associated in part with crustal extension in the Basin and Range Province. Although Utah is not on a tectonic plate boundary, active faults and distributed seismicity can generate damaging earthquakes. Earthquake sources include mapped faults capable of surface rupture and earthquakes that do not rupture the ground surface.

Southwestern Utah's earthquake hazard is influenced by active fault systems, including the Hurricane, Washington, and Sevier–Toroweap fault zones. Ground-shaking severity depends on magnitude, distance, rupture characteristics, wave-propagation effects, and local site conditions. Susceptible soils may amplify shaking or experience liquefaction and lateral spreading, while steep slopes may fail as landslides or rockfall. The September 2, 1992, St. George earthquake and the earthquake-triggered Springdale landslide demonstrate that secondary geologic hazards can drive substantial consequences during a moderate earthquake.

Location

Comparatively higher probabilistic shaking hazard is mapped in portions of Washington, Iron, Garfield, and Beaver Counties; however, damaging earthquakes may originate from sources other than nearby mapped faults. Relative exposure should therefore be evaluated using shaking, ground-failure susceptibility, development patterns, and asset distribution rather than fault proximity alone.

All participating jurisdictions may experience earthquake ground shaking. Valley and river-corridor deposits may amplify shaking, and susceptible sediments may experience liquefaction or lateral spreading. Steep canyon and mountain terrain may experience landslides or rockfall. Figure 8 shows selected epicenters and Quaternary faults.

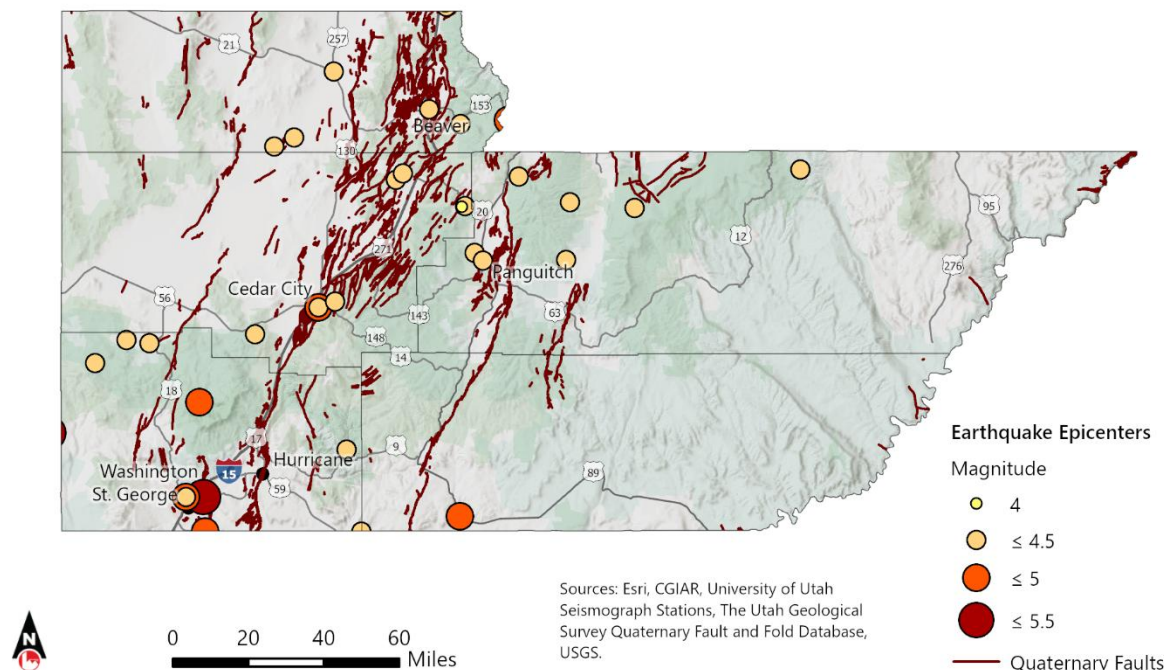


Figure 8: Map of Five Counties Previous Earthquakes Locations and Magnitude

Magnitude and Extent

Extent describes the range of anticipated intensities (i.e., how strong shaking could be) that may affect the planning area. Earthquake extent is described using commonly recognized scientific technical measures of shaking, including the Modified Mercalli Intensity (MMI) scale (observed effects and damage at a location) and instrument-based ground-motion measures (e.g., peak ground acceleration and spectral acceleration) that are used to develop USGS ShakeMaps and probabilistic hazard maps.

Earthquakes are described by magnitude, a source-based measure, and intensity, a location-specific description of shaking effects. Moment magnitude is commonly used for moderate and large earthquakes. The magnitude scale is logarithmic: each whole-number increase represents approximately 32 times more energy release, so an increase from magnitude 4.6 to 6.7 corresponds to approximately 1,400 times more energy. Intensity varies with distance, rupture and wave-path effects, and local site conditions. For mitigation planning, MMI and engineering ground-motion measures can connect hazard extent to expected effects on buildings and lifelines.³¹

Table 14: Modified Mercalli Intensity (MMI) Scale

MMI	General Description of Felt Shaking and Typical Effects
I–II	Not felt to weak shaking; felt by a few people under favorable conditions; little to no damage.
III–IV	Weak to light shaking; felt indoors by many; rattling of dishes/windows; minor non-structural effects possible.
V–VI	Moderate to strong shaking; felt by nearly everyone; some items fall; minor to moderate damage in vulnerable buildings; plaster cracking and small cracks in walls possible.
VII–VIII	Very strong to severe shaking; damage negligible in well-designed buildings but considerable in poorly built structures; chimneys and masonry may be damaged; some structural damage possible.
IX–XII	Violent to extreme shaking; heavy damage to many buildings and lifelines; ground cracking/landslides may occur; at the highest levels, near-total destruction.

Small earthquakes below magnitude 4 occur relatively frequently in the Utah region. Historical and instrumental records should be distinguished from paleoseismic evidence: the absence of a large instrumentally recorded event does not limit the magnitude of credible future earthquakes. Published geologic and seismic studies indicate that faults in southwestern Utah are capable of larger earthquakes than those in the short instrumental record.³²

³¹ U.S. Geological Survey, How much bigger is a magnitude 8.7 earthquake than a magnitude 5.8 earthquake? Energy ratio = $10^{(1.5 \times \text{magnitude difference})}$; for 6.7 minus 4.6, the ratio is approximately 1,413. https://earthquake.usgs.gov/education/how_much_bigger.php.

³² Utah Geological Survey, The September 2, 1992 St. George Earthquake, Washington County, Utah, Circular 88, 1993, pp. 1–2 and 21, <https://ugspub.nr.utah.gov/publications/circular/c-88.pdf>.

Damaging shaking can extend beyond mapped fault traces. Its intensity varies with the earthquake source, distance, local soils, and building vulnerability; an illustrative regional map does not establish the percentage of any county exposed above a defined threshold.

Figure 9 is an illustrative regional intensity map identified in the supplied plan materials with the 2023 U.S. National Seismic Hazard Model (NSHM). The NSHM is a time-independent probabilistic ground-shaking model.

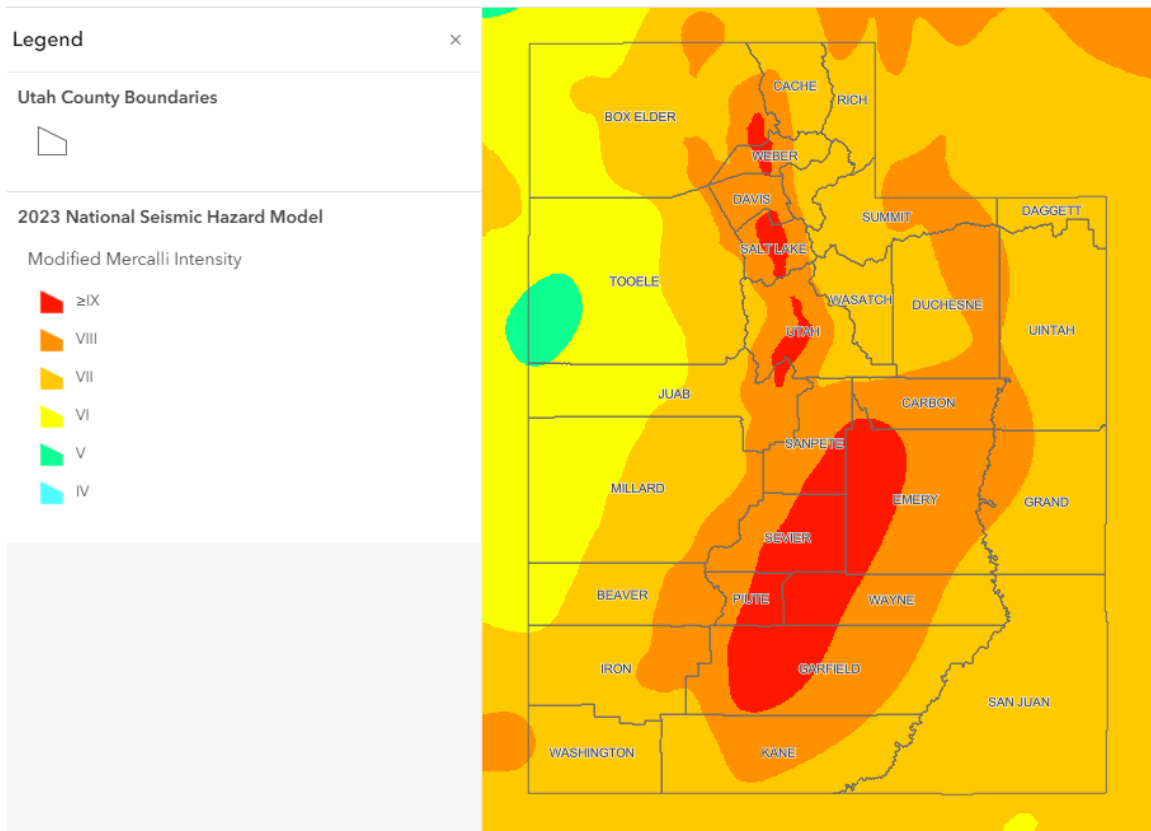


Figure 9: 2023 National Seismic Hazard Model and Utah Counties and Extent of Hazard³³

BEAVER COUNTY EARTHQUAKE EXTENT

Potentially damaging shaking can affect Beaver County, including locations away from mapped fault traces. Effects depend on local soils, building construction, and the functionality of transportation and utility lifelines.

³³ USGS National Seismic Hazard Model. Earthquake Hazards Program. 2023, <https://www.usgs.gov/programs/earthquake-hazards/science/national-seismic-hazard-model>.

GARFIELD COUNTY EARTHQUAKE EXTENT

Potentially damaging shaking can affect Garfield County. Local site conditions and susceptible buildings influence damage; the available map does not establish that this county has the region's highest intensity.

IRON COUNTY EARTHQUAKE EXTENT

Potentially damaging shaking can affect Iron County. Population centers and lifelines along the Interstate 15 corridor may experience building damage and transportation or utility disruption.

KANE COUNTY EARTHQUAKE EXTENT

Regional earthquake sources can produce ground shaking in Kane County. Building vulnerability, local soils, and access to response services influence consequences.

WASHINGTON COUNTY EARTHQUAKE EXTENT

Potentially damaging shaking can affect Washington County. The 1992 St. George earthquake demonstrates building damage and earthquake-triggered slope failure; these secondary hazards can compound damage to structures, roads, and utilities.

Previous Occurrences

Earthquakes occur regularly in and near the five-county region, although most are small and cause little or no damage. The USGS Earthquake Catalog and Utah earthquake catalogs should be used to document location, origin time, magnitude type, depth, and source uncertainty. Figure 8 maps selected local earthquakes, whereas Figure 10 is a broader Utah-region mainshock map through 2012. The figures represent separate datasets; the Point ID column in Table 15 corresponds to Figure 10.

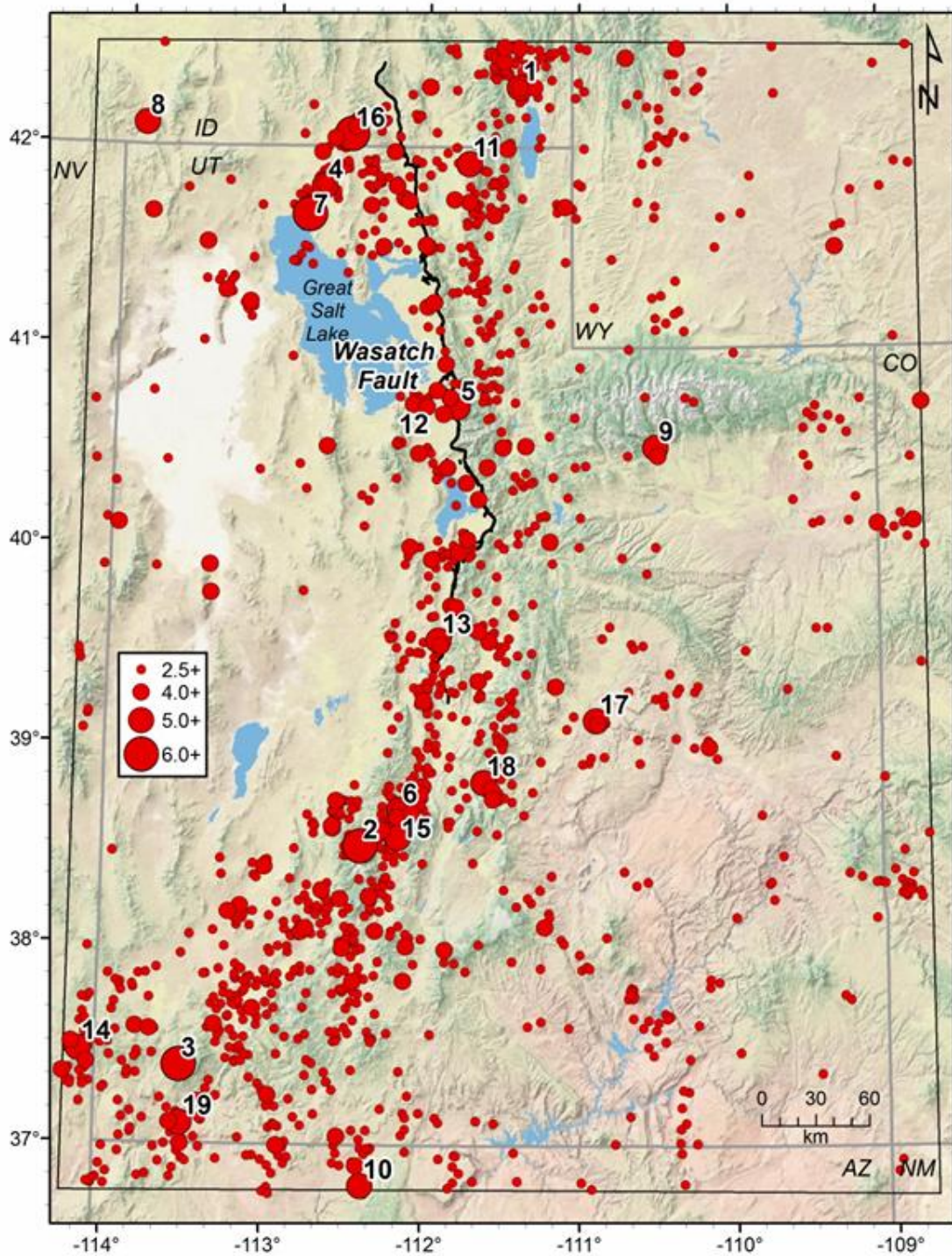


Figure 10: Epicenter Map of Independent Mainshocks in the Utah Region, 1850–2012³⁴

³⁴ Earthquake Probabilities for the Wasatch Front Region in Utah, Idaho, and Wyoming. Working Group on Utah Earthquake Probabilities, Utah Geological Survey Misc Publication 16-3, 2016, https://ugspub.nr.utah.gov/publications/misc_pubs/mp-16-3/mp-16-3.pdf.

Table 15: Earthquake History Magnitude 5 and Over

Point ID*	Year	Region	Magnitude	County
2	1901	Tushar Mountains	6.63	Beaver
3	1902	Pine Valley	6.34	Washington/Iron
10	1959	Arizona–Utah Border	5.55	Washington/Kane
14	1966	Nevada–Utah Border	5.22	Washington
19	1992	Approximately 5 miles east-southeast of St. George	5.8	Washington

*Point ID column relates to Figure 10.

Table 16: Additional Earthquake Events³⁵

Incident Date (year)	Location	Magnitude	Description (if available)
1873	Beaver City, Beaver County	4.05	A magnitude 4.05 earthquake recorded within the Beaver City municipal boundary.
1908	Milford, Beaver County	4.05	A magnitude 4.05 earthquake recorded within the Milford municipal boundary.
1923	Minersville, Beaver County	4.05	A magnitude 4.05 earthquake recorded 21.5 miles southwest of Minersville.
1966	Minersville, Beaver County	4.17	A magnitude 4.17 earthquake recorded 16.2 miles southwest of Minersville.
1998	Beaver City, Beaver County	4.48	A magnitude 4.48 earthquake recorded 9 miles southeast of Beaver City.
1963	Boulder, Garfield County	4.3	A magnitude 4.3 earthquake recorded 14 miles northeast of Boulder.
1966	Antimony, Garfield County	4.1	A magnitude 4.1 earthquake recorded 8.6 miles southeast of Antimony.
1991	Escalante, Garfield County	4.0	A magnitude 4.0 earthquake recorded 17.2 miles southeast of Escalante.
1994	Antimony, Garfield County	4.03	A magnitude 4.03 earthquake recorded 16.3 miles west of Antimony.
2012	Bryce Canyon City, Garfield County	4.13	A magnitude 4.13 earthquake recorded 9 miles north of Bryce Canyon City.

³⁵ Five County Association of Governments (FCAOG), Hazard Mitigation Plan 2022–2027 and Utah Enhanced State Hazard Mitigation Plan, 2024.

Incident Date (year)	Location	Magnitude	Description (if available)
2015	Panguitch, Garfield County	4.09	A magnitude 4.09 earthquake recorded 1.5 miles northwest of Panguitch.
1981	Cedar City, Iron County	4.18	A magnitude 4.18 earthquake recorded 7.2 miles southwest of Cedar City.
1991	Paragonah, Iron County	4.63	A magnitude 4.63 earthquake recorded 12.2 miles north of Paragonah.
1992	Cedar City, Iron County	4.19	A magnitude 4.19 earthquake recorded 2 miles northwest of Cedar City.
1992	Cedar City, Iron County	4.17	A magnitude 4.17 earthquake recorded 1.8 miles northwest of Cedar City.
1999	Paragonah, Iron County	4.11	A magnitude 4.11 earthquake recorded 13.7 miles north of Paragonah.
2010	Cedar City, Iron County	4.12	A magnitude 4.12 earthquake recorded 3.8 miles southeast of Cedar City.
1887	Kanab, Kane County	4.8	A magnitude 4.8 earthquake recorded near Kanab.
1881	Enterprise, Washington County	4.05	A magnitude 4.05 earthquake recorded near Enterprise.
1891	St. George, Washington County	4.81	A magnitude 4.81 earthquake recorded near St. George.
1902	Washington County	4.81	A magnitude 4.81 earthquake recorded in Washington County.
1903	St. George, Washington County	4.05	A magnitude 4.05 earthquake recorded near St. George.
1914	Enterprise, Washington County	4.05	A magnitude 4.05 earthquake recorded near Enterprise.
1920	St. George, Washington County	4.05	A magnitude 4.05 earthquake recorded near St. George.
1936	Washington County	4.05	A magnitude 4.05 earthquake recorded in Washington County.
1992	Approximately 5 miles east-southeast of St. George, Washington County	5.8	The September 2 event damaged structures in Hurricane, La Verkin, Washington, and St. George; the earthquake-triggered Balanced Rock Hills landslide near Springdale destroyed three homes, disrupted utilities, and closed State Route 9.
2016	Enterprise, Washington County	4.35	A magnitude 4.35 earthquake recorded near Enterprise.

At 4:26 a.m. MDT on September 2, 1992, an earthquake occurred approximately 5 miles east-southeast of St. George. The University of Utah assigned local magnitude 5.8. Investigators considered a buried projection of the Hurricane fault a possible source, rather than establishing a definitive fault association. Building damage was documented in Hurricane, La Verkin, Washington, and St. George. The Balanced Rock Hills landslide in Springdale destroyed three homes, disrupted utilities, and closed State Route 9 at the southwest entrance to Zion National Park.³⁶

Probability of Future Occurrences

Earthquake probability is rated Occasional for damaging earthquake impacts, consistent with the plan's approximate 10- to 100-year category. This is a qualitative planning classification based on the historical damaging-event record, including the 1992 earthquake; it is not a calculated annual probability or a classification of all small earthquakes.

The historical event list is a selected record, not a complete earthquake catalog from which an annual damaging-event rate can be calculated. National Risk Index values are not used as direct annual earthquake probabilities in this assessment.

The supplied regional shaking map illustrates potential shaking consequences. Its undocumented probability level and site condition preclude using it to derive annual event probability.

The historical record is consistent with an Occasional likelihood when focusing on earthquakes that produce damage rather than the more frequent, low-impact seismicity that occurs statewide. As summarized in Table 15 and the previous discussion, the five-county area has experienced recurring moderate earthquakes (many in the magnitude 4 range) and at least one notable damaging event in Washington County (1992) that produced structural damage and triggered secondary hazards (e.g., landsliding). This pattern, frequent felt events punctuated by less frequent damaging earthquakes, supports the qualitative Occasional classification without assigning a numerical annual probability.

Development growth in Washington County and portions of Iron County increases the number and value of people, buildings, and infrastructure exposed to earthquake effects. Future conditions for earthquake risk should focus on changes in exposure and vulnerability, including development near faults or susceptible soils, aging infrastructure, code adoption and enforcement, retrofit activity, and lifeline interdependencies. NCA5-based climate projections are not applicable to the probability of tectonic earthquakes and are not added to this hazard profile.

Vulnerability Assessment

Earthquake vulnerability in the five-county planning area reflects the interaction of ground shaking and secondary hazards with people, buildings, critical facilities, infrastructure, economic activity, and natural,

³⁶ Utah Geological Survey, The September 2, 1992 St. George Earthquake, Washington County, Utah, Circular 88, 1993, pp. 1–2 and 21, <https://ugspub.nr.utah.gov/publications/circular/c-88.pdf>.

historic, and cultural resources. Consequences vary with shaking intensity, local soils and slopes, construction type and age, code level, retrofit status, occupancy, access and functional needs, and the availability and redundancy of transportation, utilities, communications, emergency response, and medical services. Older unreinforced masonry, weak or unbraced parapets, nonductile construction, heavy roof systems, and inadequately anchored contents and equipment can increase losses, while liquefaction, lateral spreading, surface rupture, landslides, and rockfall may compound direct shaking damage in susceptible locations.

Unreinforced Masonry: Table 4 summarizes identified or likely unreinforced masonry in school facilities. These entries describe the school inventory and do not constitute a complete inventory of all unreinforced masonry buildings in each county. Jurisdiction-specific building inventories and current retrofit or replacement information are needed to characterize this vulnerability more fully.

Table 17: FCAOG Counties with Unreinforced Masonry Structures (URM)

County	Number of Unreinforced Masonry Structures
Beaver	No unreinforced masonry structure (URM) schools ³⁷
Garfield	Campuses with URM, 2 buildings or additions with identified URM: Escalante School and Panguitch School. Current retrofit or replacement status is not established by this inventory
Iron	1 campus and 1 building or addition with identified URM (Cedar City High)
Kane	2 campuses with identified URM, 2 buildings or additions with identified URM, 1 campus with likely URM (Kanab School and Valley High)
Washington	1 campus with likely URM

BEAVER COUNTY

Beaver County and its participating municipalities—Beaver City, Milford, and Minersville—are susceptible to damaging ground shaking, including shaking from earthquakes outside the county. The county's communities, dispersed development, public facilities, businesses, and road and utility networks may experience falling contents, nonstructural damage, structural damage, or service interruption. Table 2 identifies the 1901 magnitude 6.63 Tushar Mountains event in Beaver County, and Table 3 lists additional earthquakes near Beaver City, Milford, and Minersville.

Vulnerability is greatest where older or otherwise vulnerable buildings, unanchored equipment, and critical services coincide with stronger shaking or adverse site conditions. Table 4 identifies no unreinforced masonry schools in Beaver County, but that finding does not represent a complete

³⁷ Utah K-12 Public Schools Unreinforced Masonry Inventory. 2022, Applied Technology Council for Utah Division of Emergency Management, <https://earthquakes.utah.gov/wp-content/uploads/Utah-K-12-Public-Schools-URM-Inventory-2022.pdf>.

countywide URM inventory. Rural distances and limited alternate routes may delay response, access to medical care, inspections, utility restoration, and delivery of materials needed for recovery.

Cascading Impacts: Damage to roads, bridges, power, communications, fuel, water, or wastewater systems could restrict emergency response and isolate communities or outlying properties. Utility interruption or transportation damage could close schools and public facilities, disrupt local businesses and supply chains, and affect agricultural, mining, tourism, and recreation activity. Ground failure, landslides, or rockfall in susceptible terrain could further block routes and damage infrastructure.

Changes in Development: New development increases the number and value of exposed people, buildings, and infrastructure even when modern seismic provisions reduce damage potential. Growth near mapped faults, susceptible soils, steep terrain, or lifeline corridors may increase consequences, while code adoption and enforcement, retrofit activity, anchored nonstructural components, and replacement of vulnerable facilities may reduce vulnerability. Available information does not support a quantitative determination of how development since the prior plan has changed countywide earthquake vulnerability.

GARFIELD COUNTY

Garfield County and its participating municipalities—Antimony, Boulder, Bryce Canyon City, Cannonville, Escalante, Hatch, Henrieville, Panguitch, and Tropic—are susceptible to damaging ground shaking and earthquake-triggered ground failure. Communities are distributed across extensive rural terrain, and consequences may include damage to residences, businesses, schools, public buildings, roads, utilities, and visitor-serving facilities. Table 16 documents magnitude 4-range events near Boulder, Antimony, Escalante, Bryce Canyon City, and Panguitch.

Older buildings, unreinforced masonry, unanchored contents, steep slopes, and limited route redundancy increase vulnerability. Table 17 identifies URM at Escalante School and Panguitch School, although current retrofit or replacement status is not established and the table is not a complete building inventory. Residents with access and functional needs and visitors unfamiliar with local conditions may require additional assistance, while long travel distances may delay emergency response, inspection, sheltering, and restoration.

Cascading Impacts: Shaking-related landslides or rockfall could close canyon and mountain routes, isolate communities, and restrict access to schools, healthcare, public safety facilities, parks, and recreation destinations. Damage to electric power, communications, water, wastewater, or fuel systems could interrupt government and business operations and prolong closures. Transportation and utility disruption could also reduce tourism activity, delay supply deliveries, and complicate mutual-aid access across the county.

Changes in Development: Residential, commercial, public, and visitor-serving development adds exposed assets, including in communities dependent on a limited number of routes and utility connections. Modern codes and replacement of vulnerable buildings can reduce life-safety risk, but new development remains exposed to shaking and secondary hazards. Siting near unstable slopes or

susceptible soils, infrastructure expansion, retrofit activity, and the condition of older facilities will shape future vulnerability; available data do not quantify the net change since the prior plan.

IRON COUNTY

Iron County and its participating municipalities—Brian Head, Cedar City, Enoch, Paragonah, and Parowan—are susceptible to damaging ground shaking. Concentrated development and lifelines along the Interstate 15 corridor create the potential for correlated building, transportation, and utility losses, while mountain communities and outlying areas may have fewer alternate access routes. Table 16 records several magnitude 4-range earthquakes near Cedar City and Paragonah, demonstrating recurring local seismicity.

People, residences, businesses, schools, emergency facilities, government buildings, utilities, and transportation assets may be affected by structural and nonstructural damage. Table 17 identifies one building or addition with URM at Cedar City High; it is not a complete countywide URM inventory. Vulnerability also depends on building age and condition, anchorage of equipment and contents, local soils, slope conditions, and the ability of critical facilities and service providers to continue operating after an event.

Cascading Impacts: Damage along the Interstate 15 corridor could impede regional emergency response, freight movement, commuting, and access between communities. Failure of power, communications, natural gas, fuel, water, or wastewater systems could interrupt healthcare, education, government, and business operations, while fire or hazardous-material releases could create additional response demands. Landslides or rockfall may affect steep routes and mountain access, potentially isolating Brian Head or other outlying areas.

Changes in Development: Continued growth in and around Cedar City, Enoch, and the Interstate 15 corridor increases the population, building stock, and infrastructure exposed to earthquake effects. Code-compliant construction may perform better than older vulnerable buildings, but growth can increase absolute losses and dependence on interconnected lifelines. Redevelopment, infrastructure aging, retrofit and replacement decisions, nonstructural anchorage, and development on susceptible soils or slopes will determine whether overall vulnerability increases or decreases; available data do not quantify the net change since the prior plan.

KANE COUNTY

Kane County and its participating municipalities—Alton, Big Water, Glendale, Kanab, and Orderville—are susceptible to regional earthquake ground shaking. The 1887 magnitude 4.8 event near Kanab listed in Table 16 and the Arizona–Utah border event identified in Table 15 illustrate that earthquakes in and near the county can affect its communities. Dispersed settlement, extensive public lands, visitor activity, and long travel distances shape the county’s vulnerability.

Damage may affect residences, businesses, schools, public and emergency facilities, roads, communications, and utility systems. Table 17 identifies two campuses and two buildings or additions with URM, plus one campus with likely URM, at Kanab School and Valley High; this is not a complete countywide inventory. Older construction, unanchored contents, limited response and medical resources, and dependence on a small number of transportation and utility connections may extend disruption.

Cascading Impacts: Road damage, rockfall, or slope failure could restrict access between communities and to remote recreation areas, delay mutual aid, and strand residents or visitors. Interruption of electric power, communications, fuel, water, or wastewater service could close public facilities and businesses and complicate emergency operations. Reduced highway access and prolonged utility outages could also disrupt tourism, supply deliveries, household recovery, and continuity of government.

Changes in Development: New residential and visitor-serving development increases exposed assets and may increase demand on routes, utilities, and emergency services with limited redundancy. Modern seismic design, replacement or retrofit of vulnerable schools and public buildings, and secured nonstructural components can reduce consequences, while development near steep slopes, susceptible soils, or constrained access routes may increase them. Available information does not establish a quantified countywide change in earthquake vulnerability since the prior plan.

WASHINGTON COUNTY

Washington County and its participating municipalities—Apple Valley, Enterprise, Hildale, Hurricane, Ivins, La Verkin, Leeds, New Harmony, Rockville, Santa Clara, Springdale, St. George, Toquerville, Virgin, and Washington City—have substantial exposure to damaging shaking and secondary hazards. The 1992 St. George earthquake caused building damage in Hurricane, La Verkin, Washington, and St. George, while the earthquake-triggered Balanced Rock Hills landslide in Springdale destroyed three homes, disrupted utilities, and closed State Route 9.

The county's comparatively large and growing population, concentrated urban development, schools, healthcare and public-safety facilities, businesses, tourism assets, and interconnected lifelines create the potential for significant direct and indirect losses. Table 17 identifies one school campus with likely URM, but this does not represent a complete county URM inventory. Vulnerability is also influenced by active fault zones, susceptible soils, steep terrain, older buildings, nonstructural components, high visitor populations, and reliance on major transportation and utility corridors.

Cascading Impacts: Strong shaking may trigger landslides, rockfall, liquefaction, lateral spreading, fires, hazardous-material releases, and failures of water, wastewater, power, natural gas, fuel, transportation, or communications systems. Simultaneous damage could constrain emergency response and healthcare access, displace households, close schools and government facilities, and interrupt regional commerce and tourism. Route closures near Zion National Park or along Interstate 15 and other key corridors could compound economic losses and isolate communities.

Changes in Development: Rapid growth and redevelopment, particularly in the St. George urban area and other communities along major corridors, increase the number and value of people and assets

exposed to earthquake effects. Newer code-compliant buildings may reduce relative life-safety risk, but expansion onto susceptible soils, near mapped faults, or beneath unstable slopes may create additional exposure, while greater reliance on interdependent lifelines can increase cascading consequences. Code enforcement, retrofit of older and critical facilities, nonstructural anchorage, infrastructure redundancy, and risk-informed siting will influence future vulnerability; available information does not quantify the net countywide change since the prior plan.

LOSS ESTIMATES

The Hazus analysis models an M5.9 earthquake scenario. Although similar in magnitude to the 1992 St. George earthquake (local magnitude 5.8), the scenario represents a planning-level modeled event rather than an exact recurrence. The results provide illustrative estimates of potential damage, economic loss, displacement, debris, and lifeline impacts and should be interpreted in light of model and inventory uncertainty.

Building-stock counts, occupancy proportions, and replacement valuations cannot be reconciled to an archived inventory in the supplied materials and are not reported here. The displayed scenario losses do not establish the total replacement value of regional assets.

The county maps distinguish general building-stock losses from user-defined-facility losses. A dated facility inventory and documented update method are unavailable, so facility counts and inventory-completeness claims are not assigned.

The following results summarize modeled building damage, economic loss, displacement, shelter needs, debris, critical-facility effects, and transportation and utility impacts. Hazus estimates are planning-level results, not predictions. Results depend on hazard inputs, inventory completeness, vulnerability functions, occupancy assumptions, and other model parameters and should be interpreted with appropriate uncertainty.

SCENARIO 1: MODELED M5.9 EARTHQUAKE

Hazus estimates that about 62 buildings would be at least moderately damaged, about 88% of those are projected to be single-family or other residential structures, and 10.5% commercial buildings. The damage modeled did not indicate that any households were expected to be displaced from their homes or require temporary public shelter.

The model did not indicate any damage or loss of functionality to critical facilities, nor any loss of functionality to transportation or utility systems. An estimated \$2.38 million in economic loss was modeled to transportation systems, including \$2.06 million to airport facilities, \$300,000 to bus facilities, and \$18,000 to highway bridges. Utility systems were modeled to experience \$36.85 million in economic losses, including \$31.2 million to electric power facilities, \$4.8 million to wastewater systems, \$417,900 to natural gas systems, \$378,800 in losses to potable water systems, and \$58,700 to communication facilities. An estimated 2,000 tons of debris would be generated, which would require 80 truckloads to remove.

The total economic loss estimated for this earthquake is \$105.43 million, which includes building and lifeline-related losses. Building losses include direct building losses and losses from business interruption. Direct building losses are the estimated costs to repair or replace the damage caused to a building and its contents. Business interruption losses are associated with the inability to operate a business due to earthquake damage. Total building-related economic losses are estimated at \$66.2 million, with \$64.8 million due to direct losses and \$1.36 million from business interruption or income losses.

As shown in Figure 11, non-structural and content losses account for the largest proportion of economic losses. Residences experience the highest value of building-related economic losses, followed by commercial. Table 18 shows both direct and business interruption losses for each major occupancy type.

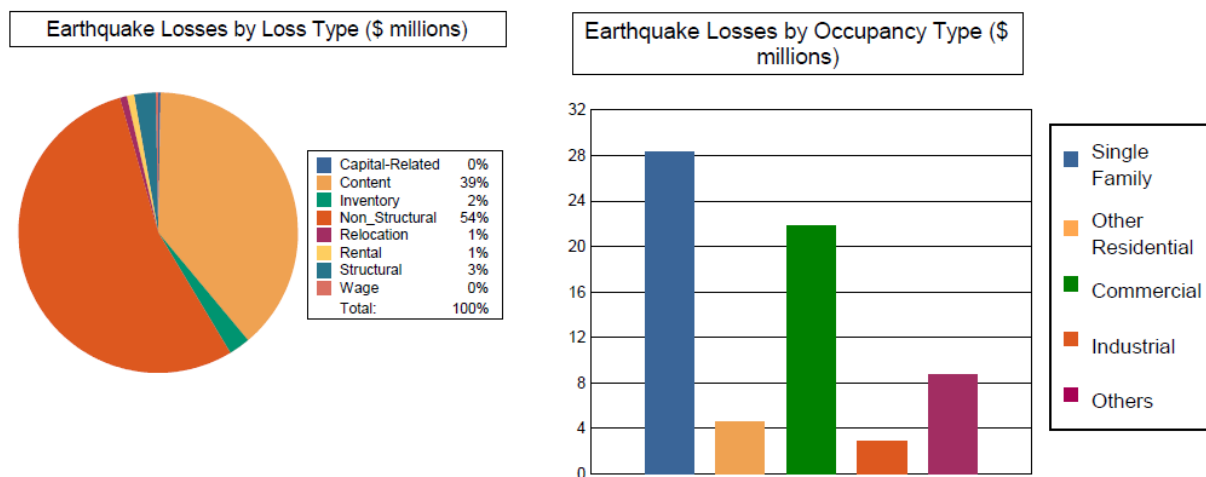


Figure 11: Earthquake Losses

Table 18: Building-Related Economic Loss by Occupancy Type (Millions of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses	Wage	0.0000	0.0106	0.1333	0.0027	0.0516	0.1982
	Capital-related	0.0000	0.0045	0.1587	0.0016	0.0203	0.1851
	Rental	0.1125	0.0522	0.2272	0.0016	0.0145	0.4080
	Relocation	0.2770	0.0310	0.1624	0.0061	0.0927	0.5692
	Subtotal	0.3895	0.0983	0.6816	0.0120	0.1791	1.3605
Capital Stock Losses	Structural	1.1244	0.1234	0.3626	0.0262	0.0792	1.7158
	Non-Structural	16.7585	3.0453	10.7825	1.5244	3.8428	35.9535
	Content	10.0442	1.2405	8.6327	1.0950	4.5272	25.5396
	Inventory	0.0000	0.0000	1.3662	0.2234	0.0419	1.6315

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
	Subtotal	27.9271	4.4092	21.1440	2.8690	8.4911	64.8404
Total		28.32	4.51	21.83	2.88	8.67	66.20

Figure 12 through Figure 17 show the supplied magnitude-5.9 scenario's economic-loss displays; Figure 18 through Figure 20 show its shaking displays. Additional county shaking maps and a second analysis are not supplied. The maps are illustrative model outputs, not verified inventories or independent loss estimates.

Readable map legend: general building-stock loss classes have upper limits of \$89,923, \$431,616, \$894,602, \$2,842,646, and \$8,204,989, from light to dark shading. User-defined-facility symbols have upper limits of \$983,556, \$8,081,945, \$36,693,012, \$95,722,288, and \$240,011,024. These are class limits, not county totals. The shaking legends progress from weakest (light blue) through weaker (light green), light (pale yellow), strong (pale orange), and strongest (orange); no calibrated MMI values are supplied.

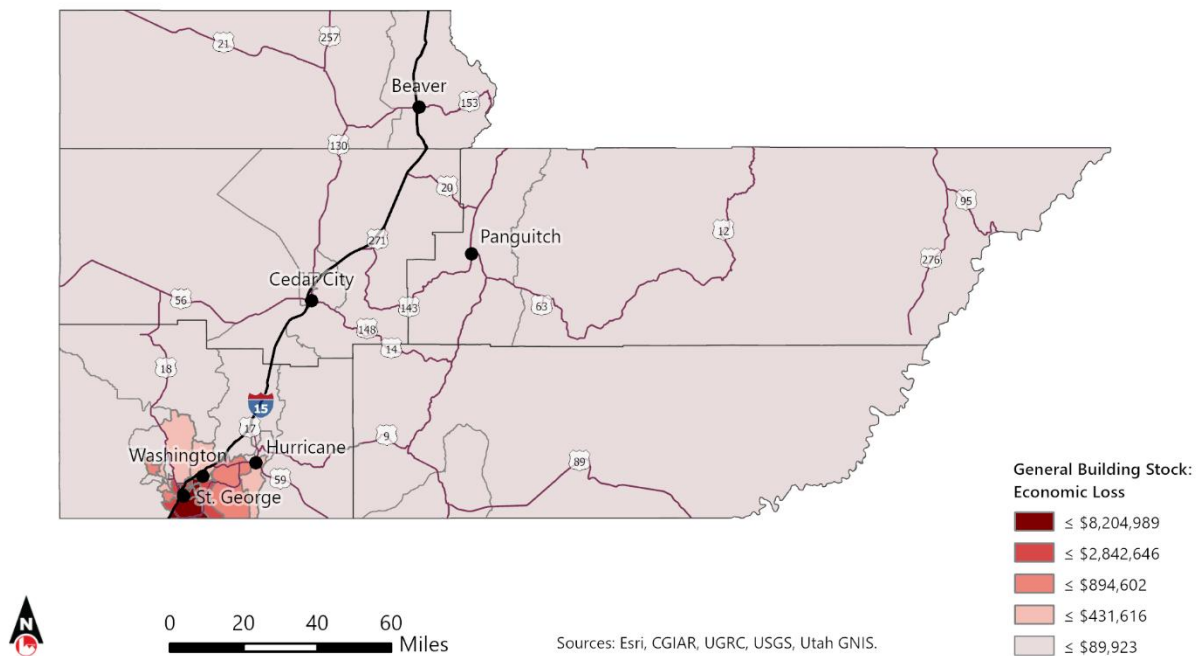


Figure 12: Economic Loss in Five-County Area for Modeled M5.9 Earthquake Scenario

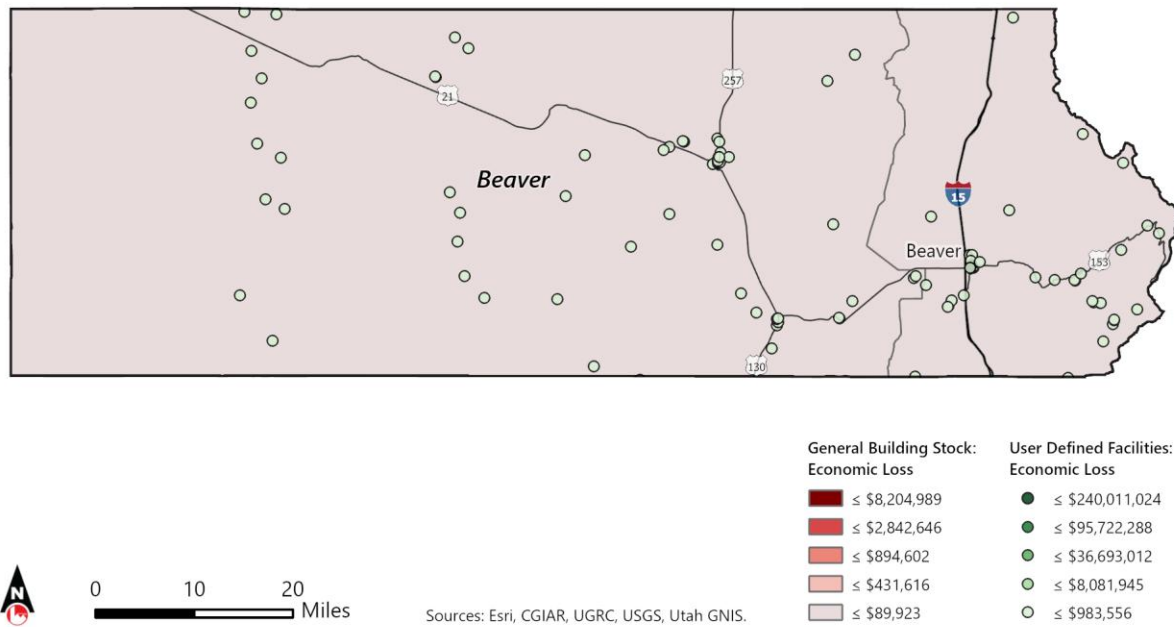


Figure 13: Economic Loss and User-Defined Facilities in Beaver County for M5.9 Scenario

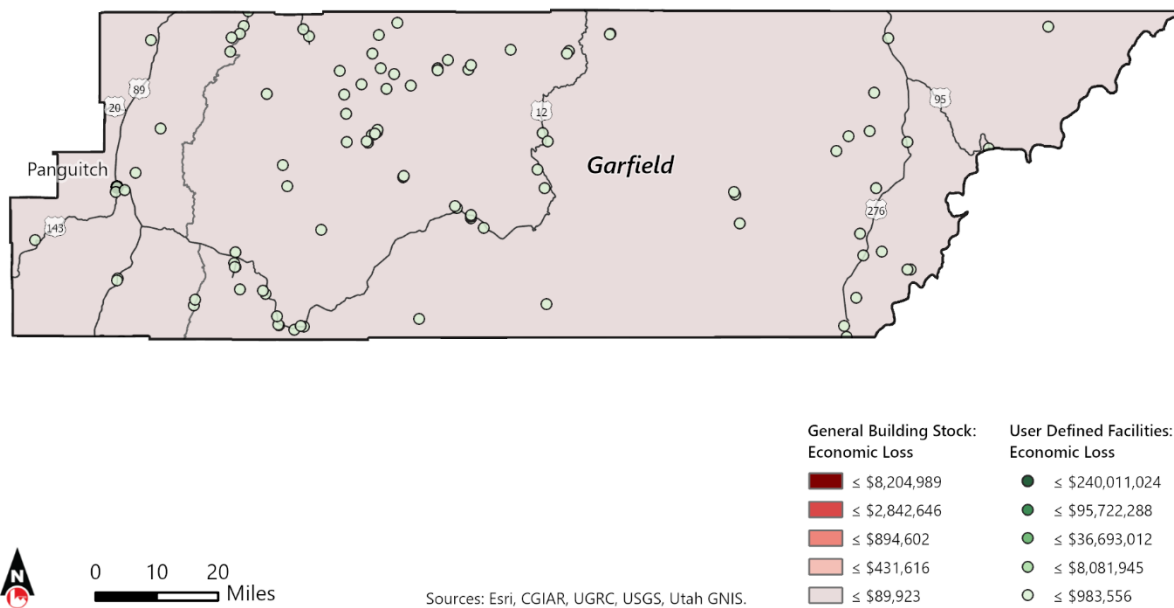


Figure 14: Economic Loss and User-Defined Facilities in Garfield County for M5.9 Scenario

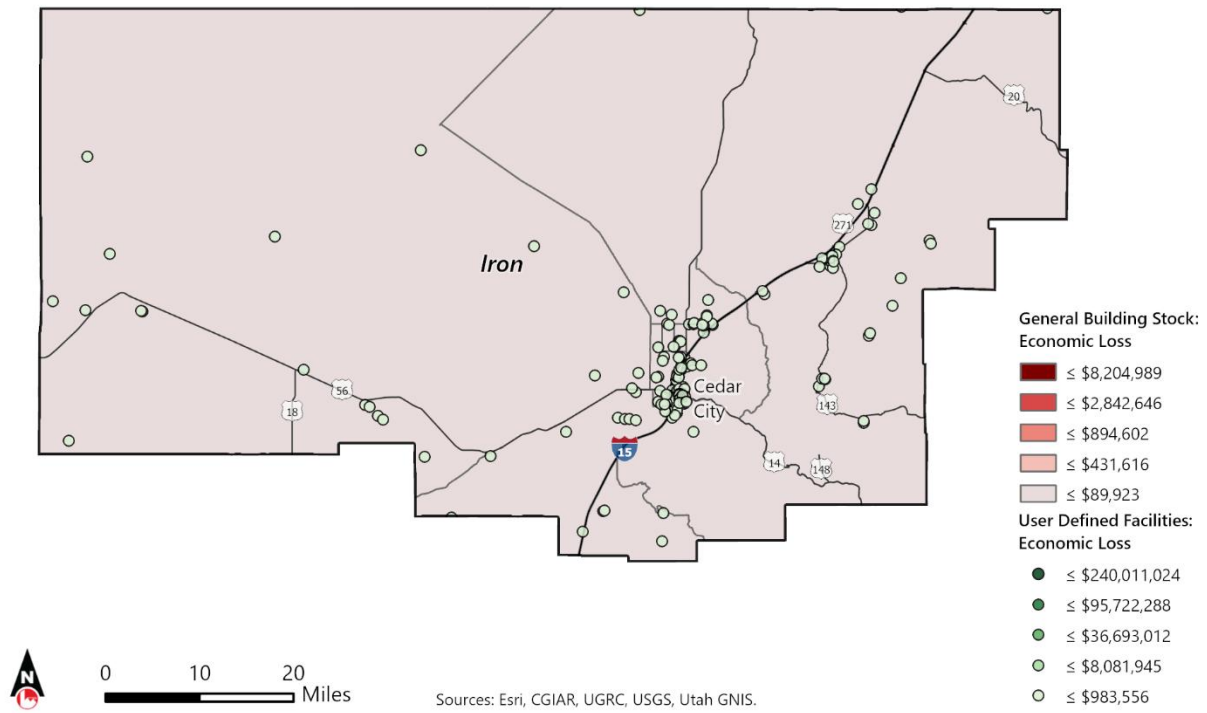


Figure 15: Economic Loss and User-Defined Facilities in Iron County for M5.9 Scenario

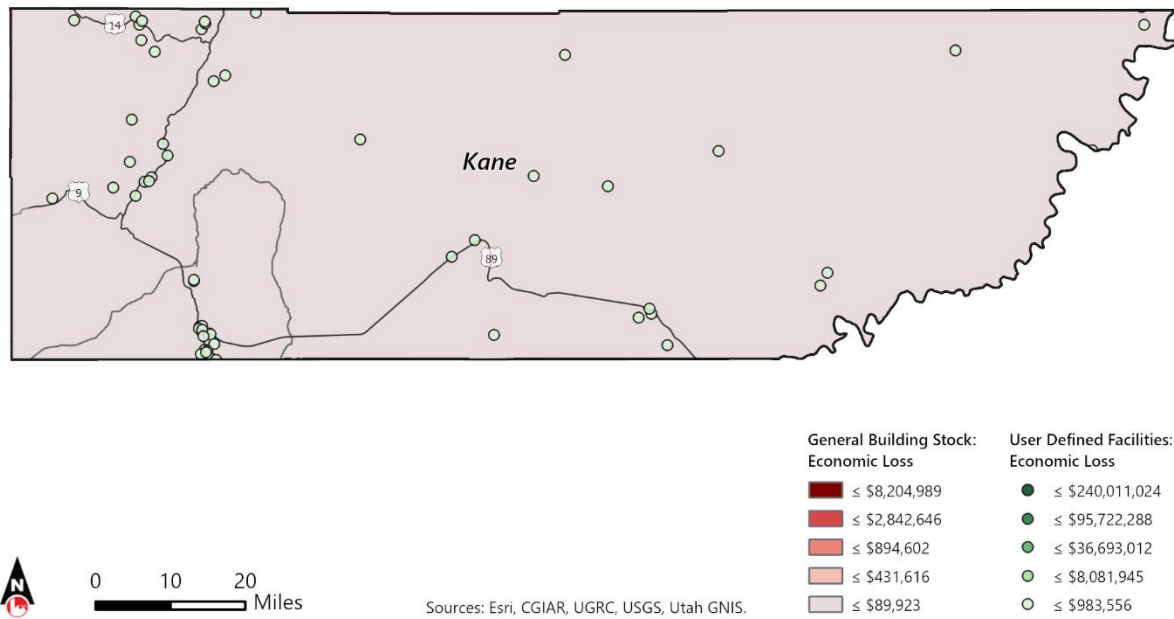


Figure 16: Economic Loss and User-Defined Facilities in Kane County for M5.9 Scenario

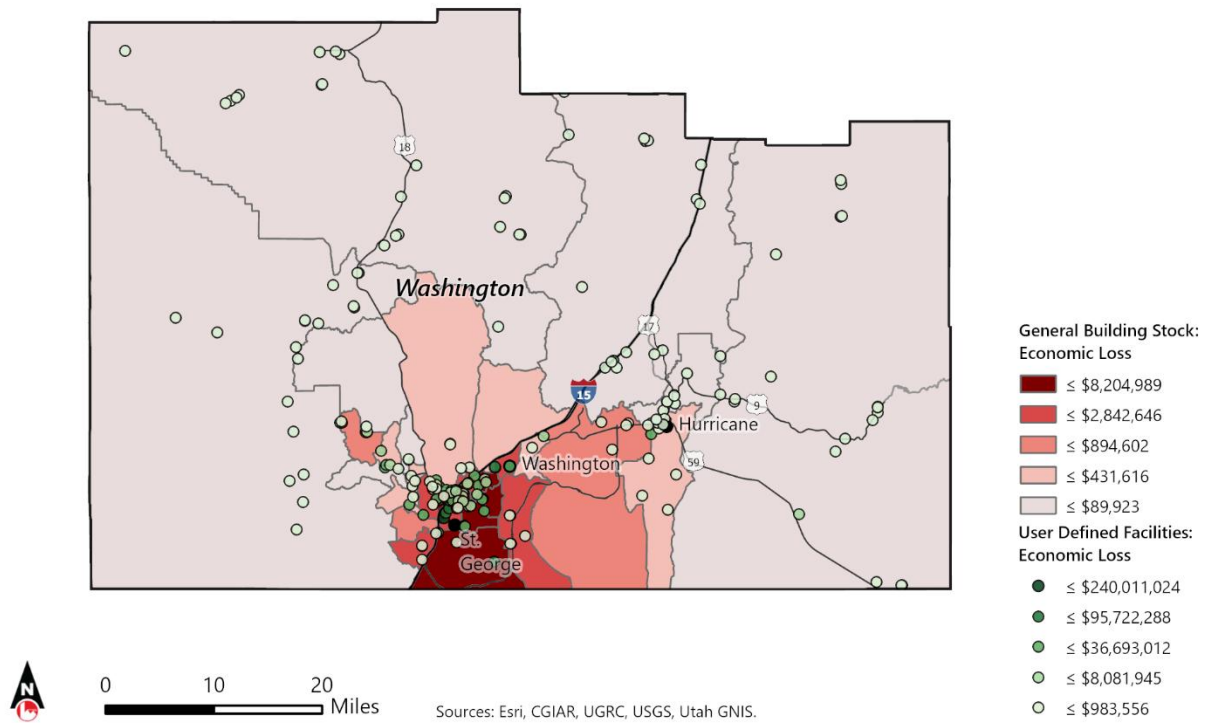


Figure 17: Economic Loss and User-Defined Facilities in Washington County for M5.9 Scenario

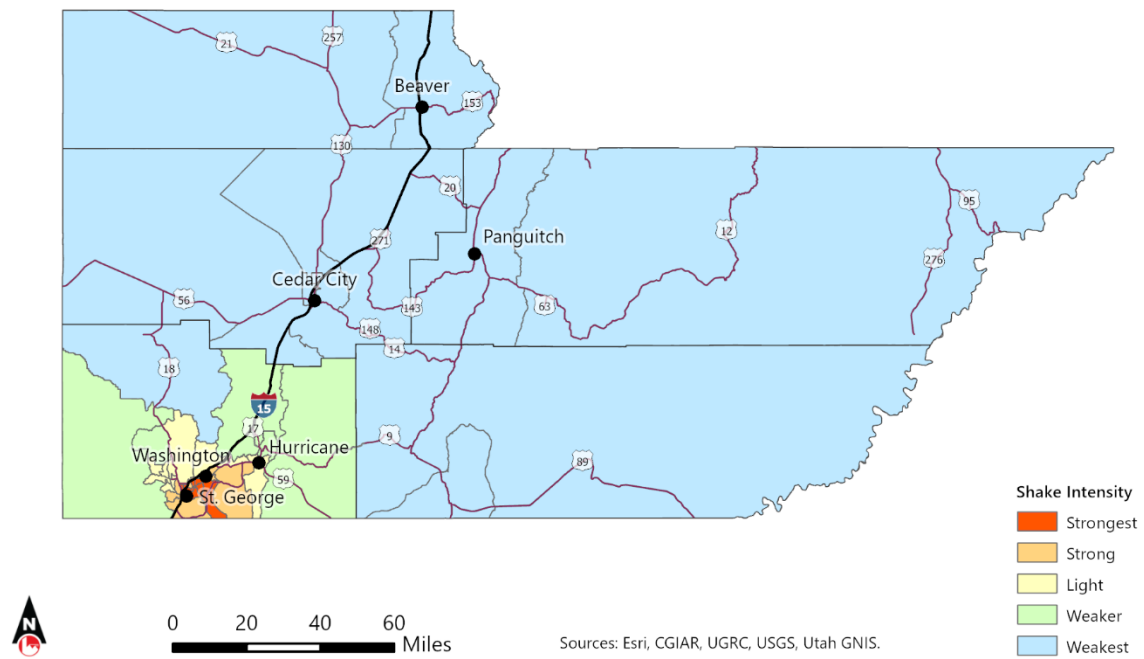


Figure 18: Shake Intensity for Five-County Region M5.9 Scenario

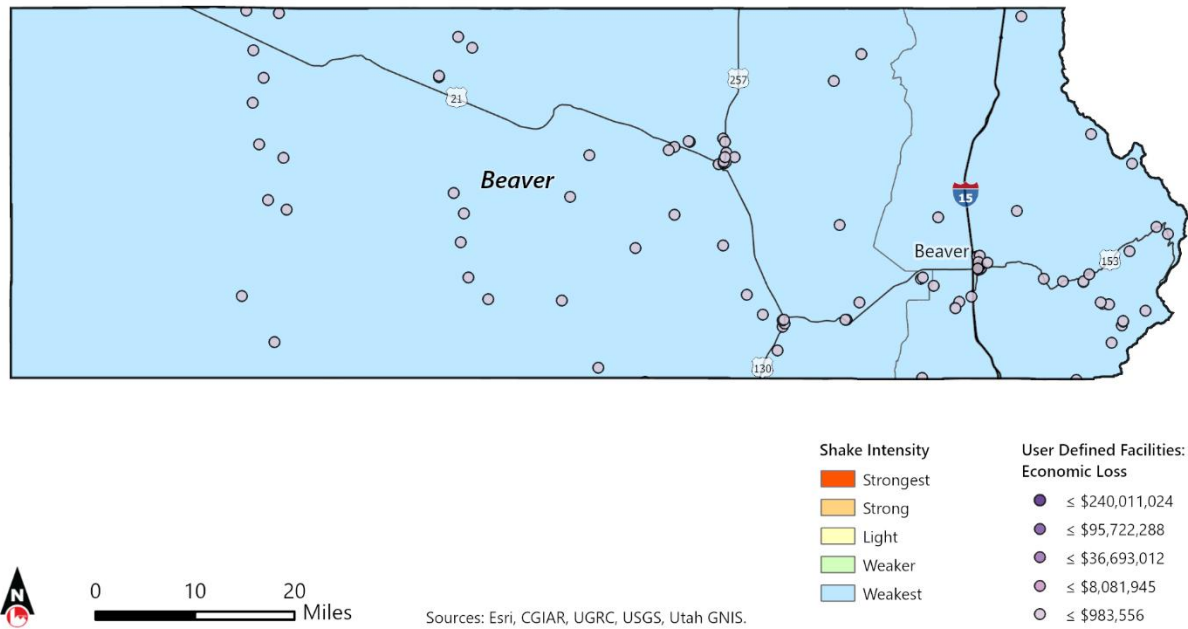


Figure 19: Shake Intensity for Beaver County for M5.9 Scenario

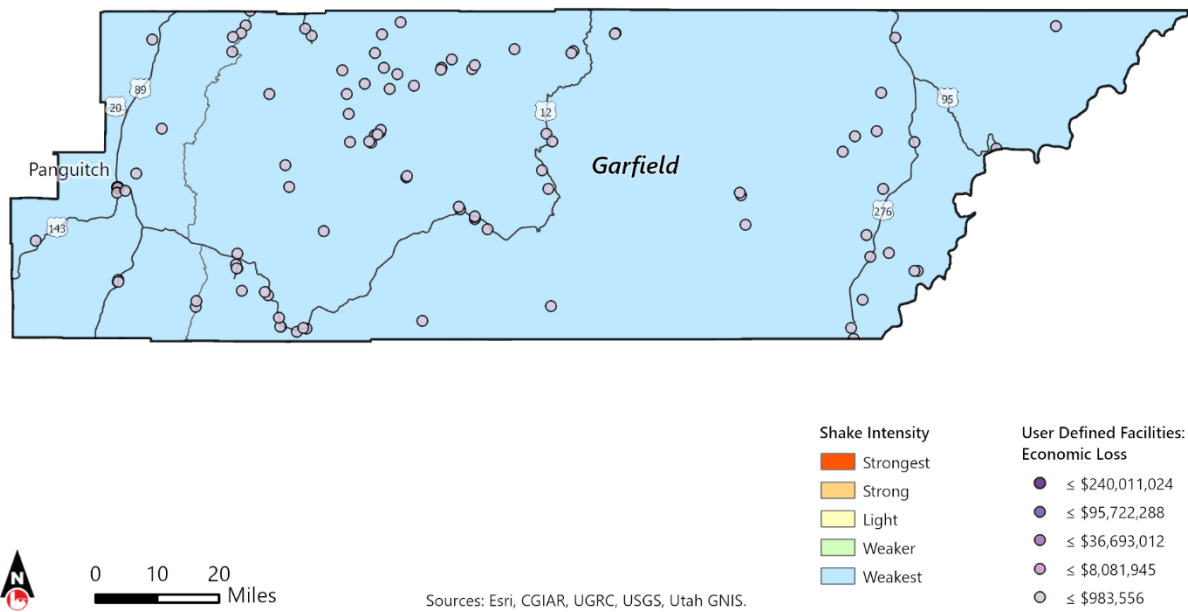


Figure 20: Shake Intensity for Garfield County for M5.9 Scenario

Extreme Heat

Extreme heat occurs when local weather conditions are substantially hotter than normal and create increased risk to health, infrastructure, ecosystems, or community functions. Because risk depends on local climate, season, duration, nighttime temperatures, humidity, solar exposure, wind, and population sensitivity, no single air-temperature threshold defines extreme heat throughout the planning area. A heat wave is a period of abnormally hot weather generally lasting more than two days. A persistent high-pressure pattern can trap warm air and contribute to a heat dome, but these terms describe related meteorological conditions rather than separate hazards.³⁸

Extreme heat can cause serious illness and death. The body can become unable to dissipate heat fast enough, leading to dehydration, heat cramps, heat exhaustion, or life-threatening heat stroke. Humidity can reduce evaporative cooling, while direct sun, exertion, limited air movement, warm nights, inadequate hydration, and lack of access to cooling also increase risk. Health impacts can occur below fixed temperature thresholds because risk is relative to local conditions and individual susceptibility.³⁹

Although much of the planning area is rural, developed communities may experience urban heat-island effects where roofs, pavement, and other built surfaces absorb and retain heat and where limited shade and vegetation reduce cooling. Higher nighttime temperatures can limit recovery from daytime heat and increase health risks. The magnitude of this effect varies by land cover, development pattern, elevation, and local weather and should not be represented by one uniform temperature difference without local analysis.⁴⁰

NOAA NCEI 1991–2020 Climate Normals provide the current standard 30-year baseline for describing typical station conditions. July is generally the hottest month at the selected stations, although hazardous heat can occur from late spring into early fall. Figures 1 through 5 show monthly normals for one observation station in each county; Table 19 includes additional stations to illustrate substantial local variation associated primarily with elevation and terrain.⁴¹

The July normal maximum temperature at Milford Municipal Airport is 95°F, as shown in Figure 21.

³⁸ National Weather Service, During a Heat Wave; heat-wave definition and heat safety guidance. <https://www.weather.gov/safety/heat-during>

³⁹ CDC/NIOSH, Heat-related Illnesses, March 3, 2026; National Weather Service, Heat Safety. <https://www.cdc.gov/niosh/heat-stress/about/illnesses.html> ; <https://www.weather.gov/safety/heat>

⁴⁰ U.S. Environmental Protection Agency, Heat Island Effects, March 12, 2026. <https://www.epa.gov/heatislands/heat-island-effects>

⁴¹ NOAA NCEI, U.S. Climate Normals, 1991–2020 standard normals. <https://www.ncei.noaa.gov/products/land-based-station/us-climate-normals>

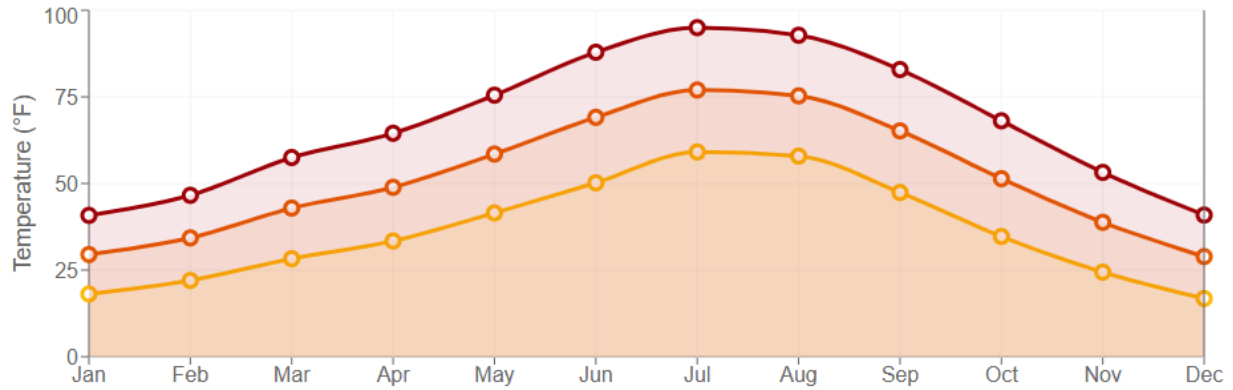


Figure 21: Average Temperature, Milford Municipal Airport, Utah, 1991–2020⁴²

The July normal maximum temperature at Panguitch is 86.1°F, as shown in Figure 22.

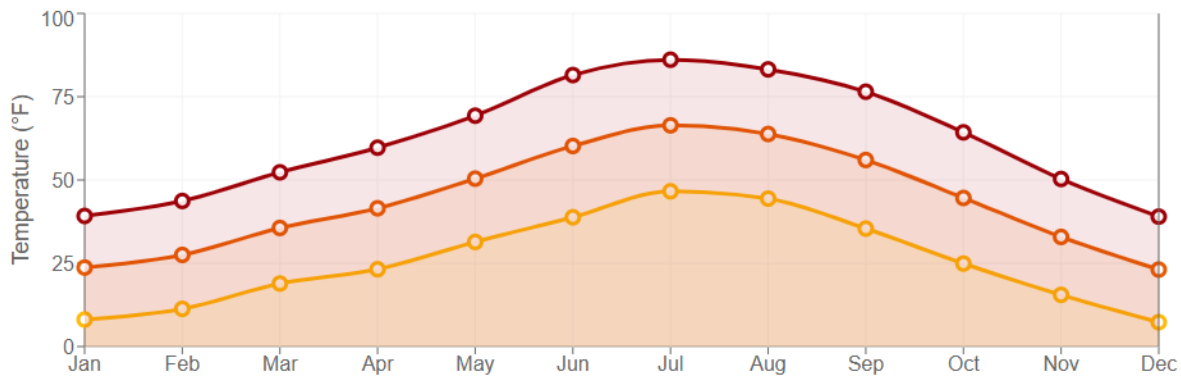


Figure 22: Average Temperature, Panguitch, Utah, 1991–2020

The July normal maximum temperature at Kanab is 94.2°F, as shown in Figure 23.

⁴²National Oceanic and Atmospheric Administration, National Centers for Environmental Information, U.S. Climate Normals, 1991–2020 monthly normals, Milford Municipal Airport (USW00023176).
<https://www.ncei.noaa.gov/access/us-climate-normals/#dataset=normals-monthly&timeframe=30&location=UT&station=USW00023176>.

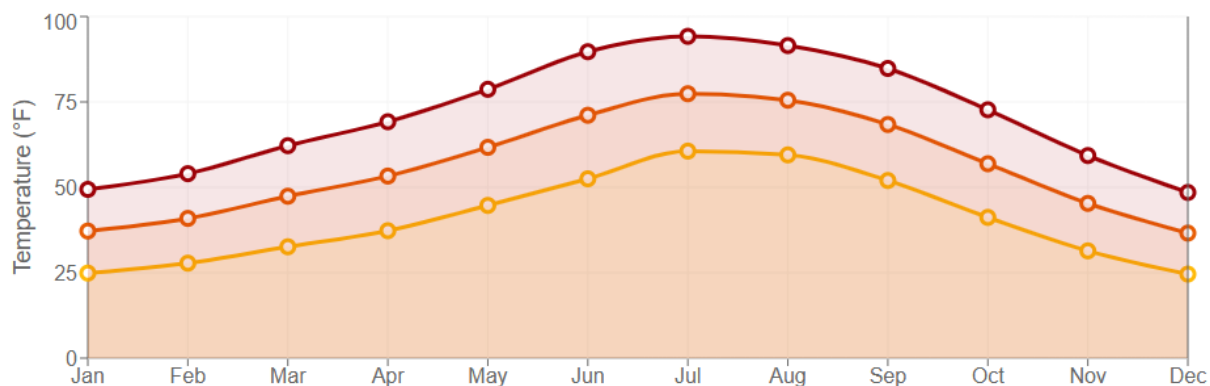


Figure 23: Average Temperature, Kanab, Utah, 1991–2020

The Cedar City Municipal Airport station (NOAA USW00093129) has a July normal maximum temperature of 91.0°F, minimum of 57.1°F, and mean of 74.0°F for 1991–2020.⁴³

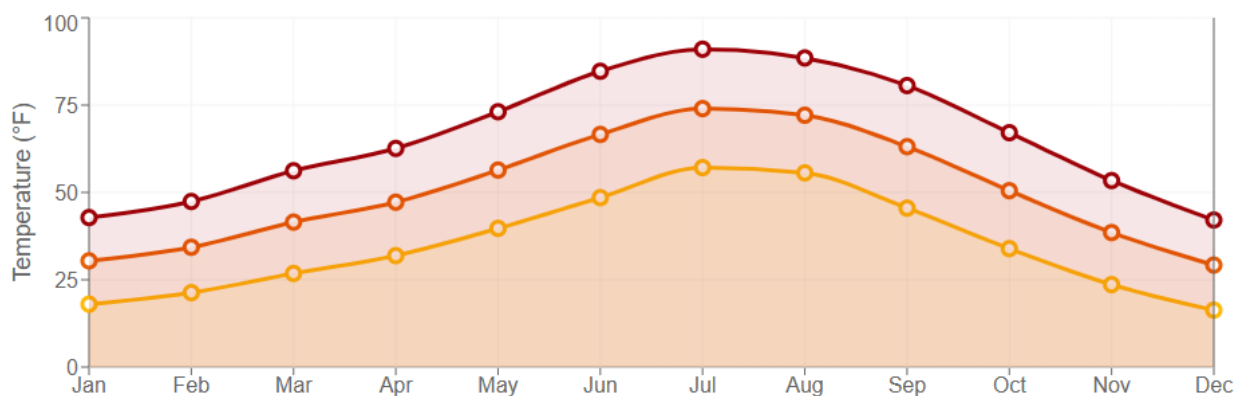


Figure 24: Average Temperature, Cedar City, Utah, 1991–2020

The July normal maximum temperature at St. George is 101.9°F, as shown in Figure 25.

⁴³ NOAA NCEI, 1991–2020 Monthly Climate Normals, Cedar City Municipal Airport, station USW00093129; July MLY-TMAX-NORMAL 91.0°F, MLY-TMIN-NORMAL 57.1°F, MLY-TAVG-NORMAL 74.0°F; retrieved October 10, 2026. <https://www.ncei.noaa.gov/data/normals-monthly/1991-2020/access/USW00093129.csv>

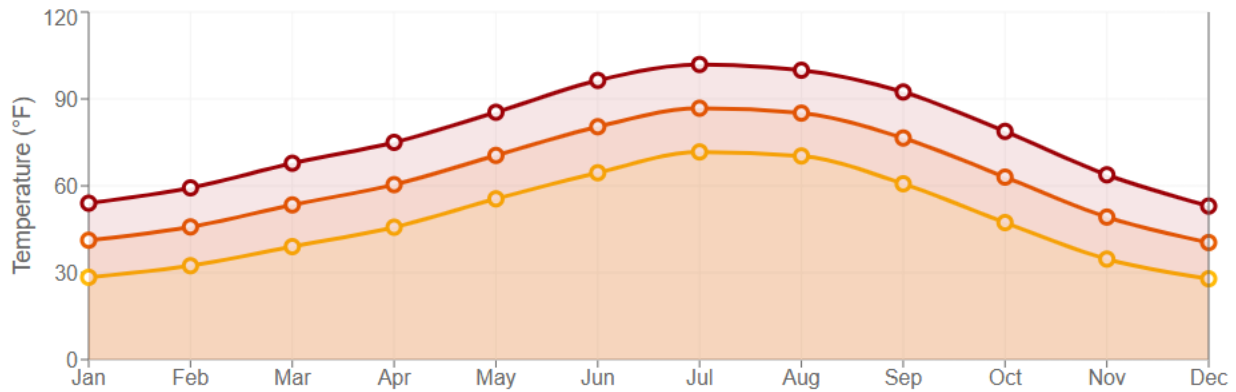


Figure 25: Average Temperature, St. George, Utah, 1991–2020

Location

Table 19 summarizes 1991–2020 July normals for selected stations. The values demonstrate that one countywide temperature does not represent all communities. For example, the listed July normal maximum temperatures for Beryl Junction and Brian Head differ by 24.4°F. Station values describe conditions at the observation site and should not be interpreted as countywide averages.

Table 19: Normal July Temperatures, 1991–2020

Station Location	County	Max Temp (°F)	Min Temp (°F)	Average Temp (°F)
Milford Municipal Airport	Beaver	95.0	59.1	77.0
Beaver Canyon Power House	Beaver	79.7	51.5	65.6
Panguitch	Garfield	86.1	46.6	66.4
Bryce Canyon National Park HQRS	Garfield	80.0	52.1	66.0
Boulder	Garfield	83.6	61.2	72.4
Escalante	Garfield	92.3	57.1	74.7
Cedar City Municipal Airport	Iron	91.0	57.1	74.0
Brian Head	Iron	68.5	42.7	55.6
Beryl Junction	Iron	92.9	50.2	71.6
Kanab	Kane	94.2	60.6	77.4
Orderville	Kane	91.0	55.3	73.2
Big Water	Kane	97.8	67.1	82.4
Paria	Kane	96.2	65.1	80.7

Station Location	County	Max Temp (°F)	Min Temp (°F)	Average Temp (°F)
St. George	Washington	101.9	71.7	86.8
La Verkin	Washington	98.3	67.6	83.0
Zion National Park	Washington	100.3	69.5	84.9
Enterprise	Washington	89.7	56.0	72.9
Veyo	Washington	92.1	63.8	77.9

The selected station normals demonstrate substantial local variation in summer temperatures; lower-elevation southern locations generally experience hotter conditions than higher-elevation locations. Heat consequences also depend on population sensitivity and access to cooling.

The CDC/ATSDR Heat and Health Index combines historical temperature, heat-related illness, and community characteristics to compare potential heat-health impacts at the ZIP-code level. Figure 26 displays the supplied 2024 rank classes, from low to high, including the top 10%. These relative ranks describe potential health impacts rather than air temperature or projected days above a threshold.⁴⁴

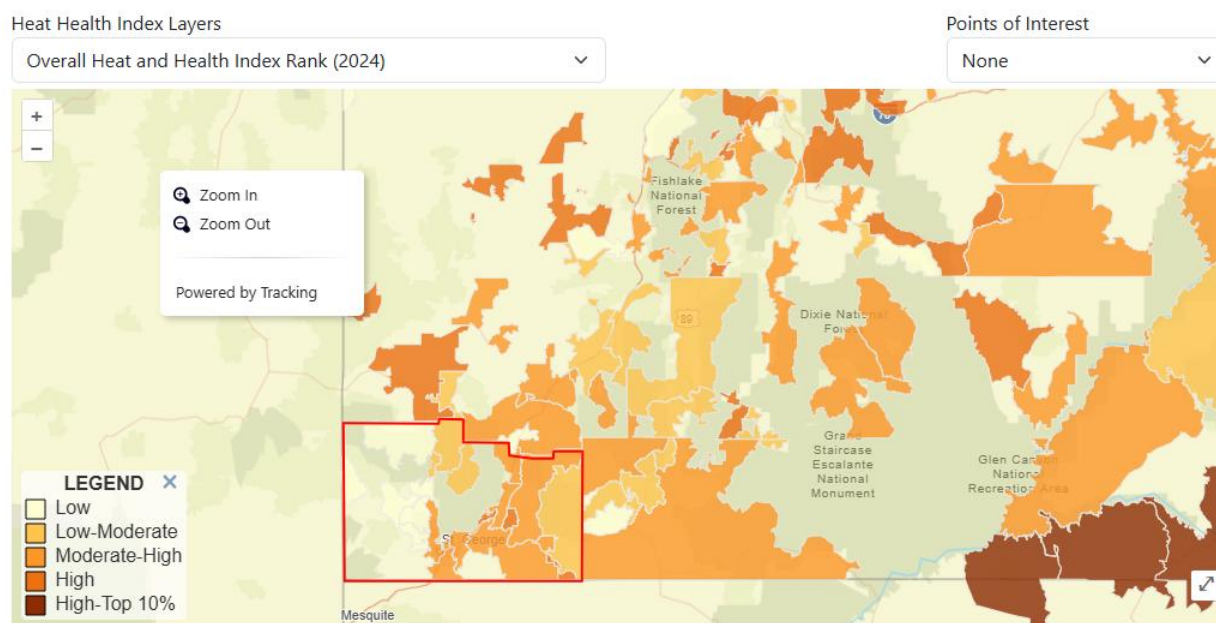


Figure 26: CDC/ATSDR Heat and Health Index Ranks, 2024 (ZIP-Code Level)

⁴⁴Centers for Disease Control and Prevention / Agency for Toxic Substances and Disease Registry, "Heat & Health Index," September 4, 2025, <https://atsdr.cdc.gov/place-health/php/hhi/index.html>.

Magnitude and Extent

The NWS Heat Index estimates how hot conditions feel when air temperature and relative humidity are combined. It was developed for shady, light-wind conditions; direct sunlight can increase heat stress. Because humidity is often low in southwestern Utah, Heat Index should be used with air temperature, warm-night indicators, HeatRisk, and Wet Bulb Globe Temperature when evaluating impacts to outdoor workers, athletes, and recreation users.

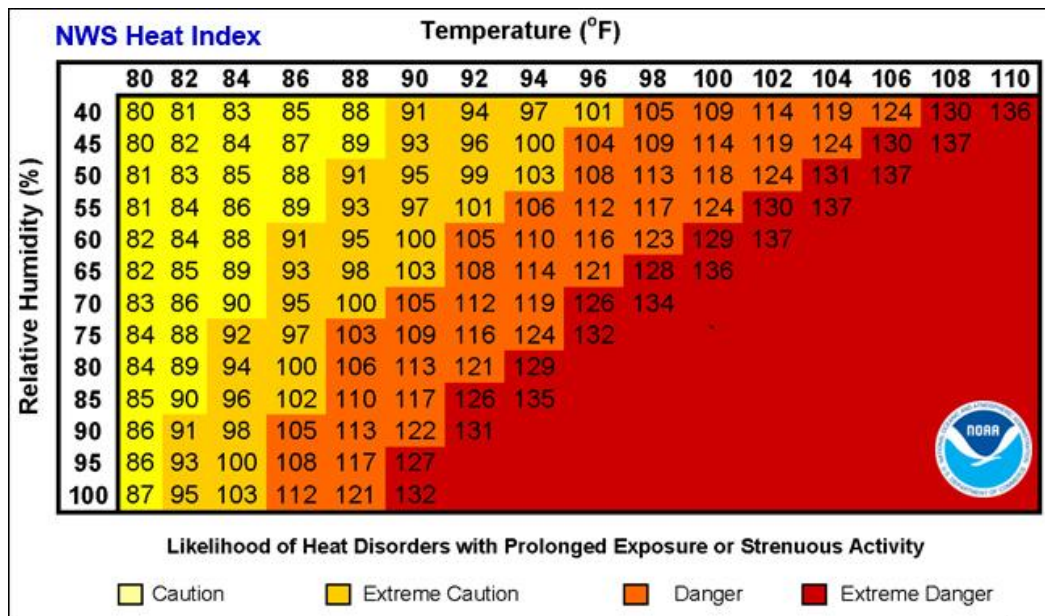


Figure 27: NWS Heat Index Scale⁴⁵

NWS's experimental HeatRisk product provides a color and numeric forecast of the potential for heat-related impacts over a 24-hour period and identifies groups most likely to be affected. HeatRisk supplements, rather than replaces, official NWS watches, warnings, and advisories.⁴⁶

Table 20: NWS HeatRisk Scale⁴⁷

Category	Risk of Heat-Related Impacts
Green - 0	Little to no risk from expected heat.
Yellow - 1	Minor – Primarily affects those who are extremely sensitive to heat and without cooling/hydration.
Orange - 2	Moderate – Affects those who are sensitive to heat, especially those without cooling/hydration, and some health systems and industries.

⁴⁵National Weather Service, "Heat Forecast Tools," Heat Index chart and explanation, accessed October 9, 2026, <https://www.weather.gov/safety/heat-index>.

⁴⁶National Weather Service, Weather Prediction Center, "NWS HeatRisk Overview," accessed October 9, 2026, <https://www.wpc.ncep.noaa.gov/heatrisk/overview.html>. The documentation identifies HeatRisk as experimental.

⁴⁷ NWS HeatRisk. <https://www.wpc.ncep.noaa.gov/heatrisk/>.

Category	Risk of Heat-Related Impacts
Red - 3	Major – Affects anyone without cooling/hydration as well as health systems and industries.
Magenta - 4	Extreme – Rare and/or long-duration extreme heat with no overnight relief affecting anyone without cooling/hydration as well as health systems, industries, and infrastructure.

Previous Occurrences

A search of OpenFEMA Disaster Declarations Summaries for Utah through October 10, 2026, found no federal major-disaster or emergency declaration identified specifically as heat. This finding does not establish the absence of heat events or heat as a contributing condition in declarations for other incident types; state declarations were not evaluated.⁴⁸

On July 10, 2021, the St. George Cooperative Observer station recorded 117°F, tying Utah's official maximum-temperature record first established in St. George on July 5, 1985.⁴⁹

The NOAA NCEI Storm Events Database documents selected excessive-heat episodes and associated impacts reported by National Weather Service forecast zones. It is not a complete inventory of every hot day or every heat-related illness or death.⁵⁰

Table 21 lists selected verified Excessive Heat records from 2021 and 2024 within the 2021–2025 review period. They are reported by NWS forecast zone, whose boundaries may extend beyond the planning counties; the event impacts are not allocated to individual jurisdictions. Capitol Reef National Park and Vicinity and Western Canyonlands are regional forecast zones, not county boundaries.

Table 21: NCEI Storm Events Database for Excessive Heat⁵¹

Date	Event Type	Location	Fatalities	Injuries	Property Damage	Crop Damage
6/3/2021	Excessive Heat	Lower Washington County (Zone)	0	0	\$0	\$0

⁴⁸ FEMA, OpenFEMA Disaster Declarations Summaries, version 2; Utah records retrieved October 10, 2026, <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2>.

⁴⁹ NOAA NCEI, State Climate Extremes Committee Memorandum, June 27, 2022, Potential Record-tying Utah Maximum Temperature Event at St. George, UT, pp. 1–2, <https://www.ncei.noaa.gov/monitoring-content/extremes/scec/reports/20220708-Utah-Maximum-Temperature.pdf>.

⁵⁰ NOAA NCEI, Storm Events Database, Excessive Heat records for Utah, 2021 and 2024; details files d2021_c20260323 and d2024_c20260728, retrieved October 10, 2026, Events 968648, 968655, 968736, 968745, 968746, 968748, 968749, 968751, 1182539, and 1192724, <https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/>.

⁵¹ National Centers for Environmental Information (NCEI), "Storm Events Database: Excessive Heat," 2026. <https://www.ncei.noaa.gov/access/storm-events-database>.

Date	Event Type	Location	Fatalities	Injuries	Property Damage	Crop Damage
6/4/2021	Excessive Heat	Glen Canyon Recreation Area/Lake Powell (Zone)	0	0	\$0	\$0
6/14/2021	Excessive Heat	Lower Washington County (Zone)	0	0	\$0	\$0
6/14/2021	Excessive Heat	Zion National Park (Zone)	0	0	\$0	\$0
6/14/2021	Excessive Heat	South Central Utah (Zone)	0	0	\$0	\$0
6/14/2021	Excessive Heat	Capitol Reef National Park and Vicinity (Zone)	0	0	\$0	\$0
6/14/2021	Excessive Heat	Western Canyonlands (Zone)	0	0	\$0	\$0
6/14/2021	Excessive Heat	Glen Canyon Recreation Area/Lake Powell (Zone)	0	0	\$0	\$0
7/13/2024	Excessive Heat	Lower Washington County (Zone)	1	2	\$0	\$0
7/21/2024	Excessive Heat	Lower Washington County (Zone)	1	0	\$0	\$0

Probability of Future Occurrences

Extreme heat is rated Highly Likely as a recurring summer hazard somewhere in the planning area. The rating is qualitative, supported by the 1991–2020 station normals, the documented St. George extreme, and the selected NOAA Excessive Heat episodes; it does not imply annual excessive-heat events in every jurisdiction or a calculated threshold-exceedance probability.

The plan's Highly Likely category means expected occurrence at least once per year. The Fifth National Climate Assessment identifies increasing heat risks across the Southwest, including effects on health, infrastructure, water, ecosystems, and outdoor activities.⁵²

The available figures do not establish a reproducible county-specific projection of annual days above 95°F or 100°F. Quantitative threshold-day estimates are therefore omitted; future conditions are described qualitatively.

The Climate Explorer charts display temperature change from a 1961–1990 observed baseline, as labeled on their axes. That anomaly baseline differs from the 1991–2020 NOAA station normals used above.

⁵² U.S. Global Change Research Program, Fifth National Climate Assessment, Chapter 28: Southwest, 2023, <https://nca2023.globalchange.gov/chapter/28/>.

Because the supplied exports do not establish complete scenario and geographic metadata, the charts are illustrative and are not used for county-specific quantitative conclusions.

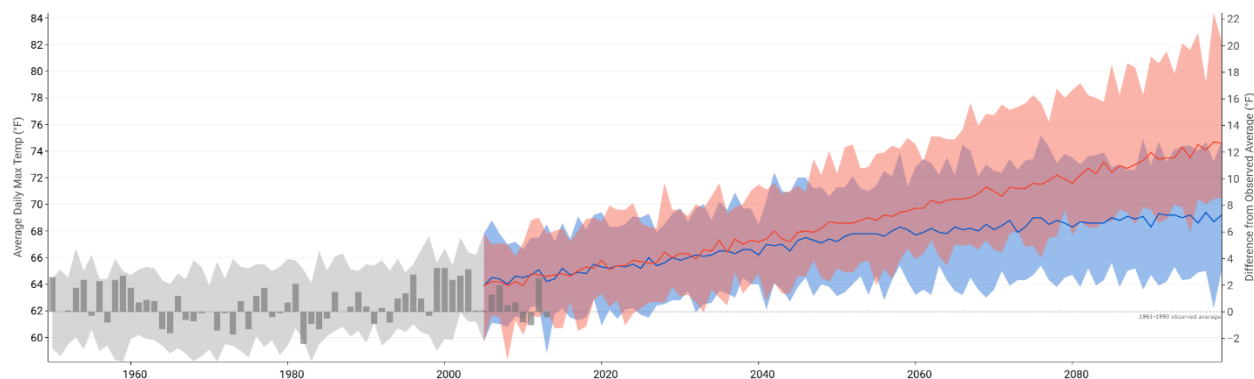


Figure 28: Climate Explorer Average Daily Maximum Temperature Change from the 1961–1990 Observed Baseline

Vulnerability Assessment

Extreme heat can affect all participating jurisdictions, but vulnerability varies substantially with elevation, typical summer temperature, nighttime cooling, land cover, housing condition, access to air conditioning, outdoor activity, and the reliability of electricity and water systems. People at elevated risk include older adults, infants and children, people with chronic medical conditions or disabilities, outdoor workers, athletes and recreation users, people experiencing homelessness, visitors unfamiliar with local conditions, and households with limited transportation or cooling access. Buildings may remain structurally intact while becoming unsafe to occupy when indoor temperatures rise. The following county assessments apply the temperature data and event information presented above without treating individual weather stations as countywide averages.

BEAVER COUNTY

Beaver County, Beaver City, Milford, and Minersville are exposed to episodes of extreme heat, although elevation and terrain produce meaningful local differences. Table 1 shows a July normal maximum of 95.0°F at Milford Municipal Airport compared with 79.7°F at Beaver Canyon Power House, illustrating why conditions at one station should not be applied uniformly. Residents without effective cooling, agricultural and construction workers, travelers, and people participating in outdoor recreation are particularly susceptible during prolonged hot periods.

Critical facilities, homes, schools, businesses, and community gathering places can experience unsafe indoor temperatures if cooling is absent or power is interrupted. Agricultural operations may face worker-safety constraints, greater livestock heat stress, and increased water demand. Transportation incidents or vehicle failures in remote areas can expose occupants to dangerous heat, while limited healthcare capacity and travel distances may delay treatment for heat illness.

Cascading impacts. Extreme heat can increase electricity demand at the same time that electrical equipment operates under added stress; an outage can then disable air conditioning, refrigeration, communications, well pumps, and electrically powered medical devices. Higher water demand can strain local supplies or distribution systems, and heat combined with dry vegetation can worsen wildfire conditions and smoke exposure. These linked effects can increase calls for emergency medical service and place additional demands on public-safety personnel.

Changes in development. New housing, commercial activity, renewable-energy facilities, transportation use, and outdoor employment can increase the number of people and assets exposed to heat, especially where development is distant from cooling centers or emergency services. Development that adds paved and roofed surfaces with limited shade can retain heat locally. Conversely, current codes, efficient cooling, backup power for critical facilities, drought-appropriate shade, and adequate water and electric capacity can reduce the vulnerability of new development.

GARFIELD COUNTY

Garfield County and the participating communities of Antimony, Boulder, Bryce Canyon City, Cannonville, Escalante, Hatch, Henrieville, Panguitch, and Tropic experience varied heat exposure because of large differences in elevation and terrain. Table 1 lists July normal maximum temperatures of 80.0°F at Bryce Canyon National Park Headquarters, 83.6°F at Boulder, 86.1°F at Panguitch, and 92.3°F at Escalante. Even in cooler high-elevation locations, unusual heat can affect people unaccustomed to high temperatures, while lower-elevation communities and canyon environments may experience greater heat stress.

Tourism and outdoor recreation increase exposure among visitors, park and hospitality workers, guides, road crews, and emergency responders. Remote travel, rugged terrain, limited shade, variable cellular coverage, and long transport times can complicate rescue and medical treatment. Homes and lodging without adequate cooling can become unsafe, and local clinics, public buildings, water systems, and visitor services may face increased demand during regional heat episodes.

Cascading impacts. Heat can coincide with drought and dry fuels, increasing wildfire potential and compounding outdoor health risks through smoke. High visitor volumes can amplify water and electricity demand, while a power interruption can disable cooling, refrigeration, communications, and pumping systems. Road closures, vehicle breakdowns, or wildfire evacuations during hot weather can leave residents and visitors exposed for longer periods and stretch law-enforcement, fire, emergency medical, and search-and-rescue resources.

Changes in development. Additional housing, lodging, visitor facilities, and recreation use can increase the exposed population, particularly in remote locations with limited utility redundancy or emergency-service access. Expansion of paved areas and buildings may create localized heat retention where shade is limited. Heat-aware site design, efficient cooling, shaded public spaces, reliable backup power and communications, and utility-capacity planning can reduce vulnerability as communities and tourism facilities develop.

IRON COUNTY

Iron County and the participating communities of Brian Head, Cedar City, Enoch, Paragonah, and Parowan have sharply different heat exposure across developed valleys and high-elevation terrain. Table 1 lists a July normal maximum of 91.0°F at Cedar City Municipal Airport, 92.9°F at Beryl Junction, and 68.5°F at Brian Head. The wide range demonstrates that vulnerability depends on local conditions; residents and visitors in cooler locations may also be less acclimated when unusually hot weather occurs.

Cedar City and nearby growing communities concentrate residents, healthcare facilities, schools, businesses, transportation corridors, and outdoor activities that can be affected by prolonged heat. Outdoor workers, university students and event attendees, older adults, children, and households without dependable cooling are susceptible. In rural and recreation areas, distance from medical care, limited shade, and delayed discovery of a person in distress may increase consequences.

Cascading impacts. Increased cooling demand can stress the electric system, and outages can quickly create unsafe conditions in residences, care settings, and public facilities. Heat can raise water demand, affect agricultural workers and livestock, worsen drought stress, and contribute to dry fuels and wildfire conditions. Wildfire smoke, road closures, or evacuations during a heat episode can further burden healthcare, emergency response, shelters, and transportation systems.

Changes in development. Continued residential and commercial growth in and around Cedar City and Enoch can increase the number of people dependent on electric cooling and can add heat-retaining roofs and pavement. New recreation, resort, industrial, and transportation-related development may also add outdoor workers and visitors. Enforcing energy and life-safety standards, preserving or adding shade, providing cooling access, and sizing electric, water, healthcare, and emergency-service capacity for peak conditions can limit added vulnerability.

KANE COUNTY

Kane County and the participating communities of Alton, Big Water, Glendale, Kanab, and Orderville face substantial but locally variable heat exposure. Table 1 lists July normal maximum temperatures of 94.2°F at Kanab, 91.0°F at Orderville, 97.8°F at Big Water, and 96.2°F at Paria. Lower-elevation desert and canyon areas can become especially hazardous, while elevation, terrain, and nighttime temperatures influence risk in other communities.

Residents, outdoor workers, visitors, and recreation users may be exposed far from shade, potable water, mobile service, or rapid medical assistance. Glen Canyon National Recreation Area and other remote destinations can place visitors in severe conditions for extended periods, and the NOAA records in Table 3 include Excessive Heat episodes for the Glen Canyon forecast zone. Homes, lodging, public facilities, and vehicles are vulnerable when cooling fails or is unavailable.

Cascading impacts. Extreme heat can combine with drought, low water availability, and dry fuels to increase pressure on water systems and worsen wildfire conditions. High recreation demand can coincide with peak electric and water use, while outages or communications failures can complicate warnings,

rescue, and sheltering. Vehicle failures, road disruptions, or emergency incidents in remote areas can lengthen exposure and require resource-intensive search, rescue, and medical transport.

Changes in development. Growth in Kanab, Big Water, and other communities, together with additional tourism facilities and recreation use, can increase exposure and seasonal demand on utilities and emergency services. Development in remote or unshaded settings may place more people far from cooling and medical care, while added pavement and roofs can increase localized heat retention. Reliable cooling, shade, backup power and communications, water planning, and clear emergency access can reduce the susceptibility of new development.

WASHINGTON COUNTY

Washington County and its participating municipalities experience the planning area's most consistently high heat exposure, although conditions still vary with elevation. Table 1 lists July normal maximum temperatures of 101.9°F at St. George, 100.3°F at Zion National Park, 98.3°F at La Verkin, 92.1°F at Veyo, and 89.7°F at Enterprise. St. George also recorded 117°F on July 10, 2021, tying Utah's official maximum-temperature record.

The county's concentration of population, older adults, visitors, construction activity, outdoor recreation, healthcare facilities, and developed property increases the number of people and systems exposed. Warm nights can limit physical recovery and keep indoor temperatures elevated. The verified 2024 Lower Washington County Excessive Heat records in Table 3 include two fatalities and two injuries across two events, demonstrating that severe consequences can occur even when reported property and crop damage is zero.

Cascading impacts. Sustained heat can produce very high electricity and water demand; a power outage can disable cooling, refrigeration, traffic controls, communications, pumps, and medical equipment. Heat can also worsen drought and wildfire conditions, while smoke or evacuation can increase demand for cooled public spaces and medical care. Heavy recreation and visitor use, transportation incidents, or search-and-rescue calls during extreme heat can compound staffing and resource demands across emergency services.

Changes in development. Continued residential, commercial, and tourism growth can increase the exposed population, cooling demand, water use, traffic, and the extent of heat-retaining roofs and pavement, particularly in the lower county. Development near recreation areas or at the urban fringe can add outdoor exposure and emergency-response needs. Compact shade networks, reflective or lower-heat materials where appropriate, efficient cooling, backup power for critical facilities, and utility and healthcare capacity matched to peak demand can reduce added vulnerability.

Flooding

Flooding is the overflow or accumulation of water on normally dry land. It can occur along rivers and streams, in mapped floodplains, at canyon mouths and alluvial fans, within ephemeral washes and slot

canyons, and where runoff exceeds drainage capacity. Flood risk is not limited to areas shown on FEMA Flood Insurance Rate Maps.

In southwestern Utah, flooding, erosion, and sedimentation can cause loss of life, damage to infrastructure, impacts to reservoirs, and degradation of natural habitats. Understanding the types of flooding that occur in the five-county region helps communities identify appropriate mitigation actions. Common flood types include the following:

- **Riverine Flooding:** Overbank flooding occurs when rivers rise and flow beyond their banks and main channels. Major river systems in the region include the Virgin, Colorado, Sevier, Paria, and Escalante Rivers.
- **Flash Flooding (Including Dry-Wash Flooding):** Rapid flooding in a normally dry area or a quick rise of water in a stream or wash, typically developing within hours of intense rainfall. In southwestern Utah, summer monsoon storms can generate fast-moving flows in washes, slot canyons, and canyons.
- **Post-Wildfire Flooding and Debris Flows:** Wildfire can remove vegetation and alter soil properties, increasing runoff, erosion, sediment transport, and debris-flow potential during subsequent rainfall. Flooding and debris flows are related but distinct processes; post-fire assessments distinguish their locations and potential effects.
- **Ice and Debris Jams:** Flooding occurs when ice or debris blocks a channel and causes water to back up and spill into surrounding areas, sometimes compounding ongoing flooding by restricting flow at bridges, culverts, or narrow channel sections.
- **Snowmelt (and Rain-On-Snow) Flooding:** Flooding that occurs when warming temperatures rapidly melt snowpack (often on already saturated ground), increasing runoff into creeks and rivers and potentially causing overbank flooding.
- **Dam or Levee Incident or Failure:** Overtopping, excessive seepage, operational releases, or structural failure can release water downstream. Dam failure is profiled separately in this plan; this flood profile addresses resulting inundation only as a cascading or related mechanism.

This profile focuses on the flood mechanisms most relevant to the Five County AOG region: riverine flooding along perennial rivers and streams, flash flooding in ephemeral washes and slot canyons, and post-wildfire flooding and debris flows in burn-scarred watersheds.

Flood characteristics and impacts vary by setting. Riverine floods can inundate floodplains for hours to days, with depth and duration influenced by watershed size, antecedent moisture, snowmelt, and rain-on-snow conditions. Flash floods develop rapidly (often from short-duration, high-intensity rainfall) and can be high-velocity and debris-laden, damaging roads, culverts, channels, and structures. In burn-scarred watersheds, vegetation loss and soil changes can increase peak flows and sediment loads, raising the likelihood of debris flows, channel aggradation, and clogged drainage infrastructure.

Southern Utah experiences recurring flash flooding from short-duration, high-intensity storms, including warm-season convective and monsoonal storms. Moisture sources and storm tracks vary by event; the

combination of intense rainfall, steep terrain, exposed rock, narrow canyons, and ephemeral drainage networks can produce rapid runoff and little warning.

Flash flooding can erode channels, transport sediment and debris, damage or block roads, inundate structures, and isolate communities. Outdoor recreation users in slot canyons, washes, and remote terrain are particularly susceptible because flooding may develop rapidly upstream of the affected location.

Location

Flooding in the Five County AOG planning area (Beaver, Garfield, Iron, Kane, and Washington Counties) occurs in and near river corridors, canyon mouths, alluvial fans, and ephemeral washes that can remain dry for long periods. Flash flooding can also occur across small, steep basins during short-duration, high-intensity storms and in burn-scarred watersheds following wildfires.

Mapped 1% annual chance floodplains (Special Flood Hazard Areas, or SFHAs) shown on FEMA Flood Insurance Rate Maps (FIRMs) identify many riverine-risk areas and support local floodplain management and National Flood Insurance Program (NFIP) administration. Because much of the region's damaging flooding is driven by localized convective storms, flood impacts may also occur outside mapped SFHAs, particularly along washes, in slot canyons, and downstream of recent burn areas. Reliance on mapped floodplains alone may underestimate risk in areas subject to localized storm-driven flooding.⁵³

Overall, flood risk in southwestern Utah is concentrated along the Virgin River system and other major drainages, as well as in normally dry washes where runoff can rapidly concentrate. In Washington County, the three largest flooding sources, the Virgin River, Santa Clara River, and Fort Pearce Wash, converge in the St. George area near the I-15 corridor, creating a focal point for riverine inundation, wash flows, and stormwater system exceedance during major events. Across Beaver, Garfield, Iron, Kane, and Washington Counties, this same pattern repeats at canyon mouths, alluvial fans, and ephemeral wash networks where steep terrain and short-duration, high-intensity storms can produce fast-moving flows and debris-laden flooding, including downstream of recent burn areas. This location context is used in the following section to describe the magnitude and consequences of flooding across the planning area.

Magnitude and Extent

Flood severity is described using likelihood and intensity. A 1%-annual-chance flood has a 1% chance of being equaled or exceeded in any year; a 0.2%-annual-chance flood has a 0.2% annual chance. These probabilities do not establish a schedule, and multiple events can occur within the nominal return period. Assuming independent annual probabilities, the chance of one or more 1%-annual-chance events during 30 years is approximately 26%.

⁵³ FEMA, Flood Maps; National Weather Service, Flood Related Hazards (flash flooding, dry washes, and post-fire conditions). <https://www.fema.gov/flood-maps> ; <https://www.weather.gov/safety/flood-hazards>.

For planning purposes, the 1%-annual-chance flood provides a consistent benchmark through FEMA FIRMs, Flood Insurance Studies, and Special Flood Hazard Areas. The profile also considers flash flooding, alluvial-fan flooding, drainage exceedance, and post-wildfire runoff that may occur outside mapped Special Flood Hazard Areas.

Extent also considers the range of anticipated flood intensities that may occur in the planning area (e.g., depth, velocity, duration, and debris and sediment load). In southwestern Utah, intensity can range from shallow overland flooding and ponding when stormwater systems are exceeded, to deep and sustained riverine inundation along major channels, to high-velocity, debris-laden flash flooding in washes, slot canyons, and canyon mouths, especially downstream of burn scars.

BEAVER COUNTY

Available FEMA mapping and the county's physical setting indicate that Beaver County's flood hazard is concentrated primarily along discrete river and creek corridors, agricultural bottoms, alluvial channels, normally dry washes, and roadway crossings rather than across broad, contiguous portions of the county. Flood magnitude can nevertheless be substantial at affected locations: rapid snowmelt, rain-on-snow conditions, or short-duration high-intensity rainfall can produce overbank flow, erosion, sediment transport, culvert overtopping, and temporary loss of access, while recently burned slopes in the eastern mountain watersheds can increase runoff and debris-flow potential. Mapped and documented flood-prone areas are generally narrow and dispersed, and a single event would be expected to affect a relatively small share of the county, although local depths and velocities may be damaging.

GARFIELD COUNTY

Garfield County's flood hazard is dominated by high-velocity flash flooding in steep tributaries, narrow canyons, slot canyons, and washes associated with the Sevier, Escalante, and Colorado River drainage systems, with additional exposure at roadway crossings, developed canyon mouths, low-lying valley areas, and watersheds affected by wildfire. Individual inundation areas are commonly narrow, but flood magnitude can be severe where confined topography rapidly concentrates runoff and entrained sediment, leaving little warning and threatening transportation routes, recreation areas, utilities, and isolated communities. During broad monsoonal or frontal storm systems, intense rainfall may affect multiple drainage basins during the same operational period, expanding consequences beyond one channel even though much of the county remains outside the active flood footprint. The countywide distribution of susceptible drainages, canyon environments, and post-fire watersheds supports the potential for severe localized flooding and concurrent impacts across multiple basins.

IRON COUNTY

Iron County is subject to riverine, drainage, and flash flooding generated by snowmelt, intense convective rainfall, and post-wildfire runoff, with exposure concentrated along channels and washes, at canyon mouths and alluvial fans, and across developed valley floors near Cedar City, Enoch, Parowan, and other communities. The county's effective regulatory mapping is based largely on older studies, while

preliminary studies and the ongoing 2022–2028 county mapping project provide improved hydrologic and topographic information; accordingly, mapped Special Flood Hazard Areas alone may not depict the full planning-scale footprint. Recent events illustrate the potential magnitude of localized flooding: July–August 2021 storms repeatedly affected Enoch, Cedar City, and the Parowan area, with reported residential flooding, road inundation, erosion, and substantial property losses.

KANE COUNTY

Kane County's flood magnitude is driven principally by rapid-onset flash flooding in steep watersheds, slot canyons, confined channels, and normally dry washes, together with riverine and drainage flooding along the Virgin and Paria systems and other tributaries. Intense localized rainfall can produce abrupt rises, high velocities, channel erosion, and debris-laden flows that threaten low-water crossings, state and local roads, utilities, developed drainage outlets, and heavily visited recreation areas; post-wildfire runoff can further increase peak flow and sediment loads. Although an individual event's inundation footprint is typically confined to drainage corridors, the county contains an extensive network of susceptible canyons and washes, and a widespread storm can generate concurrent incidents across separate basins, as demonstrated by recurring damaging and fatal flash floods in southern Kane County and canyon settings.

WASHINGTON COUNTY

Washington County has the region's greatest documented flood consequences and the broadest intersection of flood-prone waterways with developed areas. The Virgin and Santa Clara Rivers, Fort Pearce Wash, and numerous tributary and urban wash systems cross or converge near the county's principal population centers, transportation corridors, utilities, and other community lifelines; intense rainfall, rain-on-snow conditions, or post-fire runoff can therefore produce deep riverine inundation, high-velocity wash flows, erosion, sediment deposition, and drainage-system exceedance across multiple jurisdictions during the same event. FEMA-supported Risk MAP work in the Upper Virgin, Fort Pearce, and Escalante Desert watersheds has evaluated numerous stream reaches, and state project documentation reports more than 60 damaging flood events from 1996 through 2020, including seven events exceeding \$1 million in losses and 25 fatalities. This distributed network of studied rivers and washes, the concentration of people and assets along those corridors, and the potential for multi-community impacts indicate that Washington County can experience extensive and high-consequence flooding during major events.

Previous Occurrences

Southwestern Utah has experienced damaging riverine floods, flash floods, post-wildfire runoff, and debris flows. Historical records demonstrate repeated transportation disruption, infrastructure damage, erosion, isolation, and life-safety consequences. In more recent decades, southwestern Utah has experienced some of the most damaging floods in the state, including the January 2005 floods in Washington County, which caused hundreds of millions of dollars in damage and overwhelmed rivers and stormwater systems across the St. George area. Flooding associated with short-duration, high-intensity

storms has repeatedly closed state highways (such as SR-9, SR-12, SR-14, and SR-143), isolated rural communities, and caused fatalities, especially in canyons and burn-scarred landscapes. Post-wildfire flooding and debris flows, notably following the 2017 Brian Head Fire, have further amplified flood risk by increasing runoff and sediment transport. Overall, historical flooding in southwestern Utah reflects a pattern of frequent flash floods with episodic high-consequence events, reinforcing the region's ongoing need for floodplain management, warning systems, and infrastructure adaptation planning.

January 2005: Rain falling on snow contributed to major flooding in southern Utah, including Washington and Kane Counties. High flows and erosion affected the Virgin and Santa Clara River corridors, damaging homes, roads, bridges, utilities, and agricultural lands.

Table 22: Previous Federal Flood-Related Disaster Declarations⁵⁴

Year	Declaration Number	Event Description	Planning-Area Counties Designated
1983	DR-680-UT	Severe storms, landslides, and flooding; declared April 30, 1983.	Beaver, Garfield
1984	DR-720-UT	Severe storms, mudslides, landslides, and flooding; declared August 17, 1984.	None of the five planning-area counties designated.
2005	DR-1576-UT	Severe storms and flooding; incident period January 8–12, 2005; declared February 1, 2005.	Kane, Washington
2005	DR-1598-UT	Flood and landslide; incident period April 28–June 29, 2005. This declaration is separate from the January 2005 floods.	Beaver, Iron, Kane
2011	DR-1955-UT	Severe winter storm and flooding; incident period December 20–24, 2010; declared February 11, 2011.	Garfield, Kane, Washington
2011	DR-4011-UT	Flooding; incident period April 18–July 16, 2011; declared August 8, 2011.	Beaver
2012	DR-4053-UT	Severe storm, November 30–December 1, 2011; declared February 1, 2012. Included for statewide context.	None of the five planning-area counties designated.

⁵⁴ FEMA, OpenFEMA Disaster Declarations Summaries, version 2; Utah records retrieved October 10, 2026. <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2> Table years are declaration years; designated counties reflect FEMA records, not a complete inventory of physical impacts.

Year	Declaration Number	Event Description	Planning-Area Counties Designated
2012	DR-4088-UT	Severe storm and flooding on September 11, 2012; declared November 3, 2012.	Washington

September 14, 2015: Strong thunderstorms produced deadly flash flooding in Hildale and Zion National Park. NOAA records distinguish 20 fatalities in Utah from the combined events and one additional fatality in Arizona. Thirteen people died near Hildale and seven died in Keyhole Canyon in Zion National Park.

2017, Brian Head area: Brian Head Town's May 2025 newsletter documents that flooding destroyed the 5-Mile Picnic Area near Yankee Meadows in 2017.

The National Centers for Environmental Information (NCEI) provides historical data on severe storms and their related or cascading hazards in designated locations. Table 23 provides specific data for Flood and Flash Flood events that caused \$100,000 or greater in damage from 2021 to 2025 in the Five County AOG planning area.

Table 23: NCEI Storm Events Database Flood and Flash Flood Events \$100,000 and Greater for 2021–2025⁵⁵

Date	Event Type	Location	Fatalities	Injuries	Property Damage	Crop Damage
7/14/2021	Flash Flood	Enoch	0	0	\$270,000	\$0
7/14/2021	Flood	St. George	0	0	\$100,000	\$0
7/15/2021	Flash Flood	Lund	0	3	\$1,000,000	\$0
7/25/2021	Flash Flood	Parowan Arpt	0	0	\$100,000	\$0
7/25/2021	Flash Flood	Parowan Arpt	0	0	\$300,000	\$0
7/31/2021	Flash Flood	Enoch	0	0	\$300,000	\$0
8/1/2021	Flash Flood	Enoch	0	0	\$9,000,000	\$0
8/18/2021	Flash Flood	Cedar City	0	0	\$200,000	\$0

⁵⁵ National Centers for Environmental Information (NCEI), "Storm Events Database: Flood and Flash Flood," 2026, <https://www.ncei.noaa.gov/access/storm-events-database>.

Date	Event Type	Location	Fatalities	Injuries	Property Damage	Crop Damage
8/17/2023	Flash Flood	(CDC)Cedar City Arpt	0	0	\$1,000,000	\$0
10/10/2025	Flash Flood	Pine Valley	0	0	\$125,000	\$0

RECENT EVENTS

August 1, 2021, Enoch: A severe rainstorm caused substantial residential flooding and led the city to issue a local emergency declaration.

July 26, 2021, Cedar City: NOAA event 974481 documents flash flooding across roads, including Interstate 15 near milepost 59. The record reports \$0 in property damage, so it is not included in Table 2's selected high-damage events.⁵⁶

Probability of Future Occurrences

Flooding is rated Likely under the Five County AOG probability methodology because damaging flood and flash-flood events recur within the planning area, but the available record does not support an annualized probability for every jurisdiction or location. This regional rating is distinct from the 1% annual chance assigned to a mapped floodplain location.

FEMA flood-hazard probabilities describe the likelihood of flooding at mapped locations and should not be used as the sole basis for a regionwide occurrence rating. Flash flooding, drainage exceedance, and post-wildfire runoff may occur outside mapped floodplains.

Future flood risk may change through both hazard and exposure pathways. More intense precipitation can increase runoff and drainage exceedance, while wildfire can increase post-fire erosion and debris-flow potential. Growth and development can add exposed people and assets or alter runoff where drainage, floodplain, and low-impact-development measures are insufficient. The direction and magnitude of change vary by watershed and storm type.

The plan uses the following probability categories:

- **Highly Likely:** Expected to occur at least once per year, based on the source and period of record identified in the applicable hazard profile.
- **Likely:** Expected to occur more than once in 10 years but less than annually, based on the source and period of record identified in the applicable hazard profile.

⁵⁶ NOAA NCEI Storm Events Database, Utah Flash Flood event 974481, July 26, 2021; details file d2021_c20260323, retrieved October 10, 2026. <https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/>.

- **Occasional:** Expected to occur approximately once in 10 to 100 years, based on the source and period of record identified in the applicable hazard profile.
- **Unlikely:** Expected to occur less often than once in 100 years, or available information is insufficient to support a higher category.

Mapped 1%- and 0.2%-annual-chance flood zones describe flood likelihood at particular locations, not the annual probability of a damaging flood somewhere in the planning area. The regional Likely rating reflects recurring documented Flood and Flash Flood events rather than mapped return periods alone.⁵⁷

Collectively, the documented history of intermittent but impactful floods supports a probability classification of **Likely**, reflecting a hazard that must be planned for regularly but does not affect the region uniformly from year to year. This classification is further supported by the frequency of recent flood and flash flood events documented in the NOAA Storm Events Database.

Vulnerability Assessment

Flood vulnerability varies by flood mechanism, depth, velocity, duration, warning time, sediment and debris load, erosion potential, building characteristics, access, and the location and redundancy of community lifelines. Across the five-county region, exposure is concentrated in mapped and unmapped drainage paths, river and creek corridors, low areas, canyon mouths, alluvial fans, stormwater-constrained developed areas, recreation settings, and watersheds affected by wildfire. The county assessments below are qualitative and identify the people, structures, infrastructure, economic activities, and natural or cultural resources most susceptible to flooding; they do not establish that every asset or municipal area lies within a mapped floodplain.

BEAVER COUNTY

Beaver County and its participating municipalities—Beaver City, Milford, and Minersville—are vulnerable where people and development intersect river and creek corridors, agricultural bottoms, alluvial channels, normally dry washes, and roadway crossings. Flooding may result from rapid snowmelt, rain-on-snow conditions, short-duration high-intensity rainfall, or runoff from recently burned mountain watersheds. Although exposed areas are generally narrow and dispersed, localized water depth, velocity, erosion, and debris can create serious life-safety and property consequences.

Homes, businesses, public buildings, agricultural facilities, and other structures in low-lying areas or near channels may experience inundation, foundation undermining, sediment deposition, and damage to electrical, plumbing, and mechanical systems. Residents and travelers may be exposed at low-water

⁵⁷ FEMA, Guidance for Flood Risk Analysis and Mapping: Riverine Mapping and Floodplain Boundaries, November 2024. Special Flood Hazard Areas use the 1%-annual-chance flood; moderate-hazard areas include the area between the 1% and 0.2% floodplain boundaries.

https://www.fema.gov/sites/default/files/documents/fema_guidance_riverine_mapping_and_floodplain_boundaries_no_v2024.pdf.

crossings or on roads that follow or cross drainages, and rural or dispersed communities may have limited alternate access when a bridge, culvert, or road is closed.

Roads, bridges, culverts, water and wastewater systems, power and communications facilities, and emergency-service access are important sources of vulnerability. Flood-related closures can interrupt agricultural activity, commerce, public services, and travel between communities. Riparian areas, agricultural soils, recreation sites, and historic or cultural resources near waterways may be eroded, buried by sediment, or temporarily inaccessible.

Cascading impacts: Flooding can accelerate channel erosion, slope instability, landslides, and debris flows, particularly on steep, saturated, or recently burned slopes. Sediment and woody debris can block culverts and bridges, redirect flows, and damage downstream roads or utilities. Loss of transportation or communications links can isolate communities, delay emergency response, and interrupt water, wastewater, and power service.

Changes in development: New homes, businesses, roads, and utilities placed in or near floodplains, washes, alluvial channels, or drainage crossings can increase the number and value of exposed assets and may alter runoff if drainage capacity is insufficient. Conversely, floodplain avoidance, preserved conveyance areas, properly sized culverts and detention, elevation or floodproofing, and site-scale runoff controls can limit additional vulnerability. Available regional materials do not establish participant-specific changes in flood-prone development since the prior plan; absence of those records is not a finding of no change.

GARFIELD COUNTY

Garfield County and its participating municipalities—Antimony, Boulder, Bryce Canyon City, Cannonville, Escalante, Hatch, Henrieville, Panguitch, and Tropic—are vulnerable to high-velocity flash flooding in steep tributaries, narrow canyons, slot canyons, washes, developed canyon mouths, and low-lying areas associated with the Sevier, Escalante, and Colorado River drainage systems. Intense rainfall can rapidly concentrate runoff and debris with little warning, while wildfire-affected watersheds can produce increased runoff and sediment. Visitors unfamiliar with local conditions may be especially exposed in canyons and normally dry channels.

Residential, commercial, lodging, public, and agricultural structures near drainages or on low ground may be damaged by inundation, erosion, sediment deposition, and debris impact. The county's dispersed settlement pattern and extensive public lands increase reliance on a limited road network; flooding at crossings or through confined corridors may isolate communities, strand recreation users, and restrict access to emergency services.

State and local roads, bridges, culverts, utilities, communications systems, and visitor-serving facilities are particularly important to community function and the tourism economy. Closures affecting recreation areas, scenic routes, parks, trails, or community gateways can cause business interruption beyond the immediate flood footprint. Riparian habitat, park lands, historic resources, and cultural sites near channels may be altered by erosion, channel migration, and sediment or debris deposition.

Cascading impacts: Flooding can trigger rockfall, landslides, bank failure, and debris flows on steep or fire-affected slopes. Sediment and woody debris may plug drainage structures, overtop roads, redirect water into developed areas, and damage downstream water or wastewater facilities. Concurrent incidents in separate basins can stretch search-and-rescue capacity, close multiple access routes, and disrupt tourism and supply movement across the county.

Changes in development: Additional development at canyon mouths, along valley bottoms, near washes, or beside constrained transportation corridors can increase exposure and place more demand on drainage and emergency-access systems. Growth in visitor facilities and recreation use can also increase the number of people present in flash-flood settings. Avoidance of active channels, preservation of natural conveyance, drainage improvements, flood-resistant design, warning systems, and redundant access can reduce added vulnerability. Available regional materials do not establish participant-specific changes in flood-prone development since the prior plan.

IRON COUNTY

Iron County and its participating municipalities—Brian Head, Cedar City, Enoch, Paragonah, and Parowan—are vulnerable to riverine, drainage, and flash flooding along channels and washes, at canyon mouths and alluvial fans, and across developed valley floors. Snowmelt, intense convective rainfall, and post-wildfire runoff can produce rapid surface flow, ponding, erosion, and debris-laden flooding. The July–August 2021 events in Enoch, Cedar City, and the Parowan area demonstrate that repeated storms can affect homes, roads, and multiple communities within a short period.

Homes, businesses, public buildings, and other structures may be exposed where development occupies low-lying areas, drainage paths, alluvial fans, or locations where stormwater capacity can be exceeded. Floodwater can damage contents and building systems, erode supporting soils, and deposit sediment. Residents may be displaced, and people traveling through flooded roadways or recreating in canyons and mountain drainages may face fast-moving water with limited warning.

Roads, Interstate 15 connections, bridges, culverts, drainage facilities, water and wastewater systems, power, communications, schools, and emergency facilities are central to countywide vulnerability. Damage or closure can delay response and interrupt services across a larger area than the inundation footprint. Business interruption, cleanup costs, and reduced access to recreation and tourism destinations can compound direct property losses; natural and cultural resources may also be affected by erosion and sedimentation.

Cascading impacts: Flooding can mobilize sediment and debris, undermine roads and utilities, destabilize slopes, and initiate debris flows or landslides, especially below burn scars such as those in the Brian Head area. Blocked culverts or channels can redirect water into neighborhoods or across transportation corridors. Infrastructure damage can interrupt water, wastewater, power, and communications service and can isolate communities or delay emergency response.

Changes in development: Continued growth on valley floors and near washes, drainage corridors, canyon outlets, and alluvial fans can increase exposed population and property and can increase runoff

where impervious cover is added without adequate detention or conveyance. Up-to-date mapping, preserved drainage corridors, site-specific hydrologic review, properly designed stormwater systems, elevation or floodproofing, and redundant access can limit added risk. Available materials identify improved mapping efforts but do not establish participant-specific changes in flood-prone development since the prior plan.

KANE COUNTY

Kane County and its participating municipalities—Alton, Big Water, Glendale, Kanab, and Orderville—are vulnerable to rapid-onset flash flooding in steep watersheds, slot canyons, confined channels, and normally dry washes, as well as riverine and drainage flooding along the Virgin and Paria systems and other tributaries. Intense localized rainfall can generate abrupt rises, high velocities, erosion, and debris-laden flow. Residents, motorists, and the large number of recreation users in canyon settings may have little warning and limited escape options.

Homes, businesses, public buildings, visitor facilities, and other structures near washes, drainage outlets, river corridors, and canyon mouths may experience inundation, foundation erosion, debris impact, and sediment deposition. Rural and dispersed communities can be especially vulnerable when a single road or low-water crossing provides primary access. Flash flooding can also strand visitors in remote locations and create extensive search-and-rescue demands.

State and local roads, bridges, culverts, utilities, communications, water and wastewater systems, and recreation infrastructure support both residents and the visitor economy. Damage or closures may interrupt emergency access, commerce, park and recreation activity, and travel between communities. Riparian corridors, park lands, historic properties, and cultural resources near channels may be eroded, buried, or made inaccessible.

Cascading impacts: Flooding can trigger bank failure, rockfall, landslides, and debris flows and can move sediment or woody debris into culverts, bridges, and channels. Obstructions may back up or redirect water, damage roads and utilities, and create additional downstream hazards. Simultaneous incidents in separate canyons or basins can strain warning, rescue, transportation, and communications resources and prolong isolation of affected areas.

Changes in development: Development near washes, canyon mouths, river corridors, low-water crossings, or constrained drainage outlets can increase exposure and place more people in rapid-onset flood settings. Increased recreation use can similarly increase transient exposure even without permanent construction. Floodplain and wash avoidance, protected conveyance, drainage improvements, warning and closure procedures, flood-resistant design, and redundant access can reduce added vulnerability. Available regional materials do not establish participant-specific changes in flood-prone development since the prior plan.

WASHINGTON COUNTY

Washington County and its participating municipalities—Apple Valley, Enterprise, Hildale, Hurricane, Ivins, La Verkin, Leeds, New Harmony, Rockville, Santa Clara, Springdale, St. George, Toquerville, Virgin, and Washington City—have the region’s broadest intersection of flood-prone waterways with developed areas. The Virgin and Santa Clara Rivers, Fort Pearce Wash, and numerous tributary and urban wash systems cross or converge near population centers, transportation corridors, utilities, and recreation destinations. Riverine flooding, high-velocity wash flow, drainage-system exceedance, and post-fire runoff can affect multiple jurisdictions during the same event.

Residents, visitors, homes, businesses, public buildings, and community facilities are vulnerable in river corridors, washes, low areas, canyon outlets, and locations where drainage capacity is exceeded. The January 2005 floods and the fatal September 2015 flash floods demonstrate both major property consequences and severe life-safety risk in developed river corridors, normally dry channels, and confined recreation settings. Flooding can displace households, damage building systems and foundations, and restrict access to emergency services.

Interstate and local transportation routes, bridges, culverts, stormwater systems, water and wastewater facilities, power, communications, schools, public-safety facilities, and other community lifelines face direct damage and loss-of-access risk. Because the county’s economy depends heavily on tourism, recreation, construction, and interconnected urban services, closures or utility disruptions can cause losses well beyond the flooded area. Riparian habitat, parks, trails, historic resources, and cultural sites may be altered by erosion, channel migration, sediment, and debris.

Cascading impacts: Flooding can erode banks and slopes, trigger debris flows or landslides, and mobilize sediment and woody debris that obstruct bridges, culverts, and urban drainage systems. Redirected flow can expand inundation into developed areas, while damage to roads, utilities, and communications can delay emergency response and interrupt regional services. Concurrent impacts along the Virgin River system, Santa Clara River, Fort Pearce Wash, and tributary washes can compound evacuation, sheltering, transportation, public-health, and economic consequences.

Changes in development: Continued population and economic growth can increase the number and value of assets near rivers and washes and can increase runoff where impervious surfaces expand without adequate stormwater controls. Redevelopment and new construction can reduce vulnerability when they avoid floodways and active washes, preserve conveyance, incorporate detention and low-impact-development practices, elevate or floodproof structures, and maintain redundant access. Available regional materials do not establish participant-specific changes in flood-prone development since the prior plan, so the direction and magnitude of development-related change should be confirmed through local permitting, mapping, and capital-improvement records.

National Flood Insurance Program (NFIP) Participation

The NFIP provides federally backed flood insurance in participating communities and requires adoption and enforcement of minimum floodplain-management standards. Table 3 summarizes each jurisdiction's reported NFIP participation status, community identification number, program date, map information, Community Rating System class, policies in force, coverage, claims, and repetitive-loss entries.

Repetitive-loss properties are NFIP-insured properties that have experienced repeated flood losses, while severe-repetitive-loss properties meet higher statutory thresholds for the number and value of claims. The repetitive-loss column in Table 3 identifies the reported entries available for the listed jurisdictions and should be considered together with local flood histories, claims experience, and current FEMA records when prioritizing mitigation activities.

Table 24: NFIP Jurisdictional Inventory⁵⁸

Jurisdiction	NFIP Participation / Community ID / Program Date	Map / CRS Class	Policy Count	Coverage	Claims	Repetitive Loss
Beaver County	Participating Community ID: 490001 Program date: 09/18/87	(All Zone D) CRS Class: Not listed	-	-	0	-
Beaver City	Non-participating Community ID: 490002	04/01/77 CRS Class: Not listed	-	-	-	-
Milford	Participating Community ID: 490003 Program date: 02/02/84	(NSFHA) CRS Class: Not listed	-	-	-	-
Minersville	Not listed in supplied Community Status Book	Not listed in supplied Community Status Book	-	-	-	-
Garfield County	Participating Community ID:	08/05/86(M) CRS Class: Not listed	22	\$3,648,000	2	0

⁵⁸ Source: community-status and policy/claims inventory reproduced in the supplied plan component. The extract date, policy/claims source, and as-of dates are not recorded and could not be independently verified. Values are retained only as an undated planning inventory, not current counts. Blank cells indicate unavailable data, not zero; "not listed" does not establish nonparticipation. Repetitive-loss entries do not provide property types or severe-repetitive-loss counts.

Jurisdiction	NFIP Participation / Community ID / Program Date	Map / CRS Class	Policy Count	Coverage	Claims	Repetitive Loss
	490065 Program date: 08/05/86					
Antimony	Non-participating Community ID: 490066	04/02/76 CRS Class: Not listed	-	-	-	-
Boulder	Not listed in supplied Community Status Book	Not listed in supplied Community Status Book	-	-	-	-
Bryce Canyon City	Not listed in supplied Community Status Book	Not listed in supplied Community Status Book	-	-	-	-
Cannonville	Not listed in supplied Community Status Book	Not listed in supplied Community Status Book	-	-	-	-
Escalante	Participating Community ID: 490067 Program date: 08/28/79	08/28/79(M) CRS Class: Not listed	-	-	-	-
Hatch	Participating Community ID: 490068 Program date: 07/24/79	07/24/79(M) CRS Class: Not listed	1	\$250,000	-	-
Henrieville	Participating Community ID: 490069 Program date: 09/25/79	09/28/79(M) CRS Class: Not listed	-	-	-	-
Panguitch	Participating Community ID: 490070 Program date: 08/28/79	08/28/79(M) CRS Class: Not listed	6	\$1,288,000	-	-
Tropic	Participating Community ID:	12/04/79(M) CRS Class: Not listed	1	\$252,000	-	-

Jurisdiction	NFIP Participation / Community ID / Program Date	Map / CRS Class	Policy Count	Coverage	Claims	Repetitive Loss
	490071 Program date: 12/04/79					
Iron County	Participating Community ID: 490073 Program date: 07/17/86	07/17/86(M) CRS Class: Not listed	55	\$25,939,000	11	2
Brian Head	Not listed in supplied Community Status Book	Not listed in supplied Community Status Book	-	-	-	-
Cedar City	Participating Community ID: 490074 Program date: 10/16/84	10/16/84 CRS Class: 10	15	\$10,939,000	4	-
Enoch	Participating Community ID: 490035 Program date: 11/01/21(E)	No currently effective map date listed CRS Class: Not listed	-	-	-	-
Kanarraville	Participating Community ID: 490077 Program date: 12/11/85	(NSFHA) CRS Class: Not listed	1	\$350,000	0	-
Paragonah	Participating Community ID: 490075 Program date: 09/24/84	06/02/05 CRS Class: Not listed	2	\$618,000	0	-
Parowan	Participating Community ID: 490076 Program date: 03/18/86	03/18/86(M) CRS Class: Not listed	3	\$2,195,000	1	-
Kane County	Participating Community ID: 490083 Program date: 07/01/86	07/01/86(L) CRS Class: Not listed	18	\$5,619,000	5	0

Jurisdiction	NFIP Participation / Community ID / Program Date	Map / CRS Class	Policy Count	Coverage	Claims	Repetitive Loss
Alton	Participating Community ID: 490243 Program date: 07/10/85	(NSFHA) CRS Class: Not listed	-	-	-	-
Big Water	Not listed in supplied Community Status Book	Not listed in supplied Community Status Book	-	-	-	-
Glendale	Participating Community ID: 490084 Program date: 05/01/86	05/01/86(L) CRS Class: Not listed	3	\$562,000	0	-
Kanab	Participating Community ID: 490085 Program date: 08/19/85	08/19/85(M) CRS Class: Not listed	12	\$4,395,000	3	-
Orderville	Participating Community ID: 490086 Program date: 02/02/84	No currently effective map date listed CRS Class: Not listed	-	-	-	-
Washington County	Participating Community ID: 490224 Program date: 03/18/86	04/02/09 CRS Class: Not listed	37	\$8,311,000	19	3
Apple Valley	Participating Community ID: 490026 Program date: 09/24/12	04/02/09 CRS Class: Not listed	6	\$1,589,000	0	-
Enterprise	Participating Community ID: 490169 Program date: 04/01/87	04/02/09 CRS Class: Not listed	5	\$600,000	0	-
Hildale	Participating Community ID: 490171 Program date: 09/02/16	04/02/09 CRS Class: Not listed	14	\$2,602,000	0	-

Jurisdiction	NFIP Participation / Community ID / Program Date	Map / CRS Class	Policy Count	Coverage	Claims	Repetitive Loss
Hurricane	Participating Community ID: 490172 Program date: 02/02/84	04/02/09 CRS Class: Not listed	27	\$7,213,000	2	-
Ivins	Participating Community ID: 490173 Program date: 08/23/82	04/02/09 CRS Class: Not listed	23	\$7,479,000	6	-
La Verkin	Participating Community ID: 490174 Program date: 02/02/84	04/02/09 CRS Class: Not listed	2	\$841,000	1	-
Leeds	Participating Community ID: 490175 Program date: 02/02/84	04/02/09 CRS Class: Not listed	1	\$250,000	1	-
New Harmony	Participating Community ID: 490004 Program date: 03/05/10	04/02/09 CRS Class: Not listed	7	\$1,618,000	1	-
Rockville	Participating Community ID: 490176 Program date: 12/10/09	04/02/09 CRS Class: Not listed	4	\$347,000	0	-
St. George	Participating Community ID: 490177 Program date: 08/19/87	04/02/09 CRS Class: 6	106	\$35,988,000	26	-
Santa Clara	Participating Community ID: 490178 Program date: 08/05/86	04/02/09 CRS Class: 10	6	\$1,750,000	2	-
Springdale	Participating Community ID: 490179 Program date: 04/17/09	04/02/09 CRS Class: Not listed	9	\$3,463,000	1	-

Jurisdiction	NFIP Participation / Community ID / Program Date	Map / CRS Class	Policy Count	Coverage	Claims	Repetitive Loss
Toquerville	Participating Community ID: 490180 Program date: 02/19/86	04/02/09 CRS Class: Not listed	5	\$980,000	1	-
Virgin	Participating Community ID: 490181 Program date: 08/05/86	04/02/09(M) CRS Class: Not listed	7	\$2,210,000	0	-
Washington City	Participating Community ID: 490182 Program date: 07/01/87	04/02/09 CRS Class: Not listed	29	\$7,941,000	3	-

Table 24 retains the supplied NFIP participation, policy, coverage, claims, and repetitive-loss entries. Hyphens indicate that no value is provided in the source table, not zero. A community not listed in the supplied Community Status Book is not automatically classified as nonparticipating.

Hail

Hail is a form of frozen precipitation produced by strong thunderstorm updrafts. Hailstones grow as supercooled water freezes onto ice embryos and may range from pea-sized stones to much larger damaging hail. NWS generally considers hail severe when hailstones reach 1 inch or greater in diameter.

In the five-county region, hail commonly occurs during the spring and summer months when daytime surface heating, frontal systems, and monsoonal moisture contribute to thunderstorm development. The complex topography of southwestern and south-central Utah can enhance atmospheric instability and support strong storm updrafts capable of producing hail. While much of the region is semi-arid, isolated but intense thunderstorms frequently generate small to moderate hailstones, and occasionally severe storms produce hail large enough to damage roofs, vehicles, crops, outdoor equipment, and critical facilities.

Hail occurrence varies across the planning area; however, differences in population, development, reporting density, and observation coverage limit direct comparisons among counties. Event counts alone do not establish relative risk because exposed assets and documented impacts also influence potential losses.

Location

Hail risk within the five-county planning area varies geographically and is influenced by differences in storm frequency, terrain-enhanced convection, population exposure, and reporting density. Analysis of NOAA Storm Events Database records, FEMA's NRI annualized frequency data, and regional climatology from the NOAA Storm Prediction Center indicates that hail incidence and potential impacts are not evenly distributed across the region.

Available hail reports indicate that Washington and Iron Counties have among the greatest documented exposure to hail impacts; however, differences in reporting density, population, development, and observation coverage complicate direct county-to-county comparisons. These reporting limitations prevent a definitive county risk ranking from event counts alone.

Garfield and Beaver Counties experience a moderate hail risk. In Garfield County, hail events are commonly associated with high-elevation thunderstorms over plateaus and mountainous terrain. While events are often localized, some storms have produced large hail, potentially impacting transportation routes, recreation areas, and infrastructure. Beaver County also experiences intermittent hail events, including occasional large hail. Although reporting density is lower than in more populated counties, confirmed severe hail occurrences have been documented, and agricultural assets and major transportation corridors remain vulnerable during severe storms.

Kane County has the lowest relative hail risk among the five counties. Historical records indicate fewer documented hail events over multi-year periods. Storms in Kane County tend to be more isolated and terrain-driven, with less frequent severe hail occurrences. Lower population density and limited infrastructure concentration reduce overall exposure and potential losses compared to other counties in the planning area.

Magnitude and Extent

The TORRO Hailstorm Intensity Scale is a standardized framework developed by the Tornado and Storm Research Organisation (TORRO) to classify hailstorms based on hailstone size, associated kinetic energy, and observed damage impacts. The scale ranges from H0 (non-damaging, pea-sized hail) to H10 (super hailstorms producing hailstones greater than 100 mm in diameter), providing a consistent method for assessing hail severity and potential risk to life and property. By linking physical measurements of hailstones to typical damage outcomes, the TORRO scale supports post-event analysis, improves hazard communication, and aids emergency management and risk mitigation planning for severe convective storms.

Table 25 summarizes the TORRO Hailstorm Intensity Scale, including intensity categories, typical hail diameters, probable kinetic energy, and damage impacts. Categories range from H0 (Hard hail, with no damage) to H10 (Super Hailstorms, with extensive structural damage and potentially fatal injuries to people caught outdoors).

Table 25: TORRO Hailstorm Intensity Scale⁵⁹

Scale	Intensity Category	Typical Hail Diameter (mm)	Probable Kinetic Energy (J m ⁻²)	Typical Damage Impacts
H0	Hard hail	5	0–20	No damage
H1	Potentially damaging	5–15	> 20	Slight general damage to plants, crops
H2	Significant	10–20	> 100	Significant damage to fruit, crops, and vegetation
H3	Severe	20–30	> 300	Severe damage to fruit and crops, damage to glass and plastic structures, and paint and wood scored
H4	Severe	25–40	> 500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30–50	> 800	Wholesale destruction of glass, damage to tiled roofs, and significant risks of injuries
H6	Destructive	40–60	*	Bodywork of grounded aircraft dented; brick walls pitted
H7	Destructive	50–75	*	Severe roof damage, risk of serious injuries
H8	Destructive	60–90	*	Severe damage to the aircraft's bodywork
H9	Super Hailstorms	75–100	*	Extensive structural damage. Risk of severe or even fatal injuries to people caught in the open
H10	Super Hailstorms	> 100	*	Extensive structural damage. Risk of severe or even fatal injuries to people caught in the open

*Kinetic-energy values are not provided by TORRO for H6 through H10. Hail diameter ranges are approximate; hailstone number, density, fall speed, and surface winds also affect severity.

Table 26 outlines the National Weather Service Melbourne office's hail threat levels. These forecast threat descriptions illustrate hail severity and are not the plan's long-term probability categories.

⁵⁹ The Tornado and Storm Research Organisation, "The TORRO Hailstorm Intensity Scale," 2026, <https://www.torro.org.uk/research/hail/hscale>.

Table 26: National Weather Service Hail Damage-Threat Categories

Damage-Threat Category	National Weather Service Hail Criterion
Base	Hail at least 1.00 inch in diameter (approximately quarter-sized). This is the baseline hail criterion for a Severe Thunderstorm Warning.
Considerable	Hail at least 1.75 inches in diameter (approximately golf ball-sized). Warnings meeting this threshold may include a “considerable” damage-threat tag.
Destructive	Hail at least 2.75 inches in diameter (approximately baseball-sized). Warnings meeting this threshold may include a “destructive” damage-threat tag and trigger a Wireless Emergency Alert.

Previous Occurrences

NOAA Storm Events records document recurring hail events throughout the five-county planning area. Historical records indicate that hail is a recurring hazard across southwestern Utah, although the frequency, size, and reported impacts vary by county and by storm season. In the five-county planning area, documented hail events are most often associated with spring and summer thunderstorms and tend to be localized, affecting specific communities, transportation corridors, agricultural areas, and outdoor assets rather than the entire region at once. The following discussion summarizes disaster declaration history and recorded hail events to illustrate the pattern of past occurrence across Beaver, Iron, Kane, Garfield, and Washington Counties and to provide context for evaluating future hail risk.

DISASTER DECLARATION HISTORY

FEDERAL DISASTER DECLARATIONS

The reviewed OpenFEMA Utah declaration records identify no declaration explicitly titled for hail with a designated county in the five-county planning area. DR-1285-UT, titled Tornado, Severe Thunderstorms, and Hail, designated Salt Lake County, outside the planning area. Declaration titles do not provide a complete inventory of hail occurring during severe storms.⁶⁰

STATE DISASTER PROCLAMATIONS

State emergency declarations may address broader severe-weather impacts and are not used as an inventory of hail occurrence. This profile evaluates hail recurrence using observed hail reports rather than inferring occurrence or absence from state proclamation titles.

⁶⁰ FEMA, OpenFEMA Disaster Declarations Summaries, version 2, Utah records retrieved October 10, 2026, <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2>.

NCEI EVENTS

Table 27 lists 17 NCEI hail event records on 14 distinct calendar dates during 2021–2025, filtered to the five counties and reported diameters of at least 1 inch. Reported property damage totals \$80,000, with no reported crop damage, injuries, or deaths. The three June 21, 2024, Glen Canyon entries are separate database observations: Event 1196872 at Ice Cream Canyon, Event 1196873 at Lone Rock Beach, and Event 1196875 at Amangiri Resort.

Table 27: NCEI Storm Events Database Hail Records, Diameter at Least 1 Inch, 2021–2025

Date	Event Type	Location	Magnitude (inches)	Fatalities	Injuries	Property Damage	Crop Damage
7/14/2021	Hail	Enoch	1.00	0	0	\$0	\$0
7/22/2021	Hail	Bryce Canyon	1.50	0	0	\$0	\$0
7/24/2021	Hail	Veyo	1.00	0	0	\$0	\$0
7/29/2021	Hail	Beaver	1.25	0	0	\$0	\$0
8/1/2021	Hail	Enoch	1.00	0	0	\$0	\$0
8/14/2021	Hail	St. George Regional Airport (SGU)	1.00	0	0	\$0	\$0
8/17/2021	Hail	Beaver	2.00	0	0	\$20,000	\$0
8/21/2022	Hail	Enterprise Municipal Airport	1.50	0	0	\$0	\$0
8/22/2022	Hail	Washington	1.00	0	0	\$0	\$0
10/1/2022	Hail	Boulder	1.75	0	0	\$7,500	\$0
10/2/2022	Hail	Boulder	1.00	0	0	\$0	\$0
10/2/2022	Hail	Cedar City Regional Airport (CDC)	1.50	0	0	\$40,000	\$0
6/15/2023	Hail	Beryl Junction	1.00	0	0	\$0	\$0
9/13/2023	Hail	Rockville	1.00	0	0	\$7,500	\$0
6/21/2024	Hail	Glen Canyon / Ice Cream Canyon	1.75	0	0	\$5,000	\$0
6/21/2024	Hail	Glen Canyon / Lone Rock Beach	1.75	0	0	\$0	\$0

Date	Event Type	Location	Magnitude (inches)	Fatalities	Injuries	Property Damage	Crop Damage
6/21/2024	Hail	Glen Canyon / Amangiri Resort	1.75	0	0	\$0	\$0

Table 28 provides recent hailstorm event and impacts data for southwest Utah (2023–2025), as reported by the commercial hail-mapping service Hail Point, and includes dates, locations, hail sizes, and estimated exposure. These supplemental estimates are not verified damage counts and are not directly interchangeable with NCEI point observations.

Table 28: Key Storm Events and Impacts (Southwest Utah, 2023–2025)⁶¹

Date and Location	Hail Size (Inches)	Estimated Homes Affected	Notes
Oct. 10, 2025 – St. George, Utah	1.75	Approximately 314 homes	Population of 759 reported for the affected area.
Oct. 18, 2024 – St. George, Utah	1.25	Approximately 719 homes	Population of 1,939 reported for the affected area.
Sep. 13, 2023 – St. George, Utah	1.50	Approximately 115 homes	Commercial estimate: population of 1,008 reported for the modeled affected area. NCEI separately reports 1.00-inch hail at Rockville on this date

Probability of Future Occurrences

Hail is rated Highly Likely for occurrence somewhere in the five-county region, consistent with the plan’s annual-or-more-frequent category. The reviewed 2021–2025 NCEI records contain hail of at least 1 inch on 14 distinct calendar dates. This regional classification does not mean that each jurisdiction or property experiences damaging hail annually.

The 2021–2025 NOAA record confirms that hail-producing thunderstorms recur across the planning area, although individual events are localized and do not affect every county or jurisdiction each year. This documented regional recurrence supports the plan’s Highly Likely rating without implying annual hail impacts at any specific location.

Although much of southern Utah is characterized by a semi-arid climate, seasonal weather conditions, particularly during the spring and summer months, support the development of severe thunderstorms

⁶¹ Hail Point, Hail Maps—St. George, Utah, entries dated September 13, 2023, October 18, 2024, and October 10, 2025, retrieved October 10, 2026. Reported estimated homes: 115, 719, 314; estimated population: 1,008, 1,939, 759, respectively. <https://www.hailpoint.com/hail-maps-St-George--UT>.

capable of producing hail. These storms are often associated with frontal passages, daytime heating, and monsoonal moisture influxes, which can generate strong updrafts necessary for hail formation.⁶² As a result, hail events will likely remain a recurring seasonal hazard across the five-county planning area.

Future hail risk is expected to persist as development continues in areas exposed to severe weather and as existing buildings, infrastructure, and agricultural assets remain vulnerable to hail damage. Residential structures, vehicles, roofing materials, crops, and critical facilities may experience repeated impacts, even from relatively small hail events. While climate variability may influence storm intensity or frequency, the historical record supports the conclusion that hail-producing storms will continue to affect the planning area at a level sufficient to warrant ongoing consideration.

Overall, the probability of future hail occurrence in the Five County AOG planning area is Highly Likely, based on documented recurring hail events across Beaver, Iron, Kane, Garfield, and Washington Counties and continued exposure to seasonal convective thunderstorms. Population growth and development affect exposure and potential consequences, rather than establishing a higher probability of hail occurrence.

Factors such as population growth and increased development are expected to increase hail risk by expanding the number and concentration of people, structures, vehicles, and infrastructure exposed to hail-prone weather conditions. As development continues across the five counties, potential property damage, economic losses, and social disruptions from future hail events are expected to increase.

Future hail exposure may increase as population, housing, vehicles, infrastructure, agricultural assets, and economic activity continue to grow in hail-prone areas. The available scientific literature does not support a precise county-level projection of future hail frequency; therefore, this profile emphasizes increasing exposure and consequence rather than a quantified change in hail occurrence.

Vulnerability Assessment

The vulnerability assessment evaluates how hail may affect people, housing, public facilities, critical infrastructure, transportation systems, agricultural assets, and economic activity across Beaver, Iron, Kane, Garfield, and Washington Counties. This section considers differences in population, development patterns, land use, and documented storm activity to identify where exposure is greatest and which assets are most susceptible to damage, service disruption, and economic loss from future hail events. Although hail impacts are often localized, even short-duration storms can produce costly damage to roofs, vehicles, crops, utilities, and outdoor equipment, making vulnerability highly dependent on both the location of assets and the severity of individual events.

⁶² National Oceanic and Atmospheric Administration, "Thunderstorms Hazards-Hail," <https://www.noaa.gov/jetstream/hail>.

BEAVER COUNTY

Beaver County's hail vulnerability is driven less by population density than by the exposure of agricultural assets, transportation corridors, public facilities, and scattered rural development to severe convective storms. Historical storm reports document at least two recent hail events in the Beaver area, including a 1.25-inch hail event on July 29, 2021, and a 2.00-inch hail event on August 17, 2021, confirming that the county is susceptible to damaging hail capable of affecting structures, vehicles, crops, and outdoor equipment. Because Beaver County is geographically large and sparsely populated, reported events likely underrepresent actual hail occurrence, particularly in outlying agricultural and rangeland areas. Lower documented frequency does not necessarily indicate lower hazard potential.

The county's most vulnerable assets include irrigated cropland, hay and alfalfa production, pasture and livestock operations, farm structures, vehicles, utility infrastructure, and buildings in and around Beaver, Minersville, Milford, and other developed areas. Hail can damage roofing, siding, windows, solar equipment, and HVAC units, but in Beaver County the greatest relative losses may occur in agriculture, where a single storm during the growing season can reduce forage yields, bruise or shred crops, damage fencing and pivots, and increase costs for producers already operating under drought and water-supply constraints. Publicly owned facilities, schools, emergency service buildings, and transportation-dependent services are also vulnerable because damage to roofs, fleet vehicles, communications equipment, or maintenance yards can interrupt service delivery. Interstate 15, State Route 21, and other county roads create additional exposure because hail can rapidly reduce visibility, create hazardous driving conditions, and damage vehicles traveling through the county.

Owner-occupied homes in Beaver County have a median value of about \$283,700.⁶³ This indicator demonstrates that, although Beaver County has fewer structures and residents than more urban counties, it still has a meaningful concentration of exposed residential, agricultural, and infrastructure assets that support a moderate countywide hail vulnerability with higher localized risk in developed and irrigated agricultural areas.

Estimated vulnerable assets in Beaver County that may be exposed to hail include the following:

- Approximately 7,301 residents who may be exposed directly or indirectly through property damage, travel disruption, or service interruption.
- About 3,067 housing units that may be vulnerable to roof, siding, window, and skylight damage.⁶⁴

⁶³ U.S. Census Bureau, "QuickFacts: Beaver County, Utah," 2026, <https://www.census.gov/quickfacts/fact/table/beavercountyutah/INC110224>; U.S. Department of Agriculture, "2022 Census of Agriculture County Profile-Beaver County Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49001.pdf.

⁶⁴ U.S. Census Bureau, "QuickFacts: Beaver County, Utah," 2026, <https://www.census.gov/quickfacts/fact/table/beavercountyutah/INC110224>.

- An estimated 267 farms and ranch operations with exposure to crop loss, damaged fencing, pivots, barns, sheds, and agricultural equipment.⁶⁵
- Approximately 119,496 acres of land in farms, including 26,787 irrigated acres and more than 20,800 acres of forage production that are susceptible to hail damage during the growing season.⁶⁶
- Public buildings, schools, emergency service facilities, and utility assets in and around Beaver, Milford, Minersville, and other developed areas.
- Major transportation assets, including Interstate 15, State Route 21, local roads, fleet vehicles, and privately owned vehicles exposed to hail-related damage and hazardous travel conditions.
- Outdoor infrastructure and equipment such as HVAC units, solar installations, communications equipment, maintenance yards, and other exposed county and private assets.

Overall, Beaver County has a moderate hail vulnerability with localized areas of elevated risk where agricultural production, exposed infrastructure, and concentrated community assets coincide. Vulnerability is heightened by limited warning time, the dispersed nature of development, longer repair and replacement timelines in rural areas, and the county's dependence on weather-sensitive economic sectors. Beaver County's vulnerability is best understood as a combination of exposure, sensitivity, and recovery capacity: while the total number of exposed structures is lower than in more urban counties, the functional importance of individual assets and the potential for disproportionate economic disruption make hail a meaningful hazard for Beaver County.

In Beaver County, the most likely hail impacts include damage to roofs, siding, windows, skylights, vehicles, and outdoor equipment; crop and forage losses; injury to livestock and people caught outdoors; and temporary disruption to transportation and public services. Hail occurring during late spring and summer can be especially damaging because it coincides with the active growing season and peak use of outdoor infrastructure and road networks. Even when structural damage is limited, repeated smaller hail events can shorten the useful life of roofing materials, solar panels, and agricultural equipment, increasing maintenance and replacement costs over time. Because the county relies on agriculture, trucking, public infrastructure, and dispersed service delivery, hail impacts may be felt through direct property damage as well as indirect business interruption, reduced agricultural productivity, emergency response demands, and short-term road safety hazards.

Cascading impacts: Hail in Beaver County can produce several cascading impacts that extend beyond the initial storm damage. Crop losses may reduce seasonal farm income, strain livestock feed supplies, and increase operating costs for agricultural producers. Damage to power lines, communications equipment, or public facilities can temporarily interrupt essential services, while roof and vehicle damage may delay emergency response, inspections, and routine government operations. On major transportation routes, hail can trigger vehicle accidents or temporary traffic disruptions that affect commuting, freight movement, and access to regional services. In a rural county with limited local repair capacity, even

⁶⁵ U.S. Department of Agriculture, "2022 Census of Agriculture County Profile-Beaver County Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49001.pdf.

⁶⁶ U.S. Department of Agriculture, "2022 Census of Agriculture County Profile-Beaver County Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49001.pdf.

moderate hail events can create extended recovery periods, higher insurance and out-of-pocket costs, and compounding financial stress for households, ranchers, and businesses. These secondary effects reinforce the need for mitigation actions such as impact-resistant roofing and siding, protection of critical outdoor equipment, improved warning dissemination, and continuity planning for county facilities and essential services.

Changes in development: Continued residential, commercial, energy, and transportation development in and around Beaver, Milford, Minersville, and the Interstate 15 corridor will increase the number and value of structures, vehicles, utilities, and outdoor systems exposed to hail. Expansion of irrigated agriculture, solar installations, and other weather-sensitive facilities may also increase potential losses even if the frequency of hail does not change. Applying current building codes, impact-resistant roofing and glazing, protected equipment siting, covered fleet or equipment storage, and resilient utility design to new development can limit the growth in vulnerability. Development review should therefore consider hail-resistant materials and continuity needs for critical facilities while recognizing that growth changes exposure and consequences, not the underlying probability of hail occurrence.

GARFIELD COUNTY

Garfield County's hail vulnerability is shaped by its dispersed rural settlement pattern, high-elevation thunderstorm environment, reliance on tourism and transportation access, and the exposure of agricultural and community assets across a very large geographic area. Recent hail reports in the county confirm that Garfield County is susceptible to damaging hail, including a 1.50-inch event near Bryce Canyon on July 22, 2021, a 0.88-inch event near Ruby's Inn on August 17, 2021, and a 1.75-inch event near Boulder on October 1, 2022. These events demonstrate that hail in Garfield County can affect developed areas, visitor-serving destinations, highways, and agricultural lands, even when storms are localized. Because the county is sparsely populated and includes extensive remote terrain, documented hail frequency likely understates the full extent of exposure in outlying communities and along travel corridors.

The county's most vulnerable assets include homes and public buildings in Panguitch, Escalante, Boulder, Tropic, Cannonville, Hatch, and other small communities; tourism-related businesses and lodging facilities near Bryce Canyon National Park and along Scenic Byway 12; agricultural lands and livestock operations; utility infrastructure; and vehicles traveling on U.S. Highway 89, Scenic Byway 12, and other local roads. In Garfield County, hail vulnerability is heightened by the importance of visitor access and the economic role of recreation and tourism. Hail can damage roofs, windows, vehicles, solar equipment, signage, and outdoor recreation infrastructure, while also creating hazardous driving conditions and reducing access to parks, lodging, campgrounds, and small business districts. Agricultural producers are also vulnerable because hail during the growing season can damage forage, crops, fencing, and equipment, increasing costs in a county with limited local repair and replacement capacity.

Owner-occupied homes in Garfield County have a median value of about \$318,100.⁶⁷ In addition, Garfield County's economy includes a substantial visitor-serving sector, with accommodation and food service sales exceeding \$59 million, reflecting the importance of lodging, dining, and tourism-related assets that may be disrupted by severe hail.⁶⁸ These indicators show that, although Garfield County has a relatively small permanent population, it has a meaningful concentration of exposed residential, agricultural, transportation, and tourism-supporting assets that contribute to a moderate hail vulnerability with elevated localized risk in communities, visitor destinations, and irrigated agricultural areas.

Estimated vulnerable assets in Garfield County that may be exposed to hail include the following:

- Approximately 5,290 residents who may be affected directly by hail or indirectly through property damage, travel disruption, and service interruption.⁶⁹
- About 3,803 housing units that may be vulnerable to roof, siding, window, and skylight damage.⁷⁰
- An estimated 297 farms and ranch operations with exposure to crop loss, damaged fencing, barns, sheds, pivots, and agricultural equipment.⁷¹
- Approximately 85,397 acres of land in farms, including 15,721 irrigated acres and about 13,109 acres of forage production that are susceptible to hail damage during the growing season.⁷²
- Tourism-related lodging, restaurants, campgrounds, visitor services, and other commercial assets near Bryce Canyon National Park, Scenic Byway 12, and U.S. Highway 89.
- Public buildings, schools, emergency service facilities, utility assets, and community infrastructure in Panguitch, Escalante, Boulder, Tropic, Cannonville, Hatch, and surrounding areas.
- Major transportation assets, including U.S. Highway 89, Scenic Byway 12, local roads, fleet vehicles, private vehicles, and visitor traffic exposed to hail-related damage and hazardous travel conditions.
- Outdoor infrastructure and recreation-related assets such as signage, trailhead facilities, campground equipment, solar installations, HVAC units, and communications equipment.

Overall, Garfield County has a moderate hail vulnerability with localized areas of elevated risk where community assets, tourism infrastructure, transportation corridors, and agricultural production overlap. Vulnerability is increased by limited warning time, long travel distances, geographic isolation, reliance on

⁶⁷ U.S. Census Bureau, "QuickFacts: Garfield County, Utah," 2026, <https://www.census.gov/quickfacts/fact/table/garfieldcountyutah/PST045219>; U.S. Department of Agriculture, "2022 Census of Agriculture County Profile-Garfield County Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49017.pdf.

⁶⁸ Utah.gov, "Department of Workforce Services-Local Insight, Garfield County Snapshot," 2026, <https://jobs.utah.gov/wi/insights/county/garfield.html>.

⁶⁹ U.S. Census Bureau, "QuickFacts: Garfield County, Utah," 2026, <https://www.census.gov/quickfacts/fact/table/garfieldcountyutah/PST045219>.

⁷⁰ U.S. Census Bureau, "QuickFacts: Garfield County, Utah," 2026, <https://www.census.gov/quickfacts/fact/table/garfieldcountyutah/PST045219>.

⁷¹ U.S. Department of Agriculture, "2022 Census of Agriculture County Profile-Garfield County Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49017.pdf.

⁷² U.S. Department of Agriculture, "2022 Census of Agriculture County Profile-Garfield County Utah," 2022, https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Utah/cp49017.pdf.

weather-sensitive economic sectors, and the county's constrained repair and recovery capacity in remote areas.

Likely hail impacts in Garfield County include roof, siding, window, vehicle, and outdoor-equipment damage; losses to forage and other agricultural production; and short-term disruption to travel, visitor services, and public operations. Severe hail along U.S. Highway 89, Scenic Byway 12, or access routes to recreation destinations can create sudden visibility and roadway hazards while damaging visitor and fleet vehicles. Localized storms can also affect lodging, restaurants, campgrounds, schools, emergency facilities, and utility equipment. Because tourism and agriculture are both weather-sensitive, even a geographically limited event may create losses disproportionate to the permanent population affected.

Cascading impacts: Cascading effects may include road closures or crashes that delay emergency response and visitor movement; damage to utility or communications equipment that interrupts service in remote communities; and closure or reduced operation of lodging, recreation, and commercial facilities. Agricultural damage can reduce feed availability and producer income, while damaged roofs and vehicles can strain limited local contractors, parts supplies, and insurance resources. If hail accompanies heavy rain, lightning, or strong winds, simultaneous demands on transportation, utilities, and public works may prolong restoration. Geographic isolation and long travel distances can further extend repair timelines and increase costs for households, businesses, and local government.

Changes in development: New housing, visitor accommodations, commercial facilities, transportation improvements, and recreation infrastructure in and near established communities and tourism corridors will increase the inventory of roofs, windows, vehicles, signage, solar equipment, and outdoor assets exposed to hail. Growth near Bryce Canyon, along Scenic Byway 12 and U.S. Highway 89, and in community service centers may concentrate future losses and increase continuity demands during peak visitor periods. Use of impact-resistant materials, protected mechanical and communications equipment, covered fleet storage, and resilient design for public and visitor-serving facilities can reduce added vulnerability. Changes in development are expected to increase potential consequences and replacement costs rather than the climatological likelihood of hail.

IRON COUNTY

Iron County's hail vulnerability includes concentrated residential, public, commercial, and transportation assets in the Cedar City and Enoch area, as well as rural agricultural assets. Table 3 documents 1.00-inch hail at Enoch and Beryl Junction and 1.50-inch hail at Cedar City Regional Airport, where the October 2, 2022, record reports \$40,000 in property damage. Although the City of Enterprise is in Washington County, the August 21, 2022, Enterprise Municipal Airport hail record is included here because NCEI coded the event to Iron County. Exposed assets include roofs, windows, vehicles, airport facilities, schools, public buildings, utilities, and agricultural equipment. Potential impacts include property damage, hazardous travel, agricultural losses, and interruption of public services or business activity. Vehicle and equipment damage may delay emergency response and repairs; localized utility interruptions may compound service disruption.

Concentrated development in Cedar City, Enoch, and nearby communities places a larger inventory of homes, businesses, schools, health and emergency facilities, airport assets, and public fleets within areas where severe hail has been documented. Rural portions of the county add exposure from farms, ranches, irrigation systems, outbuildings, solar installations, and long transportation and utility corridors. Roofing, siding, glazing, HVAC equipment, communications systems, vehicles, aircraft, and agricultural equipment are particularly susceptible. The documented Cedar City Airport loss illustrates how a localized storm can affect specialized facilities and assets with high repair or replacement costs.

Likely impacts include damage to residential and commercial roofs, windows, siding, vehicles, aircraft, public fleets, outdoor equipment, and agricultural production. Hail can create abrupt visibility and traction hazards on Interstate 15, State Route 56, local roads, and airport operating areas, increasing the potential for crashes, flight or ground-operation delays, and emergency response demands. Damage to schools, government buildings, utilities, or major employers may interrupt normal operations, while repeated smaller events can shorten the service life of building envelopes and exposed equipment. Agricultural producers may experience crop, forage, fencing, and equipment losses during the growing season.

Cascading impacts: Cascading impacts may include utility or communications outages, transportation delays, school or facility closures, and reduced availability of emergency vehicles or public works equipment. Airport damage or operational restrictions can affect regional access and time-sensitive travel, while road incidents can disrupt freight and commuter movement. Agricultural losses may reduce producer income and available feed, and a surge in roof, glass, and vehicle claims may strain contractors, repair shops, and insurance processing. When hail occurs with heavy rain, lightning, or strong winds, simultaneous damage can increase debris-management needs and extend service restoration.

Changes in development: Continued growth in the Cedar City–Enoch area and along major transportation corridors will increase the number and value of homes, businesses, vehicles, public facilities, and utility systems exposed to hail. Expansion of airport-related, industrial, educational, residential, renewable-energy, and agricultural development may add specialized or outdoor assets that are costly to protect and replace. Incorporating impact-resistant roofing and glazing, sheltered equipment and fleet storage, protected rooftop systems, and continuity measures for critical facilities can reduce the vulnerability added by growth. Development changes are expected to increase exposure and potential losses even where hail frequency remains unchanged.

KANE COUNTY

Kane County's hail vulnerability includes dispersed residential and infrastructure assets exposed to localized thunderstorms. Table 3 includes the June 21, 2024, Glen Canyon records with 1.75-inch hail; the verified records represent separate observations at Ice Cream Canyon, Lone Rock Beach, and Amangiri Resort, rather than three independently counted storms. Lower reporting density does not eliminate the potential for damaging hail. Exposed roofs, windows, vehicles, outdoor equipment, agricultural assets, and transportation routes may sustain damage. Potential impacts include hazardous travel, repair costs, crop losses, and temporary service interruptions. Damage to vehicles or essential equipment may delay response and recovery in dispersed areas.

The county's exposure is concentrated in Kanab and smaller communities, visitor-serving properties, public facilities, transportation corridors, utility systems, and recreation destinations associated with Glen Canyon and other federal lands. Lodging, resorts, campgrounds, marinas, parked vehicles, rooftop systems, signage, communications equipment, and remote public-safety assets may be especially exposed because many are outdoors or depend on uninterrupted access. Agricultural and ranching operations may also sustain damage to forage, fencing, outbuildings, and equipment. Sparse settlement reduces the total number of exposed structures but can increase the functional importance of each damaged facility or route.

Likely hail impacts include damage to roofs, windows, vehicles, solar and mechanical equipment, recreation facilities, and agricultural assets, together with hazardous travel on U.S. Highway 89, U.S. Highway 89A, State Route 9, and remote local roads. Damage at resorts, campgrounds, visitor attractions, or lake-access facilities may disrupt tourism and seasonal employment even when residential impacts are limited. Hail can also injure people or livestock caught outdoors and increase demand for emergency response, inspections, and temporary protective measures. Remote locations may experience longer delays in damage assessment, material delivery, and repair.

Cascading impacts: Cascading impacts may include crashes or temporary route restrictions that delay emergency access and visitor movement; damage to utility or communications equipment that interrupts service in isolated areas; and reduced operation of lodging, recreation, and commercial facilities. Vehicle and fleet damage can constrain public-safety, maintenance, and tourism-support functions, while agricultural losses can affect producer income and feed availability. A concentrated demand for roofing, glass, and vehicle repair may exceed local contractor and parts capacity. If hail accompanies flash flooding, strong winds, or lightning, concurrent impacts can complicate evacuations, debris removal, and restoration.

Changes in development: New housing, resorts, visitor services, recreation facilities, renewable-energy systems, and transportation or utility improvements will increase the number and value of exposed assets, particularly near Kanab, established travel corridors, and major recreation destinations. Seasonal visitation may also place more vehicles and people outdoors during the thunderstorm season. Impact-resistant building materials, protected rooftop and communications equipment, covered fleet storage, redundant service arrangements, and all-weather emergency access can reduce vulnerability in new development. Growth changes the potential scale and distribution of losses rather than demonstrating an increase in hail probability.

WASHINGTON COUNTY

Washington County's hail vulnerability includes residential structures, vehicles, public facilities, infrastructure, and outdoor equipment. Table 3 documents hail at Veyo, St. George Municipal Airport, Washington, and Rockville; the Rockville record reports \$7,500 in property damage. Table 4 provides supplemental commercial exposure estimates for the St. George area. Potential impacts include roof, window, vehicle, and equipment damage, hazardous travel, and interruption of business or public services.

Damage to public fleets, utility equipment, or occupied buildings may extend disruption beyond the storm and increase repair and recovery costs.

The county contains the planning area's largest concentration of residential, commercial, institutional, transportation, and utility assets, particularly in the St. George metropolitan area and surrounding communities. This concentration increases potential aggregate losses from a localized storm because many roofs, windows, vehicles, public fleets, schools, health care facilities, businesses, construction sites, solar installations, and outdoor amenities may be exposed at the same time. Visitor-serving properties, recreation facilities, and airport assets add seasonal and specialized exposure. Although hail footprints are often narrow, dense development can produce substantial claims and operational disruption within the affected area.

Likely impacts include widespread roof, siding, glazing, skylight, vehicle, solar-panel, HVAC, and landscaping damage within localized storm paths. Hail can also create dangerous travel conditions on Interstate 15, State Route 7, State Route 9, and urban streets, while affecting airport operations and outdoor events. Damage to medical, educational, emergency, utility, or government facilities may interrupt essential functions, and impacts to hotels, retail areas, recreation venues, and construction activity may produce short-term business losses. Repeated events can accelerate deterioration of roofing and exposed equipment even when individual storms do not cause major structural failure.

Cascading impacts: Cascading impacts may include traffic crashes and congestion, delayed emergency response, temporary utility or communications outages, school or facility closures, and reduced availability of public or private fleets. A large volume of simultaneous roof, glass, solar, and vehicle claims may strain contractors, repair shops, material supplies, and insurance processing, extending recovery and increasing costs. Business interruption may affect tourism, retail, health care, and construction, while damage to critical equipment can disrupt services beyond the directly affected neighborhood. If hail occurs with intense rainfall, strong winds, or lightning, concurrent flooding, debris, and power impacts may create compound response and recovery demands.

Changes in development: Rapid residential and commercial growth in and around St. George, Washington, Hurricane, Ivins, Santa Clara, and other communities will continue to add roofs, windows, vehicles, public facilities, utilities, solar systems, and outdoor amenities to the exposed inventory. Infill and higher-density development can increase the value of assets within a single hail footprint, while expansion toward the urban fringe may lengthen utility and emergency-service networks. Applying impact-resistant roofing and glazing, protected rooftop equipment, covered fleet storage, resilient design for critical facilities, and continuity planning can limit the increase in losses. Development is expected to increase exposure and consequences substantially even without a demonstrated change in hail frequency.

Landslide

A landslide is the downslope movement of a mass of rock, soil, debris, or earth under the influence of gravity. Landslides are classified as a form of mass wasting and can range from slow, gradual movements occurring over months or years to rapid, catastrophic failures that happen with little or no warning.⁷³

Landslides encompass a wide variety of ground-movement processes, including falls, topples, slides, spreads, and flows, and may involve bedrock, debris, or soil. Common examples include rockfalls, debris flows (often referred to as mudflows), earthflows, and rotational or translational slides. The speed, size, and travel distance of a slide vary widely depending on slope conditions, material type, water content, and trigger mechanisms.

Landslides occur when the forces acting on a slope, primarily gravity, exceed the strength of the materials composing that slope. They are commonly triggered by intense or prolonged rainfall, rapid snowmelt, grading, and changes to natural drainage patterns. These factors can act alone or in combination to destabilize slopes. Additionally, soil types can contribute to slope instability and landslides.

Landslides can cause significant impacts to life, property, infrastructure, and the environment, including destruction of homes and roads, damage to utilities, blockage of waterways, and disruption to transportation networks. Landslides occur in all U.S. states and territories, particularly in mountainous, hilly, or steep-slope areas, and represent a recurring natural hazard.

Location

Landslide susceptibility occurs throughout the Five County AOG planning area where steep slopes, weak or highly fractured rock, unconsolidated deposits, pre-existing landslides, altered drainage, grading, groundwater, irrigation, intense precipitation, rapid snowmelt, erosion, or wildfire-related runoff reduce slope stability. The Utah Geological Survey (UGS) identifies debris flows, slides, and rockfalls as common Utah landslide types and notes that many recent failures are reactivations of pre-existing landslides. The county maps identify planning-level susceptibility; they do not establish that every mapped area will fail or that areas outside mapped classes are free of hazard.

County conditions vary. Beaver County includes susceptible mountain and canyon terrain associated with the Tushar Mountains and transportation corridors. Garfield and Kane Counties include steep plateau margins, cliffs, canyons, weak sedimentary units, and drainage systems susceptible to rockfall, slides, and debris flows. Iron County includes active and mapped landslide areas in Cedar Canyon, Cedar Highlands, and adjacent foothill settings. Washington County includes developed benches, foothills, incised drainages, and slope-modified areas where landslides and debris flows have affected transportation and residential development.

⁷³ U.S. Geological Survey, "What Is a Landslide and What Causes One?" <https://www.usgs.gov/faqs/what-a-landslide-and-what-causes-one>.

The Paiute Indian Tribe of Utah has lands within the planning area. This regional profile does not assign landslide exposure to a specific Tribal parcel without a documented overlay or Tribal confirmation. Parcel-specific Tribal exposure is not established by the information available for this profile.

Figure 29 depicts the supplied planning-level landslide-susceptibility map for Garfield County. The map provides regional screening context and does not establish parcel-level exposure or a probability of failure.

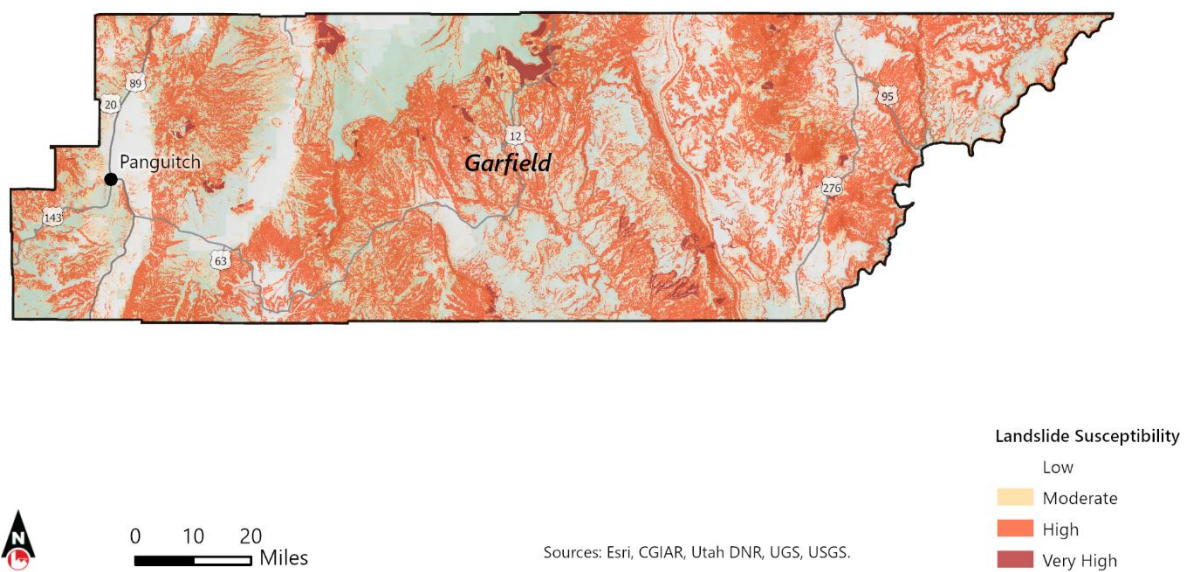


Figure 29: Garfield County Landslide Susceptibility Map

Figure 30 depicts planning-level landslide susceptibility in Washington County and identifies selected recent-event locations. Higher mapped susceptibility occurs in foothill, bench, canyon, and steep-slope settings. The map is a screening resource and does not replace site-specific investigation.

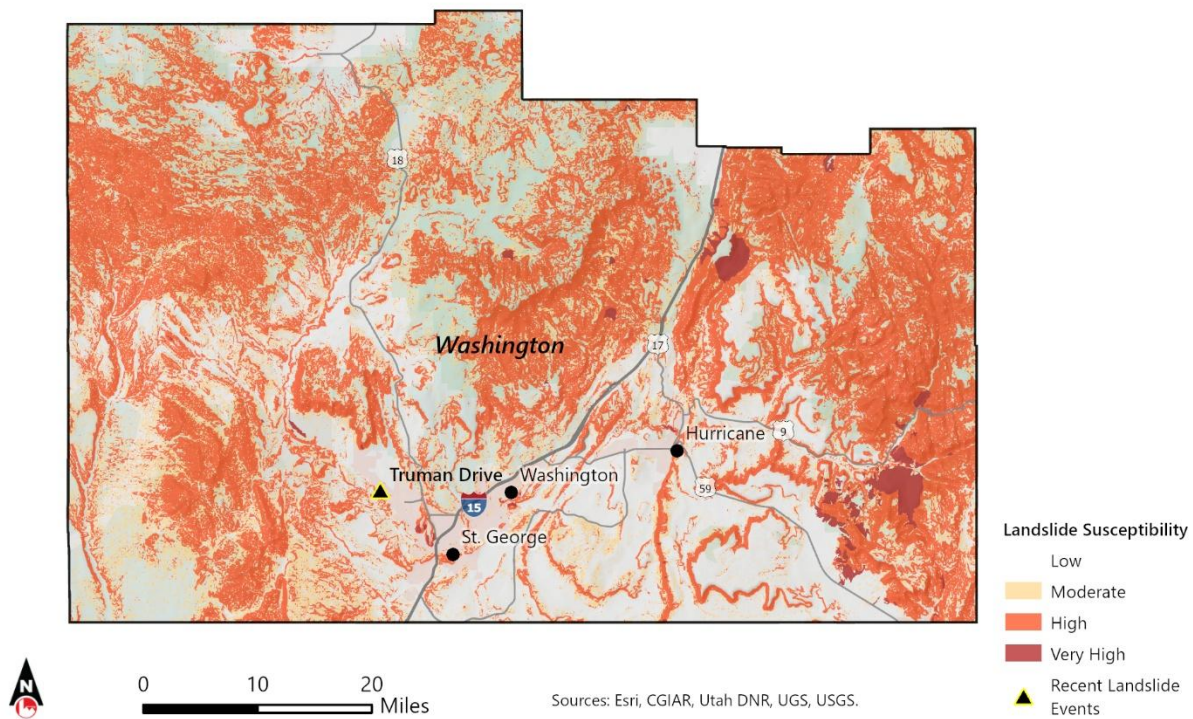


Figure 30: Washington County Landslide Susceptibility Map

Magnitude and Extent

Landslide magnitude may be described by displaced volume, affected area, movement rate, travel distance, depth, and consequences. The Universal Landslide Classification System shown in Table 29 provides order-of-magnitude size classes based on volume or mapped area. Because many local event records do not provide complete volume estimates, this plan also describes extent using mapped susceptibility, event dimensions where documented, and the assets or corridors affected.

The Universal Landslide Classification System provides a standardized method for describing and comparing landslide events based on their physical magnitude. The system categorizes landslides into numeric size classes using order-of-magnitude thresholds for displaced material volume or, when volume estimates are not available, mapped surface area. Each size class corresponds to a descriptive term that reflects the relative scale of the landslide, from very small shallow failures to extremely large, complex slope movements.

Table 29 presents the Universal Landslide Classification System as a reference for comparing the relative physical magnitude of documented landslide events by volume or mapped area.

Table 29: Universal Landslide Classification System⁷⁴

Class	Descriptor	Minimum volume (m ³)	Minimum area (m ²)
14	Monster (trillions)	≥ 100,000,000,000,000	≥ 500,000,000,000
13		≥ 10,000,000,000,000	≥ 100,000,000,000
12		≥ 1,000,000,000,000	≥ 10,000,000,000
11	Giant (billions)	≥ 100,000,000,000	≥ 1,000,000,000
10		≥ 10,000,000,000	≥ 500,000,000
9		≥ 1,000,000,000	≥ 100,000,000
8	Large (millions)	≥ 100,000,000	≥ 10,000,000
7		≥ 10,000,000	≥ 1,000,000
6		≥ 1,000,000	≥ 500,000
5	Medium (thousands)	≥ 100,000	≥ 100,000
4		≥ 10,000	≥ 10,000
3		≥ 1,000	≥ 1,000
2	Small (ones)	≥ 100	≥ 500
1		≥ 10	≥ 100
0		≥ 1	≥ 10
-1	Very small (thousandths)	≥ 0.1	≥ 1
-2		≥ 0.01	≥ 0.5
-3		≥ 0.001	≥ 0.1

Previous Occurrences

Utah has a documented history of damaging landslides. The 1983 Thistle landslide illustrates the potential for major transportation, community, and economic consequences at the state level. Within the Five County AOG planning area, the occurrence record includes federally declared flooding and landslides in 2005 and multiple recent UGS-documented events affecting Iron, Kane, and Washington Counties.

FEMA Major Disaster Declaration DR-1598-UT addressed flooding and landslides with an incident period of April 28 through June 29, 2005. Within the planning area, Beaver, Iron, and Kane Counties were designated for Public Assistance; Garfield and Washington Counties were not listed. This profile treats the declaration as evidence of regional impacts but does not assume that every designated county experienced the same landslide mechanism or severity.

⁷⁴ S. T. McColl and S. J. Cook, "A Universal Size Classification System for Landslides," *Landslides* 21, 111–20, 2024, <https://link.springer.com/article/10.1007/s10346-023-02131-6>.

Table 30: Selected Federal Disaster Declaration Involving Flooding and Landslides⁷⁵

Year	Declaration Number	Declaration Type	Title/Description
2005	DR-1598-UT	Federal	Flood and Landslide; Beaver, Iron, and Kane Counties were designated for Public Assistance within the planning area.

Table 31 presents selected UGS-documented 2023 landslide events in Iron, Kane, and Washington Counties. The table illustrates event type and scale but is not a complete inventory of landslides across the planning area. Event dates and dimensions reflect the cited UGS records and should not be generalized to countywide probability.

Table 31: Selected UGS-Documented Landslide Events in Iron, Kane, and Washington Counties, 2023⁷⁶

Landslide Name/Location	County	Date	Size
Cedar Canyon, MP8 Landslide Complex (Eight miles east of Cedar City)	Iron	06/21/2023	New scarp nearly 1,000 feet wide with over 50 feet of vertical displacement; newly formed landslide nearly 6 acres.
Meadow Creek (SR-9, five miles east of Zion National Park east entrance)	Kane	06/06/2023	2 miles × 1.5 miles
Cedar Highlands (Cedar City)	Iron	06/06/2023	100 × 250 feet
Truman Drive (Santa Clara)	Washington	06/06/2023	300 × 150 feet
Right Hand Canyon Road (Cedar Canyon, five miles east of Cedar City)	Iron	05/09/2023	120 × 50 feet

On May 9, 2023, UGS documented a rotational landslide along Right Hand Canyon Road in Cedar Canyon, approximately five miles east of Cedar City. The event damaged the roadway, and subsequent observations documented continued movement. The event illustrates how stream erosion, fill, weak bedrock, and wet conditions can interact at a transportation corridor.

⁷⁵ Federal Emergency Management Agency, DR-1598-UT designated areas, reviewed October 9, 2026, <https://www.fema.gov/es/disaster/1598/designated-areas>.

⁷⁶ Utah Geological Survey, Landslide Current Events and Cedar Canyon, MP8 Landslide Complex, updated June 22, 2023. The MP8 scarp dimensions describe width and vertical displacement, not plan-view length. <https://geology.utah.gov/hazards/landslides/current-events/>; <https://geology.utah.gov/portfolio-item/cedar-canyon-mp8-landslide-complex/>.



Figure 31: Cedar Canyon, MP8 Landslide Complex, Iron County⁷⁷

Probability of Future Occurrences

Landslides are rated Likely under the Five County AOG probability methodology based on the documented recurrence of landslides, rockfalls, and debris flows in susceptible terrain, including multiple UGS-documented 2023 events and the 2005 federal disaster declaration. This regional rating indicates that an event is likely to occur somewhere within the five-county planning area; local probability and consequences vary by slope, geology, groundwater, drainage, disturbance, wildfire history, exposure, and route redundancy.

Potential triggers include prolonged or intense precipitation, rapid snowmelt, elevated groundwater, erosion or undercutting, grading, drainage modification, irrigation or leakage, earthquakes, and wildfire-related changes in runoff and soil conditions. Trigger significance varies by landslide type and site.

Future risk may change through both hazard and exposure pathways. More intense rainfall following wildfire can increase runoff-driven debris-flow potential on steep burned slopes, while development, grading, irrigation, and infrastructure expansion can increase exposure or alter slope stability. Broader regional climate information does not support a uniform projection for all landslide types or locations. Burn-scar assessments, groundwater conditions, slope performance, and development patterns inform changes in local risk.

Overall probability rating: Likely.

The evidentiary basis is the documented recurrence of slides, rockfalls, and debris flows in susceptible terrain, including multiple UGS-documented 2023 events and the 2005 federal declaration.

⁷⁷ Utah Geological Survey, Cedar Canyon, MP8 Landslide Complex, Iron County, updated June 22, 2023. The photograph illustrates the MP8 complex, not Right Hand Canyon Road. <https://geology.utah.gov/portfolio-item/cedar-canyon-mp8-landslide-complex/>.

Population growth and development do not change the underlying geologic probability by themselves, but they can increase exposure, modify drainage, add irrigation or loading, and place additional structures and lifelines in or below susceptible terrain. Jurisdiction-specific development changes since the previous plan approval are not established by the information available for this profile.

The regional probability is not described as uniformly increasing. Local changes depend on landslide type and location and are informed by updated susceptibility mapping, recent-event information, burn-scar assessments, groundwater and drainage observations, and jurisdiction-confirmed development patterns.

Landslide events are expected to continue to occur across the Five County AOG planning area due to widespread steep terrain, complex geology, exposure to weather, and wildfire-related triggering mechanisms. Historical documentation confirms recurring landslides, rockfalls, and debris flows throughout Beaver, Iron, Garfield, Kane, and Washington Counties, particularly along canyon systems, mountain fronts, and transportation corridors. These documented events demonstrate that landslides are not isolated or unusual occurrences, but a recurring regional hazard closely tied to terrain and environmental conditions. Therefore, the overall probability of future landslide occurrence across the planning area is assessed as Likely, with local variation influenced by slope, geology, land use, and recent disturbance.

Landslides are most often triggered by seasonal precipitation events, rapid snowmelt, and short-duration, high-intensity storms that increase slope saturation and destabilize weak or fractured geologic materials. In addition, post-wildfire conditions significantly elevate landslide and debris-flow risk by removing vegetation, increasing runoff, and reducing slope cohesion.⁷⁸ These conditions are present to varying degrees across all five counties and are expected to persist. While much of the planning area remains rural, critical infrastructure, including highways, local roads, utilities, recreation assets, and emergency access routes, frequently crosses landslide-prone terrain, resulting in continued exposure even where population density is low.

- Likely, based on documented historical landslides, rockfall, and debris flow events across all five counties, demonstrating recurring occurrence under known environmental conditions.
- Factors contributing to landslide risk include the following:
 - Extensive steep slopes, weak or erodible geologic materials, and narrow canyon systems
 - Seasonal precipitation, rapid snowmelt, and high-intensity storms
 - Wildfire exposure and post-fire debris flow susceptibility
 - Ongoing and projected development near hillsides, canyon corridors, and transportation routes

Factors such as population growth, expanded development in constrained terrain, and increased wildfire activity can increase future landslide risk by expanding the number and concentration of people, structures, and infrastructure exposed to unstable slopes. As development and use of landslide-prone

⁷⁸ USGS, "Post-Wildfire Debris Flow," 2024, <https://www.usgs.gov/publications/post-wildfire-debris-flows>.

areas continue across the counties and Tribal lands, potential property damage, service disruptions, and social and economic impacts from future landslide events may increase accordingly.

The regional probability of future landslide occurrence is assessed as Likely. Potential consequences vary locally with hazard conditions, exposure, and access redundancy; the available information does not establish a uniform increase in probability.

Vulnerability Assessment

Vulnerability refers to the people, property, infrastructure, natural and cultural resources, and community systems that may be damaged or disrupted by landslides, rockfalls, and debris flows. Across the Five County AOG planning area, vulnerability is concentrated where susceptible slopes, runout paths, canyon walls, drainage corridors, or unstable fill intersect development, transportation routes, utilities, recreation areas, and emergency access. Countywide population and housing totals provide planning context but are not estimates of direct exposure.

The five counties share steep terrain and geologic conditions that can produce slope failure, but their exposure patterns differ. Iron and Washington Counties include developed areas near active or susceptible slopes, while Beaver, Garfield, and Kane Counties depend heavily on long transportation and utility corridors through rugged terrain with limited alternate access. Direct exposure would require an overlay of current assets with landslide inventories, susceptibility mapping, runout areas, and site-specific investigations; that analysis is not available for this regional profile.

Potential consequences include injury or loss of life, damage to buildings and infrastructure, road closures, utility interruption, sediment and debris entering waterways, emergency-response delays, and economic losses from repairs and interrupted travel or tourism. The Paiute Indian Tribe of Utah has lands within the planning area, but parcel-specific Tribal vulnerability is not assigned without a documented spatial analysis and Tribal coordination.

BEAVER COUNTY

Beaver County's landslide vulnerability is concentrated in the Tushar Mountains, canyon systems, alluvial slopes, drainage crossings, and other areas where steep or disturbed terrain intersects Beaver City, Milford, Minersville, dispersed residences, agriculture, recreation, and public lands access. Intense precipitation, rapid snowmelt, erosion, wildfire effects, and altered drainage can initiate rockfall, debris flow, or shallow slope failure. Although the county's population is comparatively small, localized failures can have significant consequences where communities and facilities depend on a limited number of routes.

Potentially vulnerable assets include state and county roads, bridges, culverts, mountain and recreation access routes, electric and communications lines, water and drainage facilities, agricultural infrastructure, public facilities, residences, campgrounds, and trailheads. According to U.S. Census Bureau QuickFacts, Beaver County had a 2020 Census population of 7,072 and an estimated population of 7,301 as of July 1,

2025; the county had an estimated 3,102 housing units as of July 1, 2025, and 2,518 households during the 2020–2024 period. These countywide figures describe the development context; they do not indicate how many people or structures are in landslide-susceptible areas.

Likely direct impacts include debris deposition, roadbed or embankment failure, culvert blockage, structural damage, and damage to utilities that share constrained corridors. Indirect impacts may include detours, restricted access to homes, ranches and recreation sites, delayed emergency services, interrupted freight or school travel, and costs for debris removal, slope stabilization, roadway repair, and utility restoration. Beaver County's exposure is therefore driven primarily by lifeline dependence and limited route redundancy rather than widespread structural concentration.

Cascading impacts. A blocked mountain or canyon road can isolate residents, agricultural operations, and recreation users while delaying emergency response and repair crews. If utilities are co-located with the affected route, a single slope failure may also interrupt power, communications, or water service. Debris entering channels or blocking culverts can redirect runoff, increase localized flooding or erosion, degrade water quality, and contribute to additional slope instability.

Changes in development. Population growth does not by itself change underlying geology, but new construction, grading, irrigation, drainage modification, vegetation removal, and added loading can increase exposure or reduce slope stability when they occur in or below susceptible terrain. Expansion of residential, recreation, energy, or utility infrastructure into mountain and canyon settings could place additional assets on access-limited corridors. Jurisdiction-specific development changes since the previous plan are not established here and should be confirmed through local review and updated mapping.

GARFIELD COUNTY

Garfield County's vulnerability is concentrated along steep plateau margins, canyon walls, escarpments, weak sedimentary units, drainage crossings, and narrow travel corridors serving Antimony, Boulder, Bryce Canyon City, Cannonville, Escalante, Hatch, Henrieville, Panguitch, and Tropic. Rockfall, debris flow, and other slope failures may be triggered by intense rainfall, rapid snowmelt, erosion, or post-wildfire runoff. Permanent population is low, but seasonal visitation and dependence on constrained routes increase the number of people who may be exposed or isolated.

Potentially vulnerable assets include State Route 12, U.S. 89 and its approaches, county roads, bridges and culverts, co-located utilities, emergency and medical access, Bryce Canyon and Escalante-area visitor facilities, trailheads, campgrounds, lodging, residences, and public-land access points. Garfield County had a 2020 Census population of 5,083, an estimated 5,256 residents in 2025, approximately 2,042 households, and about 3,803 housing units countywide. These totals are not direct-exposure estimates; the greatest vulnerability occurs where assets intersect mapped susceptibility, steep canyon walls, or runout areas.

Likely impacts include rockfall or debris on roadways, embankment or bridge-approach damage, blocked drainage, damage to utilities, and isolation of small communities or visitor destinations. Closure of a

segment of State Route 12, an approximately 123-mile corridor connecting U.S. 89 and State Route 24, could affect residents, deliveries, emergency response, tourism, and access to high-visitation recreation areas. Economic consequences may include repair and detour costs, canceled trips, reduced visitor spending, and interrupted business activity.

Cascading impacts. A closure on a scenic byway or park-access route may delay emergency and medical transport, strand travelers, restrict deliveries, and reduce access to tourism-dependent communities well beyond the immediate slide area. Damage to co-located utilities can extend outages, while sediment or debris blocking a drainage crossing can redirect water, worsen erosion, and produce secondary flooding or additional slope failure.

Changes in development. New homes, lodging, visitor facilities, roads, and utilities near canyon walls, plateau margins, drainageways, or unstable slopes can increase the number and value of exposed assets. Road widening, cut-and-fill work, altered drainage, and increased visitor use may also place greater demands on constrained corridors. Countywide growth does not establish a uniform increase in hazard; local changes should be evaluated through land-use review, geotechnical investigation, and updated susceptibility and wildfire information.

IRON COUNTY

Iron County's vulnerability is concentrated where development and infrastructure intersect Cedar Canyon, Cedar Highlands, foothills, canyon mouths, drainage crossings, fill embankments, and other susceptible terrain serving Brian Head, Cedar City, Enoch, Paragonah, and Parowan. Recent events demonstrate active slope movement: in 2023, the Cedar Canyon MP8 complex developed a scarp nearly 1,000 feet wide with more than 50 feet of vertical displacement and a newly formed landslide of nearly 6 acres; UGS also documented movement at Cedar Highlands and along Right Hand Canyon Road.

Potentially vulnerable assets include State Route 14, Right Hand Canyon Road, foothill and canyon neighborhoods, bridges, culverts, drainage infrastructure, electric and communications lines, emergency routes, schools, public facilities, airport access, and recreation corridors. Structures and lots may be directly affected where they overlie or lie below unstable slopes, while facilities elsewhere may be indirectly affected by road or utility interruption. Countywide population, housing, school, and bridge totals are not used as direct-exposure estimates without a spatial overlay.

Likely impacts include displacement or cracking of roadbeds and pavement, repeated maintenance needs, debris deposition, damage to developed lots, and interruption of utilities and drainage. Closures may disrupt emergency response, school travel, access to public facilities, commuting, and recreation travel. Potential economic consequences include debris removal, monitoring, geotechnical investigation, slope stabilization, road and utility repair, property damage, and business interruption; available information does not support a countywide loss estimate.

Cascading impacts. Continued slope movement can repeatedly damage repaired roads and utilities, prolong closures, and increase maintenance costs. A closure in Cedar Canyon or another constrained route can delay emergency response and utility restoration, while blocked drainage may redirect runoff

and cause localized flooding or erosion. Damage to co-located power, communications, or water infrastructure can extend service disruption beyond the mapped landslide footprint.

Changes in development. Continued residential and infrastructure growth near Cedar City, Cedar Highlands, canyon mouths, and foothill settings can increase exposure where new assets intersect unstable slopes or runout areas. Grading, cut-and-fill construction, irrigation, leaking utilities, and drainage modification may alter local stability even where regional geologic probability is unchanged. Future reviews should use current UGS mapping, recent-event boundaries, geotechnical studies, and jurisdiction-confirmed development patterns to identify newly exposed areas.

KANE COUNTY

Kane County's vulnerability is concentrated along steep cliffs, narrow canyons, weak sedimentary units, alluvial fans, drainage crossings, and highway corridors serving Alton, Big Water, Glendale, Kanab, Orderville, and major visitor destinations. The June 6, 2023, Meadow Creek landslide near State Route 9 was documented at approximately 2 miles by 1.5 miles and demonstrates the scale of active movement that can affect a major community and visitor-access route. Intense rainfall, snowmelt, erosion, wildfire effects, and slope disturbance can contribute to future failures.

Potentially vulnerable assets include U.S. 89, State Route 9, local canyon roads, bridges, culverts, electric and communications lines, water and drainage infrastructure, emergency and health-care access, residences, lodging, campgrounds, and visitor facilities. Direct exposure is limited to assets on or below susceptible slopes and within runout or debris-flow paths, but indirect disruption can extend across the county because alternate routes are often lengthy or unavailable. Countywide population, household, housing, and visitor totals are therefore context rather than direct-exposure estimates.

Likely impacts include roadway displacement, rockfall or debris blockage, damage to drainage crossings and co-located utilities, structural damage or isolation, and restricted access to communities and recreation destinations. Consequences may include delayed emergency and medical access, extended detours, repair and stabilization costs, interrupted deliveries, and reduced visitor access and spending. The significance of an event depends on its location, movement rate, warning time, and the availability of alternate routes.

Cascading impacts. Closure of U.S. 89, State Route 9, or a local canyon road can affect residents, visitors, emergency services, freight, and utility restoration beyond the immediate failure area. Debris blocking culverts or channels can redirect flow and create secondary flooding or erosion, while damage to utilities sharing the corridor can cause power, communications, or water outages and prolong recovery.

Changes in development. New residential, tourism, and recreation development near cliffs, canyon mouths, drainageways, or alluvial fans may increase exposure even if the underlying geologic likelihood remains similar. Grading, road cuts, fill placement, irrigation, and drainage changes can modify local slope conditions, and increased visitor use can raise the number of people dependent on vulnerable routes. Jurisdiction-specific changes should be confirmed through local development review and incorporated into future exposure mapping.

WASHINGTON COUNTY

Washington County's vulnerability is concentrated where developed benches, foothills, incised drainages, canyon margins, and slope-modified terrain intersect rapidly growing communities and regional lifelines. Participating municipalities include Apple Valley, Enterprise, Hildale, Hurricane, Ivins, La Verkin, Leeds, New Harmony, Rockville, Santa Clara, Springdale, St. George, Toquerville, Virgin, and Washington City. The June 6, 2023, Truman Drive event in Santa Clara, documented at approximately 300 by 150 feet, demonstrates that active movement can occur within a developed setting.

Potentially vulnerable assets include residences on or below susceptible slopes; Interstate 15; State Routes 7, 9, 18, and 34; local roads; bridges and culverts; drainage systems; electric, communications, and water infrastructure; schools; medical and emergency facilities; airport access; and visitor and recreation corridors. Washington County has substantial population and building exposure overall, but countywide totals are not direct landslide-exposure estimates. Quantification requires current asset data overlaid with susceptibility, inventory, runout, and site-specific hazard information.

Likely impacts include damage to homes, lots, neighborhood streets, retaining structures, drainage facilities, and utilities in foothill or bench settings. Road or utility failures may interrupt access to schools, hospitals, emergency facilities, commercial areas, airport routes, and visitor destinations. Potential consequences include injury, property repair, temporary displacement, debris removal, slope stabilization, business interruption, traffic disruption, and delayed emergency response; available data do not support a countywide loss estimate.

Cascading impacts. Neighborhood or corridor closures may delay emergency response, school travel, commuting, deliveries, and utility repair. Damage to drainage systems can redirect runoff and create localized flooding or erosion, while failure of co-located water, power, or communications infrastructure can extend service interruptions. Impacts on State Route 9 or other visitor routes may also affect access and economic activity in gateway communities.

Changes in development. Continued population and housing growth expands the number and value of assets that may be placed on or below susceptible slopes, particularly along benches, foothills, canyon margins, and drainage corridors. Grading, cut-and-fill construction, retaining walls, irrigation, leaking utilities, and modified drainage can change site-specific stability and runoff. Growth should not be interpreted as a uniform increase in landslide probability, but it can increase exposure and consequences unless current geologic information and geotechnical review guide siting and design.

Problem Soils

"Problem soils" is a planning term for soils whose physical or chemical properties can constrain construction, infrastructure, agriculture, or water management. Relevant limitations may include shrink-swell potential, collapse upon wetting, salinity or sodicity, corrosivity, low bearing strength, shallow depth to bedrock, poor drainage, and erosion susceptibility. The USDA Natural Resources Conservation Service (NRCS) Web Soil Survey and Soil Survey Geographic Database (SSURGO) provide screening-level soil

properties and engineering interpretations. Site-specific geotechnical investigation remains necessary for engineering design because map units can contain multiple soil components and inclusions.

Types of Problem Soils in Southern Utah

In southern Utah, problem soils are closely tied to arid and semiarid weather conditions, sedimentary and volcanic parent materials, and historic lakebed and alluvial fan environments, which produce soils with high clay content, salinity, gypsum, or collapsible structure.⁷⁹ Across Beaver, Iron, Kane, Garfield, and Washington Counties, several types of problem soils are present due to the region's arid weather, geologic history, and dominant soil parent materials.

- **Expansive Soils:** One of the most significant soil concerns is the presence of expansive (shrink-swell) soils. These soils contain clay minerals, most commonly montmorillonite, that expand when wet and shrink when dry. This repeated volume change causes ground movement that can damage building foundations, pavements, pipelines, and concrete slabs. Expansive soils are widespread in areas underlain by fine-grained sedimentary formations and clay-rich alluvial deposits. In Washington County, expansive soils are a well-documented contributor to foundation cracking and infrastructure distress, especially in rapidly developing areas where clay-rich Aridisols are common.
- **Saline and Sodic Soils:** These soils are also prevalent across the five-county area and contain elevated concentrations of soluble salts or sodium, which reduce soil strength, impede drainage, and accelerate corrosion of concrete and metal infrastructure. Saline and sodic conditions are most commonly found in valley bottoms, playas, and areas influenced by ancient lakebeds or strong evaporative processes. Throughout southern Utah, saline and alkaline soils are characteristic of Aridisols, where limited precipitation prevents the natural leaching of salts from the soil profile, allowing them to accumulate near the surface.⁸⁰
- **Collapsible Soils:** These soils are typically composed of loosely packed silt and fine sand that appear stable under dry conditions but undergo sudden settlement when wetted. Collapsible soils pose serious risks to foundations, roadways, and buried utilities and are commonly associated with alluvial fan deposits, wind-deposited sediments, and volcanic ash layers. These soils are particularly problematic in areas undergoing urban expansion, where irrigation practices, landscaping, or leaking utilities introduce moisture into soil profiles that historically remain dry.⁸¹

⁷⁹ Utah State University Extension, "Soils of Utah," https://extension.usu.edu/rangelands/files/RRU_Section_Six.pdf; U.S. Department of Agriculture, Natural Resources Conservation Service, "Soil Survey of Iron-Washington Area, Utah, Parts of Iron, Kane, and Washington Counties." archived USDA publication Accessed April 8, 2026, <https://ia801605.us.archive.org/4/items/usda-soil-survey-of-iron-washington-area-utah/usda-soil-survey-of-iron-washington-area-utah.pdf>.

⁸⁰ Utah State University Extension, "Soils of Utah," https://extension.usu.edu/rangelands/files/RRU_Section_Six.pdf; NOAA Office for Coastal Management Digital Coast, "Soil Survey Geographic Database," <https://coast.noaa.gov/digitalcoast/data/ssurgo.html>.

⁸¹ U.S. Department of Agriculture, Natural Resources Conservation Service, "Soil Survey of Iron-Washington Area, Utah, Parts of Iron, Kane, and Washington Counties." archived USDA publication Accessed April 8, 2026, <https://ia801605.us.archive.org/4/items/usda-soil-survey-of-iron-washington-area-utah/usda-soil-survey-of-iron-washington-area-utah.pdf>; Utah State University Extension, "Soils of Utah," https://extension.usu.edu/rangelands/files/RRU_Section_Six.pdf.

- **Gypsiferous Soils:** These soils represent another category of problem soils within the Colorado Plateau region. These soils contain high concentrations of gypsum, a mineral that dissolves readily when exposed to water. Dissolution of gypsum can lead to loss of soil strength, subsidence, and the development of sinkhole-like features. Gypsum-rich soils create challenges for road construction, building foundations, and septic system performance due to their solubility and variable bearing capacity.
- **Shallow, Rocky, and Erodible Soils:** In upland and canyon environments throughout all five counties, shallow, rocky, and highly erodible soils are common. These soils often occur directly over bedrock and may contain large amounts of rock fragments, which limit excavation and reduce their suitability for septic systems and other subsurface infrastructure. These soils are also highly susceptible to erosion and slope instability, particularly following wildfires or intense rainfall events. These conditions are especially widespread in areas with steep terrain and thin soil cover.

Location

Problem-soil conditions are not randomly distributed. They reflect mapped soil components, parent material, landforms, drainage, slope, and geologic setting and may vary substantially within a soil map unit or development site. Countywide screening should therefore use current SSURGO properties and engineering interpretations and should be supplemented by site-specific geotechnical investigation for design decisions.

Figure 32 through Figure 36 depict broad NRCS soil orders. Soil order is a taxonomic classification and does not, by itself, establish shrink-swell potential, collapse potential, corrosivity, salinity, bearing strength, erodibility, or other engineering limitations. Property-specific SSURGO/Web Soil Survey interpretations are needed to establish the location and extent of individual soil limitations.

BEAVER COUNTY

Problem soils are mainly found in closed basins, on valley floors, and in areas shaped by volcanic and alluvial processes. Playa environments and low-lying valleys commonly contain saline and sodic soils, where evaporation exceeds precipitation, and salts accumulate near the ground surface. Collapsible soils occur in broad alluvial fans and in deposits influenced by volcanic ash, particularly near the community of Beaver and surrounding agricultural areas, where these soils may settle rapidly when exposed to moisture. Gypsiferous and weakly cemented soils are present locally where sedimentary units are exposed at or near the surface. In upland areas, shallow soils over volcanic bedrock are widespread, limiting development opportunities outside valley bottoms because of limited soil depth and excavation challenges.

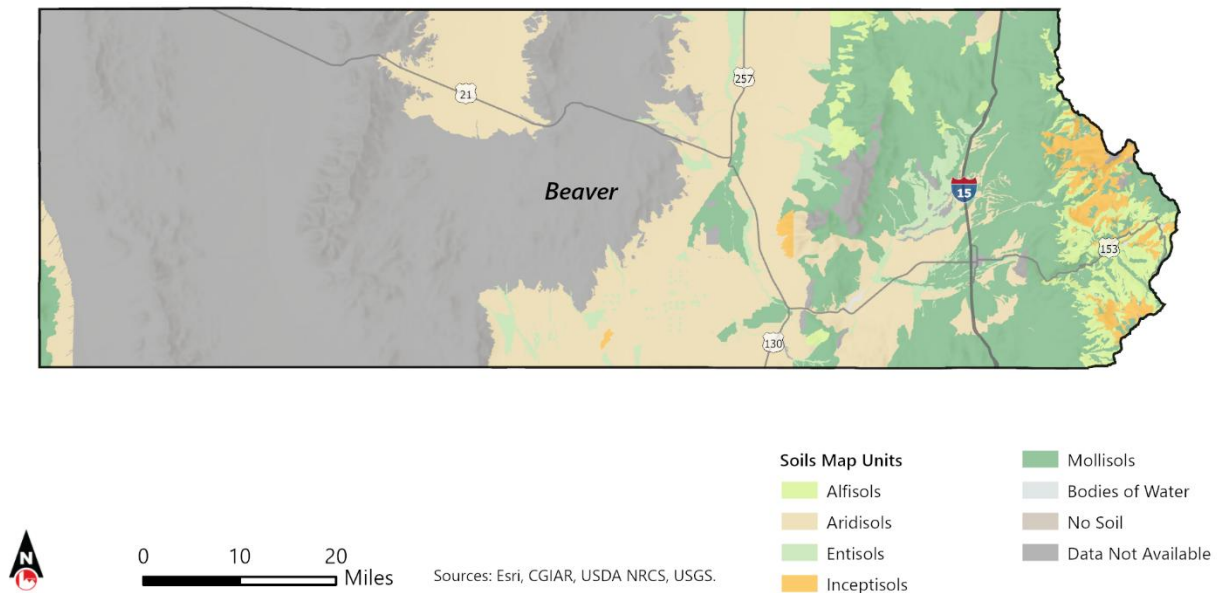


Figure 32: Beaver County Soils Classification Map

GARFIELD COUNTY

Problem-soil conditions reflect the county's Colorado Plateau geology and rugged terrain. Gypsiferous soils are widespread throughout the county, especially in areas underlain by gypsum-bearing sedimentary formations east of Bryce Canyon and within lower-elevation basins. Shallow, rocky, and highly erodible soils dominate canyon rims, plateaus, and steep slopes, limiting opportunities for construction and infrastructure placement. Saline soils occur in valley bottoms and localized depressions where drainage is restricted. Due to thin soil cover and steep slopes, erosion and slope instability are common concerns, especially following land disturbance or periods of intense rainfall.

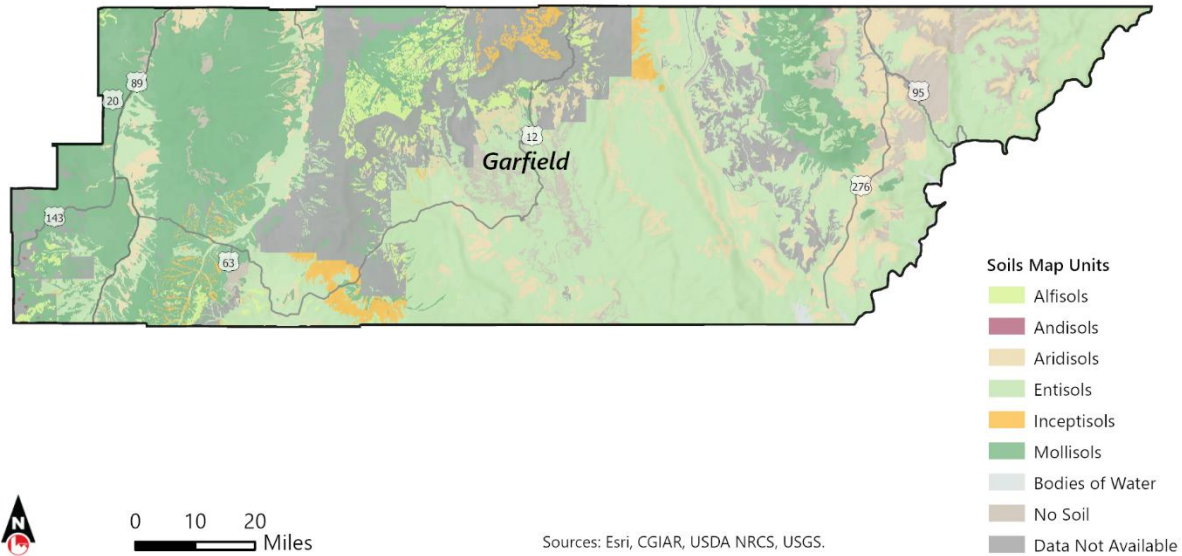


Figure 33: Garfield County Soils Classification Map

IRON COUNTY

Utah Geological Survey studies document collapsible-soil hazards in Cedar Valley, including developed areas of Cedar City and Enoch. Wetting of susceptible soils can cause settlement and damage structures or infrastructure. The occurrence and severity of other soil limitations depend on site materials and conditions; current NRCS Web Soil Survey information and site-specific geotechnical investigation are needed to evaluate those limitations.⁸²

⁸² Utah Geological Survey, Utah Geological Survey Releases Geologic Hazard Studies for Bryce Canyon and Cedar Valley, May 5, 2026, Cedar Valley study discussion; Collapsible Soil Hazard Map for the Cedar City, Utah Area, Contract Report 91-10, 1991, <https://geology.utah.gov/utah-geological-survey-releases-geologic-hazard-studies-for-bryce-canyon-and-cedar-valley/>; https://ugspub.nr.utah.gov/publications/contract_reports/cr-91-10.pdf. These sources establish local collapsible-soil concerns, not countywide engineering-property prevalence.

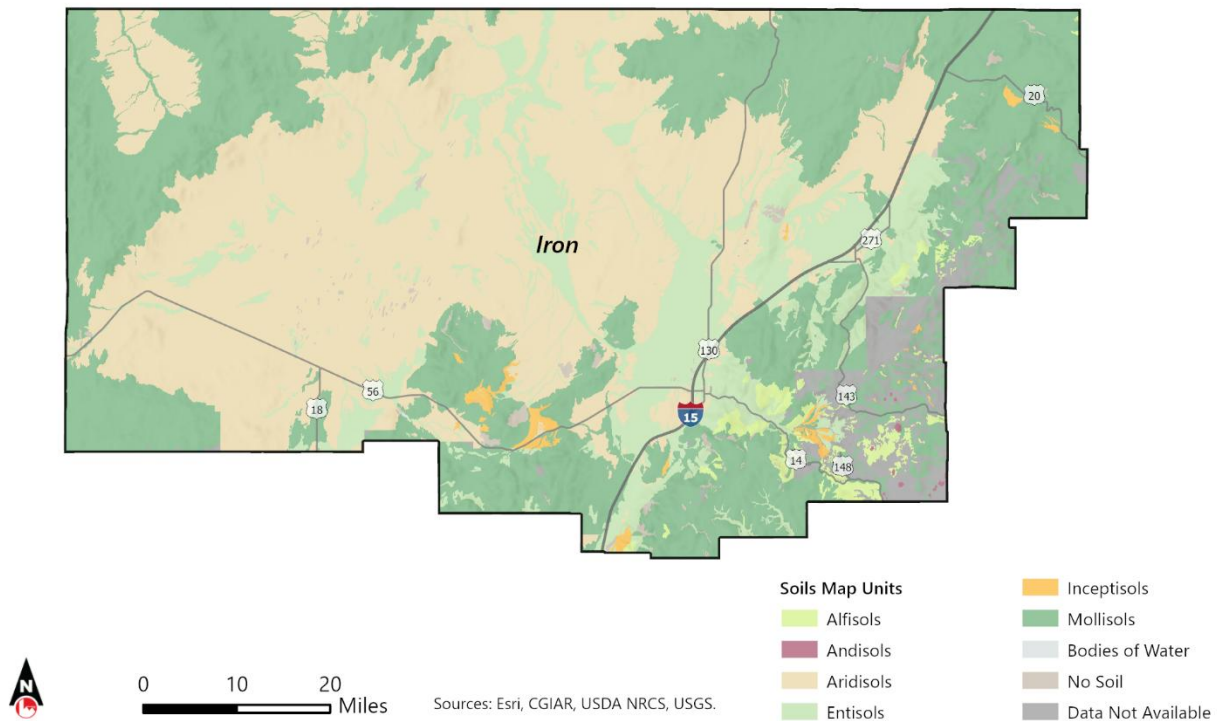


Figure 34: Iron County Soils Classification Map

KANE COUNTY

Problem soils tend to occur in distinct geographic settings tied to the county's valleys, alluvial plains, and underlying sedimentary geology. Valley floors and low-lying alluvial areas contain expansive and saline soils, particularly in and around the City of Kanab, adjacent to agricultural lands, and along Kanab Creek, where fine-grained alluvial sediments have accumulated. Gypsiferous soils are widespread across the Colorado Plateau portion of the county, especially in areas east and north of Kanab, where gypsum-rich sedimentary formations are exposed at or near the surface. In contrast, upland and canyon environments throughout the Grand Staircase–Escalante region are dominated by shallow, rocky soils with limited bedrock depth. These soils have a high erosion potential and constrain development due to excavation limitations and slope instability concerns.

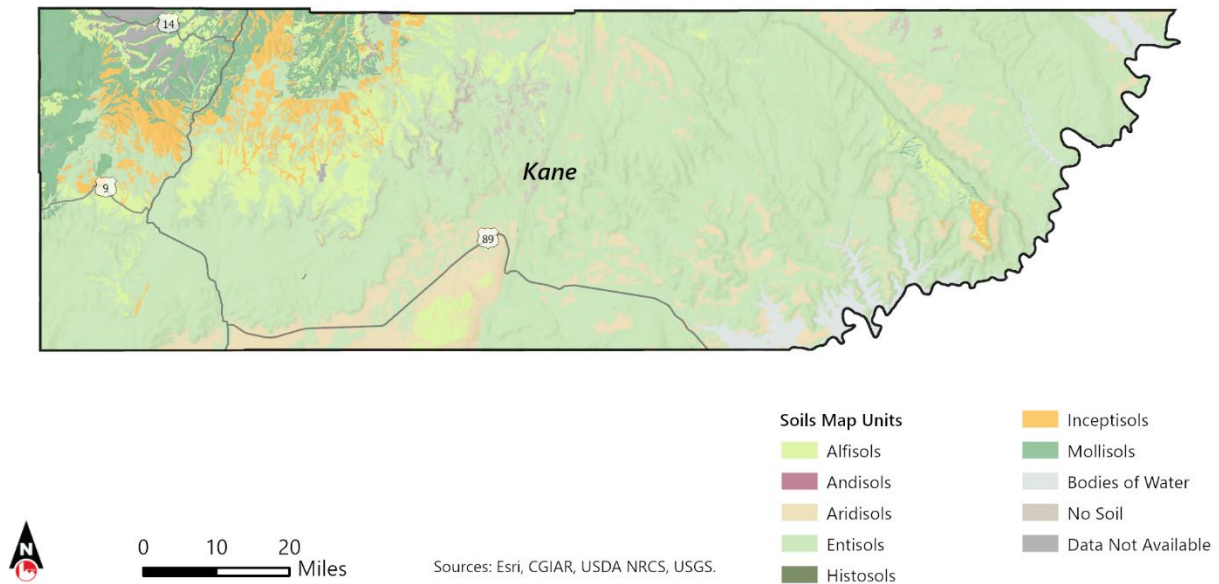


Figure 35: Kane County Soils Classification Map

WASHINGTON COUNTY

Some of the most extensively documented problem soils in southern Utah can be found in the county, largely due to rapid population growth and development. Expansive clay soils are widespread throughout the urban corridor, particularly in and around St. George, Washington City, Hurricane, and Ivins, where clay-rich Aridisols underlie much of the developed landscape. Collapsible soils are also common in alluvial-fan and wind-deposited sediments along valley margins and in expanding residential areas, where wetting can trigger settlement. Saline soils occur on lower terraces and historic floodplains, while shallow, rocky soils dominate the foothills and uplands surrounding the urban core. Collectively, these soil conditions can change markedly over short distances, increasing the risk to development in Washington County without site-specific geotechnical investigation.

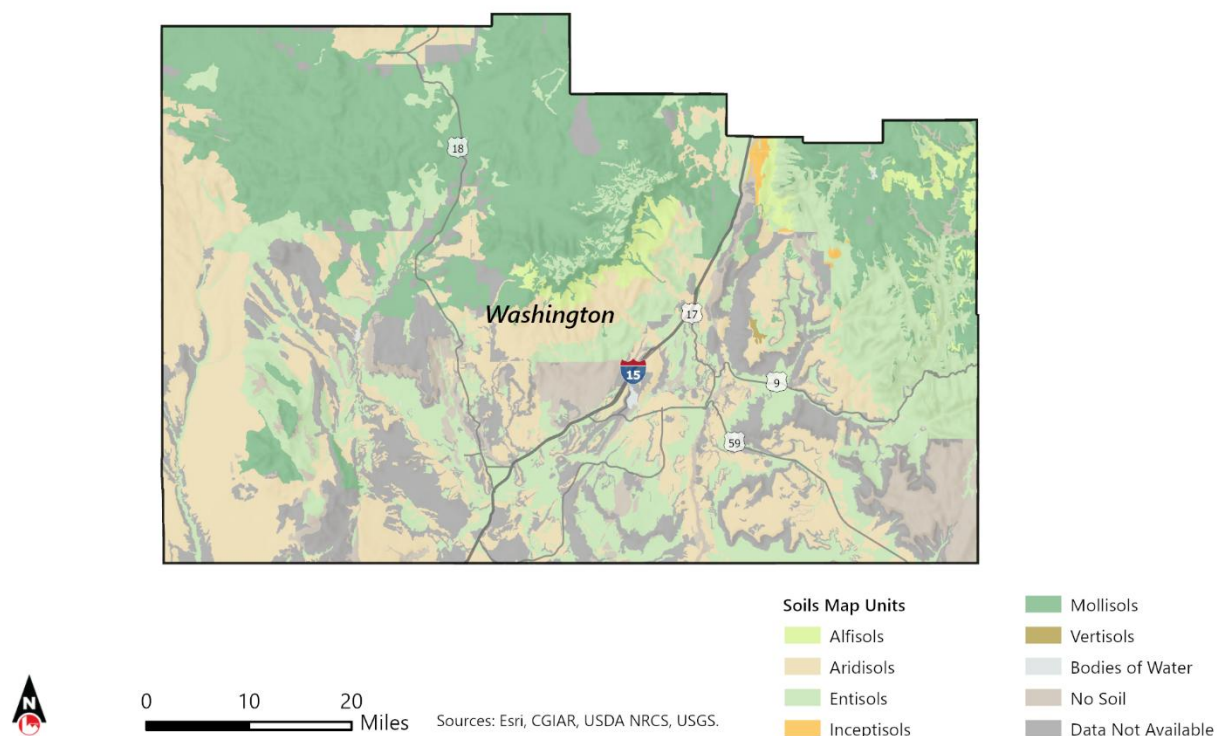


Figure 36: Washington County Soils Classification Map

Magnitude and Extent

Problem-soil extent varies by soil property, mapped component, depth, and landscape position. The available soil-order maps provide regional context but do not quantify the location or extent of individual engineering limitations. Accordingly, this profile characterizes extent qualitatively and does not assign county acreage or percentages without a reproducible SSURGO-based analysis.

Table 32 presents Expansion Index classifications for expansive soils under specified laboratory test conditions.

Table 32: Classification of Potential Expansion of Soils Using Expansion Index (EI)⁸³

Potential Expansion	Expansion Index (EI)
Very Low	0–20
Low	21–50
Medium	51–90
High	91–130

⁸³ ASTM International, "Standard Test Method for Expansion Index of Soils-ASTM D4829-11," 2011 (historical edition), accessed October 9, 2026, <https://store.astm.org/d4829-11.html>.

Potential Expansion	Expansion Index (EI)
Very High	>130

Table 32 classifies expansive-soil potential, not impact intensity or event magnitude. Higher Expansion Index values indicate greater potential for expansion under the test conditions, but the severity of damage also depends on soil thickness, moisture change, foundation and pavement design, drainage, construction quality, and maintenance. Other problem-soil conditions require separate indicators, such as electrical conductivity or salinity class, sodium-related ratings, collapse potential, gypsum content or dissolution susceptibility, corrosion ratings, depth to a restrictive layer, and erosion hazard. Where those measures are unavailable, the plan identifies potential concern areas without assigning a quantitative extent rating.

Previous Occurrences

No comprehensive, consistently maintained regional inventory of problem-soil damage was available for this update. Problem soils are persistent site conditions rather than discrete incidents, and damage may be recorded through building, public works, utility, permitting, geotechnical, or maintenance records rather than disaster databases. In the absence of a verified regional inventory, this profile does not assign dates, losses, injuries, or fatalities to specific problem-soil occurrences.

FEDERAL DECLARATIONS

FEMA disaster declarations do not use “problem soils” as a standard incident type. Soil-related damage may occur as a secondary effect of flooding, severe storms, earthquakes, landslides, or subsidence; therefore, the absence of a declaration titled for problem soils does not demonstrate that soil-related impacts have not occurred.

STATE DECLARATIONS

No verified state proclamation, executive order, or declaration specifically identifying problem soils was available for inclusion. This statement is limited to declarations specifically titled for the condition and does not exclude soil-related impacts associated with another declared hazard.

Probability of Future Occurrences

Problem soils, including expansive, collapsible, saline, gypsiferous, and shallow soils, are expected to continue affecting the Five County AOG planning area due to the region’s arid-to-semiarid weather, geologic conditions, soil composition, and ongoing land development patterns. Historical documentation and geologic mapping confirm that problem-soil conditions are widespread across all five counties, particularly in valley bottoms, alluvial fans, basin margins, and areas underlain by clay-rich or gypsum-bearing formations. These documented conditions demonstrate that problem soils are not isolated or unusual, but rather a continuing regional hazard closely tied to landscape position, geology, and moisture

variability. Because problem soils are persistent conditions, an event-recurrence probability is not assigned. Damaging manifestations are possible when susceptible soils coincide with moisture change, loading, excavation, inadequate drainage, or development. The likelihood of damage therefore varies by site and by the effectiveness of investigation, design, construction, and maintenance practices.

Future problem-soil risk may increase where weather variability, land-use change, or population growth increases exposure or changes soil moisture conditions. Long-term projections for southern Utah indicate increased precipitation variability, including longer dry periods punctuated by higher-intensity storm events, which may affect shrink-swell cycles and soil collapse where susceptible soils and site conditions coincide.⁸⁴ Population growth, particularly in Washington, Iron, and Kane Counties, is expected to drive continued residential, commercial, and infrastructure development into areas with known soil limitations, including valley margins and alluvial fan environments. Even in more rural counties such as Beaver and Garfield, continued dependence on limited transportation corridors and utility systems through problem-soil areas sustains vulnerability to soil-related damage.

Problem-soil conditions persist; the following factors influence the potential for damaging manifestations:

- Extensive areas of problem soils
- Seasonal precipitation, irrigation, and other moisture fluctuations that activate soil movement and affect wet-dry cycles
- Ongoing and projected development in valley floors, alluvial fans, and basin margins
- Continued exposure of transportation routes, utilities, residential structures, and other critical infrastructure to problem-soil conditions

Factors such as continued population growth, expanding development into geologically constrained areas, and increasing moisture variability may increase future problem-soil risk by expanding the number and concentration of people, structures, and infrastructure exposed to adverse soil conditions. As development and land use continue across county lands, potential property damage, infrastructure repair costs, and social and economic impacts related to problem soils may rise accordingly.

Future risk is expected to be driven primarily by changes in exposure, including development and infrastructure investment in areas with soil limitations. Moisture variability may affect shrink-swell, collapse, erosion, and gypsum-dissolution processes, but the direction and magnitude of change at a specific site cannot be determined without local soil, drainage, and climate information.

Vulnerability Assessment

Southwestern Utah's vulnerability to problem soils is shaped by its arid climate, complex geology, and development concentrated in valley floors, alluvial fans, basin margins, and plateau communities. Expansive, collapsible, saline, sodic, shallow, rocky, erodible, and locally gypsiferous soils can damage

⁸⁴ Utah Division of Emergency Management, "Climate Change," <https://hazards.utah.gov/wp-content/uploads/Utah-SHMP-Ch12-Climate-Change-1.pdf>.

buildings, roads, utilities, agricultural facilities, and critical infrastructure through settlement, shrink-swell movement, erosion, corrosion, reduced bearing capacity, and drainage limitations. Because these are persistent site conditions rather than discrete incidents, vulnerability depends on the coincidence of susceptible soils with exposed assets, moisture change, loading, excavation, drainage, design, construction, and maintenance practices.

BEAVER COUNTY

Beaver County's vulnerability is concentrated in valley bottoms, closed basins, and alluvial settings where saline, sodic, collapsible, shallow, and locally expansive soils overlap with Beaver, Milford, Minersville, agricultural areas, and connecting transportation and utility corridors. Although population and building density are comparatively low, dispersed settlement, long travel distances, and limited infrastructure redundancy can make localized failures consequential.

Homes, older buildings, schools, emergency facilities, local roads, bridge approaches, culverts, water and wastewater lines, septic systems, canals, laterals, corrals, barns, and equipment pads may experience foundation or slab cracking, uneven settlement, pavement distress, corrosion, drainage problems, pipe failure, or reduced agricultural productivity. Irrigation, stormwater infiltration, leaking pipes, and changing groundwater conditions can introduce moisture into collapsible or shrink-swell soils and worsen damage.

The most significant effects are likely to be recurring repair and maintenance costs rather than a single catastrophic loss. Older structures and infrastructure may be more susceptible where they predate modern geotechnical investigation, foundation design, drainage standards, or soil treatment. Vulnerable residents may be affected indirectly through housing damage, service interruptions, travel limitations, and increased repair costs.

Cascading impacts. Road settlement or foundation distress can restrict emergency response, school transportation, agricultural operations, and daily travel where alternate routes are limited. Breaks in water, wastewater, irrigation, or other buried utilities can interrupt service and saturate moisture-sensitive soils, producing additional settlement or instability; repeated repairs can also strain local budgets and divert funds from other capital and mitigation priorities.

Changes in development. Future exposure may increase where new homes, agricultural facilities, utilities, or transportation improvements extend across valley-floor and alluvial-fan soils. Even modest growth can add assets to constrained locations; applying current SSURGO screening, site-specific geotechnical investigation, moisture controls, and appropriate foundation and pavement design can limit the increase in vulnerability.

GARFIELD COUNTY

Garfield County's vulnerability reflects rugged terrain, dispersed communities, and widespread shallow, rocky, erodible, saline, and gypsiferous soils in plateau, canyon, basin, and valley settings. Communities such as Panguitch, Escalante, Boulder, Tropic, Cannonville, Henrieville, and Hatch, together with highways

and remote service corridors, have limited alternate access and may be affected even when soil-related damage is localized.

Homes, schools, emergency facilities, scenic byways, local roads, bridge approaches, culverts, water and wastewater systems, septic systems, campgrounds, visitor facilities, utilities, and agricultural infrastructure may experience foundation movement, erosion, washouts, settlement, corrosion, septic limitations, or loss of bearing capacity. Gypsum dissolution is an additional concern where water reaches susceptible materials, while shallow bedrock and steep slopes increase excavation and stabilization costs.

Tourism and recreation assets are important exposure considerations because access roads, campgrounds, and visitor-serving facilities often occupy constrained terrain. Agricultural lands may face salinity, drainage, and erosion problems that affect productivity and damage canals, ditches, pads, and farm roads. Older or remote infrastructure may be especially vulnerable where geotechnical data, drainage improvements, or maintenance access are limited.

Cascading impacts. Erosion, roadway settlement, culvert failure, or slope-adjacent soil instability can delay emergency response, school travel, deliveries, and visitor access between small communities and essential services. Utility or septic failures can interrupt basic services and add water to sensitive soils, while damage to recreation access can reduce seasonal revenue and extend recovery because repair resources are distant.

Changes in development. New housing, tourism facilities, utilities, and transportation improvements may increase exposure where construction extends into shallow, steep, erodible, or gypsum-bearing terrain. Growth may remain limited in scale, but site constraints can raise per-project costs and long-term maintenance obligations; early geotechnical screening, drainage design, erosion control, and careful siting are therefore important.

IRON COUNTY

Iron County has elevated vulnerability because rapid growth and concentrated development overlap with documented collapsible-soil hazards in Cedar Valley and other site-specific limitations in valley and alluvial-fan settings. Exposure is greatest in Cedar City, Enoch, Parowan, Paragonah, and developed portions of Cedar and Parowan Valleys, where homes, schools, businesses, roads, utilities, and public facilities occupy basin fill and variable alluvial deposits.

Residential subdivisions, commercial buildings, schools, critical facilities, roads, sidewalks, bridge approaches, water and wastewater lines, storm drainage, septic systems, irrigation works, and agricultural facilities may experience settlement, shrink-swell movement, cracking, corrosion, erosion, or reduced bearing capacity. Irrigation, leaking utilities, shallow groundwater, stormwater infiltration, and wet-dry cycles can activate moisture-sensitive soils and increase cumulative damage.

Because the county has a comparatively large and concentrated built environment, localized failures can affect many residents and impose substantial cumulative costs. Newer growth areas on alluvial fans or basin margins may encounter soil conditions that vary over short distances, while older buildings and

infrastructure may lack modern geotechnical design or moisture-control measures. Indirect effects can include housing damage, utility interruptions, travel delays, and disruption to schools or essential services.

Cascading impacts. Foundation distress, pavement settlement, or utility failure can interrupt access to homes, schools, medical services, businesses, and emergency facilities. Water, sewer, storm-drainage, or irrigation leaks can saturate collapsible or expansive soils and worsen damage; repeated repairs can affect business continuity, agriculture, municipal budgets, and the reliability of rapidly expanding service systems.

Changes in development. Continued residential, commercial, and infrastructure expansion around Cedar City, Enoch, and other valley communities is likely to increase the number and value of exposed assets. Extending roads and utilities into alluvial-fan and basin-margin settings can create long-lived maintenance obligations unless site-specific investigation, engineered foundations, drainage controls, construction inspection, and disclosure of soil limitations are incorporated early.

KANE COUNTY

Kane County's vulnerability is shaped by valley-floor development, dispersed rural communities, tourism infrastructure, and expansive, saline, gypsiferous, shallow, rocky, erodible, and locally collapsible soils. Exposure is concentrated in and around Kanab, Orderville, Alton, Glendale, Big Water, agricultural valleys, and transportation and utility corridors serving remote recreation destinations.

Homes, schools, lodging, emergency facilities, roads, bridge approaches, culverts, water and wastewater systems, septic systems, campgrounds, park access roads, utilities, and agricultural facilities may experience cracking, settlement, erosion, corrosion, drainage limitations, or localized loss of bearing capacity. Irrigation, leaks, stormwater infiltration, intense rainfall, and wet-dry cycles can activate expansive, collapsible, or gypsiferous soils.

Transportation and utility systems are particularly important because they connect widely separated communities, public lands, visitor destinations, and essential services with limited redundancy. Older structures may lack current geotechnical design, and agricultural lands may experience salinity, drainage, and erosion problems that affect productivity and damage canals, ditches, pads, and access roads.

Cascading impacts. Road distortion, erosion, or culvert failure can delay emergency response, school transportation, agricultural activity, and visitor movement. Water, wastewater, septic, or utility failures can interrupt basic services and introduce moisture that worsens soil instability; damage to park access, campgrounds, or lodging areas can also reduce tourism activity and seasonal revenue.

Changes in development. Growth around Kanab and other valley communities, together with continued visitor demand, may place additional structures and infrastructure on fine-grained alluvium, plateau margins, and gypsum-bearing formations. Careful siting, geotechnical investigation, engineered foundations, drainage and erosion controls, and realistic maintenance planning can reduce the vulnerability added by new development.

WASHINGTON COUNTY

Washington County has the region's greatest concentration of exposure because rapid population growth and extensive urban and suburban development overlap with expansive, collapsible, saline, shallow, erodible, and locally gypsiferous soils. Vulnerability is greatest in the St. George–Hurricane corridor and communities including Washington City, Santa Clara, Ivins, La Verkin, and Toquerville, where development occupies alluvial fans, floodplain terraces, and basin margins with variable soil properties.

Residential subdivisions, multifamily housing, schools, hospitals, emergency facilities, commercial centers, roads, bridge approaches, sidewalks, retaining walls, storm drainage, water and wastewater systems, irrigation works, parks, and utility corridors may experience foundation movement, cracking, settlement, pavement distress, corrosion, erosion, or service-line failure. Landscaping, irrigation, stormwater infiltration, leaks, shallow groundwater, and pronounced wet-dry cycles can intensify these effects.

The density and value of exposed assets mean that localized soil-related damage can affect many people and produce substantial cumulative economic losses. Healthcare, education, commerce, tourism, and public safety may be indirectly affected when access or utilities fail. Older infrastructure may lack modern moisture controls, while new development may encounter sharply changing conditions over short distances.

Cascading impacts. Foundation movement, road settlement, or buried-utility failure can interrupt access to homes, schools, hospitals, businesses, and emergency facilities. Leaking water, wastewater, storm-drainage, or irrigation systems can worsen settlement or heave by saturating susceptible soils, and repeated repairs can strain public, district, business, and household budgets while disrupting commerce and essential services.

Changes in development. Continued expansion along the urban corridor is likely to increase both the number and value of assets exposed to problem soils, particularly on alluvial fans and valley margins. Avoidance where feasible, property-specific geotechnical investigation, engineered foundations and pavements, soil treatment, drainage and irrigation controls, construction quality assurance, and long-term maintenance can reduce the vulnerability created by future development.

Radon Gas

Radon is a naturally occurring, colorless, odorless, and tasteless radioactive gas produced by the radioactive decay of uranium found in soil, rock, and groundwater. As uranium breaks down, it forms radium, which further decays into radon gas. Because uranium is present in varying concentrations throughout Earth's crust, radon occurs nationwide and can affect urban, rural, and Tribal areas alike. Radon gas moves upward through soil and rock fractures and can enter buildings through cracks in foundations, floor drains, sump pumps, construction joints, and other openings, where it can accumulate

to elevated levels, particularly in enclosed or poorly ventilated spaces such as basements and crawlspaces.⁸⁵

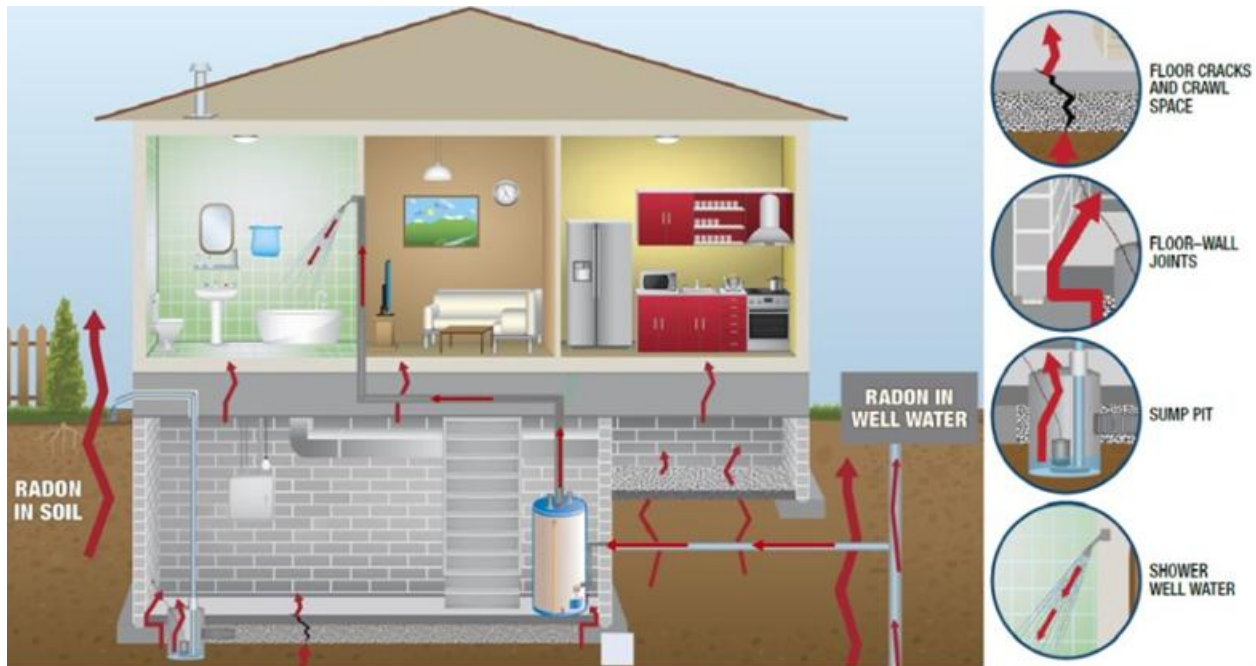


Figure 37: How Radon Enters Homes and Buildings⁸⁶

When inhaled, radon and its radioactive decay products emit ionizing radiation that can damage lung tissue. Long-term exposure to elevated indoor radon concentrations significantly increases the risk of lung cancer. Radon is the second leading cause of lung cancer in the United States and the leading cause of lung cancer among nonsmokers. The U.S. Environmental Protection Agency (EPA) estimates that radon exposure is responsible for roughly 21,000 lung cancer deaths each year nationwide. There is no known safe level of radon exposure, and health risk increases with radon concentration and duration of exposure.

Radon levels vary widely due to differences in local geology, soil permeability, building construction, and ventilation.⁸⁷ Elevated radon concentrations have been documented in every state, including areas not traditionally associated with high radon potential. Because radon is undetectable by human senses, testing is the only way to determine indoor radon levels. The EPA recommends mitigation actions for buildings with radon concentrations at or above 4 picocuries per liter (pCi/L) of air.⁸⁸

⁸⁵ U.S. Environmental Protection Agency, "Radon," 2026, <https://www.epa.gov/radon>.

⁸⁶ Adapted from Conference of Radiation Control Program Directors, Reducing the Risk from Radon: Information and Interventions—A Guide for Health Care Providers, Publication E-18-2, 2018, p. 2. https://crcpd.org/wp-content/uploads/2023/12/E-18-2HealthCareProfessionalsGuide_Radon_2018.pdf.

⁸⁷ U.S. Environmental Protection Agency, "Where Does Radon Come From?" 2026, <https://www.epa.gov/radon/where-does-radon-come>.

⁸⁸ U.S. Environmental Protection Agency, "Radon Risks and Solutions," 2026, <https://www.epa.gov/radon/radon-risks-and-solutions>.

Location

The five-county region features a diverse range of geologic, topographic, and climatic conditions that influence radon potential. This region spans the Basin and Range Province and the Colorado Plateau, both of which contain rock types and soil formations that can naturally produce radon gas. Many areas within the region contain sedimentary and volcanic rock formations, fractured bedrock, and permeable soils, which can allow radon to move upward and enter homes and buildings.

The region includes rural communities, small towns, and growing urban centers. Indoor radon potential cannot be inferred from development patterns or the availability of prior tests; each occupied building requires testing to establish its radon concentration. Elevation varies across the region, from lower desert valleys to higher plateaus and mountainous terrain, contributing to localized differences in radon potential. In addition, seasonal temperature changes and building ventilation patterns can affect indoor radon concentrations, especially during colder months when buildings are more tightly sealed.

Radon concentration in air is expressed in picocuries per liter (pCi/L). Figure 38 is reproduced from the 2019 Utah State Hazard Mitigation Plan and provides historical screening information. Because the underlying test period, sample size, geographic aggregation, and representativeness are not documented in this section, the figure is not used to quantify current county exposure or vulnerability.

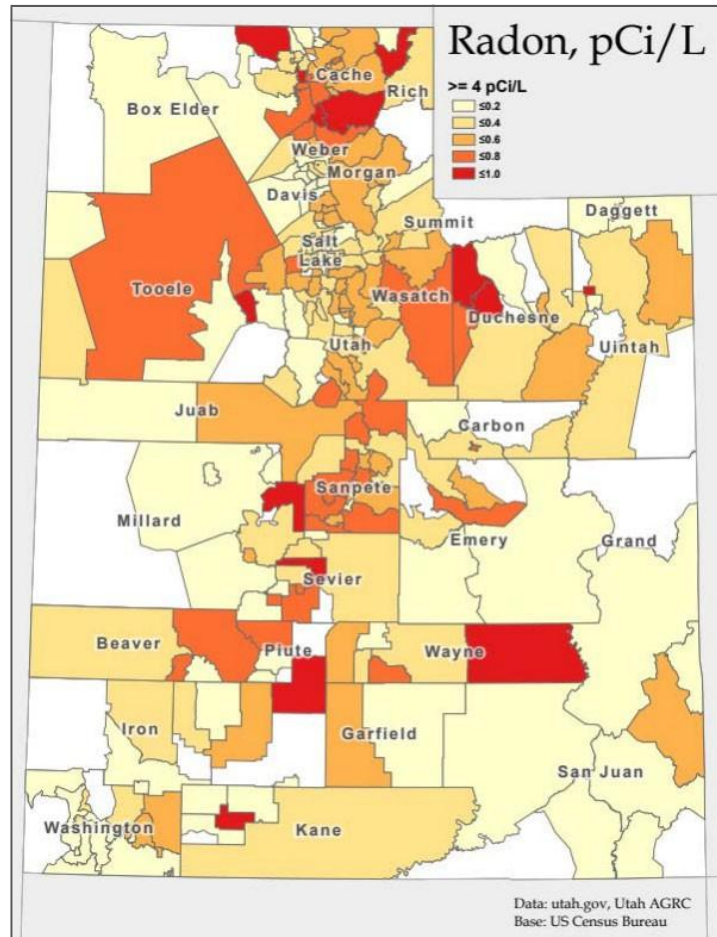


Figure 38: Radon, pCi/L Range of Magnitude by County, Utah⁸⁹

The 2024 Utah State Enhanced Hazard Mitigation Plan summarizes how radon was ranked in local mitigation plans. In the reproduced map, Beaver County is shown as Moderate and Garfield, Iron, Kane, and Washington Counties are shown as Low. This map represents local-plan hazard rankings rather than measured indoor radon concentrations; therefore, it should not be used as a substitute for current testing data (see Figure 39).

⁸⁹Utah Division of Emergency Management, 2019 Utah State Hazard Mitigation Plan, Chapter 8, Map 16, "Radon, pCi," <https://hazards.utah.gov/wp-content/uploads/Utah-SHMP-Ch8-Geologic-Hazards.pdf>.

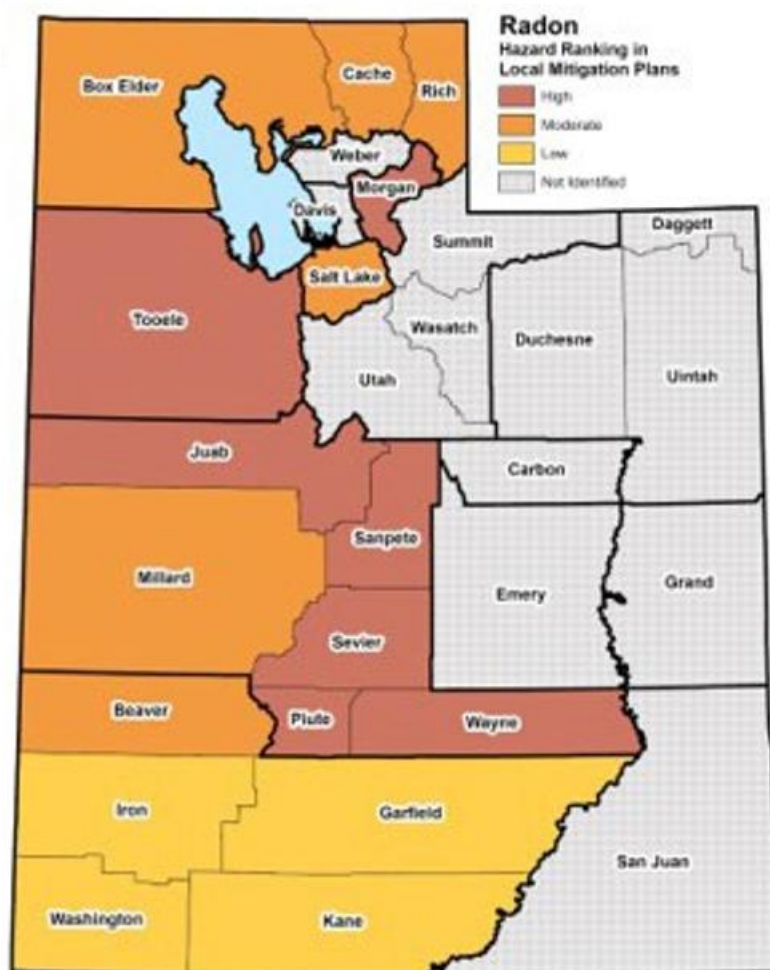


Figure 39: Radon Geological Hazard Ranking in Local Mitigation Plans, Map by County⁹⁰

The EPA Map of Radon Zones classifies all five counties as Zone 2, meaning the predicted average indoor screening level is between 2 and 4 pCi/L. EPA zones were developed to identify areas with the potential for elevated indoor radon and do not predict the concentration in an individual building. EPA recommends fixing homes at or above 4 pCi/L and considering corrective action between 2 and 4 pCi/L because no known level of radon exposure is risk-free. Testing is necessary to characterize each building.

Figure 40 displays reported counts of pre-mitigation radon tests by county for the cited query. It does not show measured concentration, the percentage of tests at or above 4 pCi/L, or the number of untested buildings. Because testing is voluntary and the map does not provide a population-based sample, it is used only to describe the availability and geographic distribution of reported tests and not to estimate countywide prevalence.

⁹⁰Utah Division of Emergency Management, 2024 Utah Enhanced State Hazard Mitigation Plan, Section 4.10.8, Table 4-63 and Figure 4-92 (local-plan radon significance rankings). <https://hazards.utah.gov/wp-content/uploads/GeologicHazardChapterHMP.pdf>.

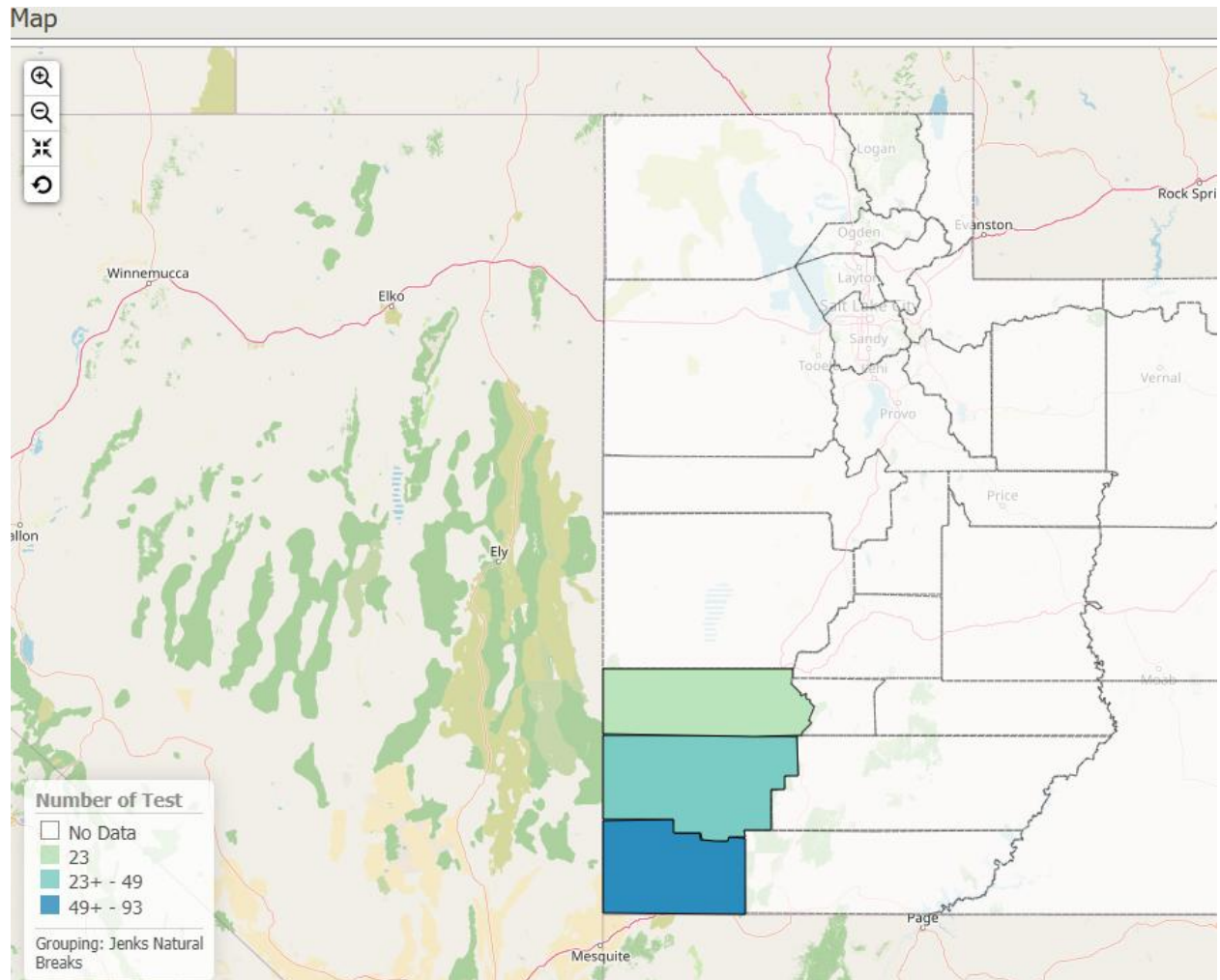


Figure 40: 2022 Map of Number of Pre-Mitigation Radon Tests on Buildings (Five County AOG Region)⁹¹

Radon risk in the area is generally localized rather than uniform, meaning that elevated indoor radon levels can occur in any county or community regardless of broader regional trends. As a result, radon presence is considered a location-based hazard affecting all five counties, with potential impacts wherever occupied structures exist. Because radon cannot be detected without testing, its geographic distribution is best understood at the site-specific level rather than through visual or environmental indicators.

Magnitude and Extent

The extent of radon is measured by the concentration of radon gas present in indoor air and is expressed in picocuries per liter (pCi/L). The U.S. EPA has established an action level of 4.0 pCi/L, at or above which mitigation is recommended to reduce long-term health risks. Radon concentrations between 2.0 and 3.9

⁹¹ Utah.Gov, "Utah Environmental Public Health Tracking Portal: Map of Pre-Mitigation Radon Testing of Buildings in Five County Region," 2022, <https://ibis.utah.gov/epht-view/query/result/radon/RadonNumberTest/Count.html>.

pCi/L are considered moderate, and mitigation should be considered at these levels.⁹² As a result, the extent of radon in the five-county region is best defined by indoor testing results rather than by geographic boundaries, with severity increasing as measured concentrations exceed EPA guidance levels.

While radon does not have an intensity scale like earthquakes or hurricanes, the EPA uses concentration ranges to describe the extent and severity of radon exposure risk, as displayed in Table 33.

Table 33: Radon Severity Scale⁹³

Extent and Severity Interpretation	Radon Level (pCi/L)
Average outdoor background level	~0.4 pCi/L
U.S. average indoor level	~1.3 pCi/L
Moderate extent – EPA recommends considering mitigation	2.0–3.9 pCi/L
High extent – EPA action level; mitigation recommended	≥ 4.0 pCi/L

Radon concentration can range from approximately 0.4 pCi/L in outdoor air to substantially higher indoor levels. EPA estimates the national average indoor level at about 1.3 pCi/L, recommends considering corrective action between 2 and 4 pCi/L, and recommends fixing homes at or above 4 pCi/L. Health risk increases with concentration and duration of exposure; the action level is not a boundary between safe and unsafe conditions.

Previous Occurrences

Radon is a naturally occurring hazard that does not manifest as a discrete or sudden event and therefore does not meet the criteria for a disaster declaration under the Stafford Act. Because radon is a persistent indoor environmental condition rather than a discrete incident, the plan evaluates occurrence through indoor testing and exposure information rather than an event chronology. State agencies recognize radon as a leading cause of lung cancer and the deadliest geologic hazard in the state, with impacts occurring gradually over extended periods of exposure rather than through immediate or observable incidents.⁹⁴

FEDERAL DECLARATIONS

FEMA disaster declarations are not an appropriate measure of radon occurrence because radon is a chronic indoor hazard rather than a discrete disaster incident. Accordingly, this profile does not use declaration records to estimate radon frequency, location, or exposure.

⁹² U.S. Environmental Protection Agency, "What Is EPA's Action Level for Radon and What Does It Mean?" 2026, <https://www.epa.gov/radon/what-epas-action-level-radon-and-what-does-it-mean>.

⁹³ U.S. Environmental Protection Agency, "What Is EPA's Action Level."

⁹⁴ Utah Geological Survey, "Radon Gas Hazards," <https://geology.utah.gov/hazards/problem-soils/radon/>.

STATE DECLARATIONS

State declarations are likewise not used to characterize radon occurrence or exposure. Indoor testing data and building-specific follow-up provide the relevant evidence for this hazard.

Probability of Future Occurrences

Radon exposure is expected to continue across all five counties due to the area's geological conditions. Statewide information confirms that elevated indoor radon occurs in Utah, but the available information in this section does not establish a representative prevalence rate for each county or participating jurisdiction.⁹⁵ Because radon is continuously generated and building concentrations vary over time, the plan's discrete-event recurrence categories are not applicable. The likelihood that an individual building has an elevated concentration can be determined only through testing.

Future radon risk is expected to persist and potentially increase as residential and commercial development continues across the region. Growth in Washington and Iron Counties, as well as ongoing infill and rural development in Beaver, Kane, and Garfield Counties, will increase the number of occupied structures potentially exposed to radon. New construction occurring in previously undeveloped areas may lack site-specific radon testing data, and unless radon-resistant construction practices and post-construction testing are routinely implemented, future buildings may unknowingly expose occupants to elevated radon levels. Existing homes and public buildings that have not been tested or mitigated will also remain vulnerable.

Future changes in radon risk are expected to be driven primarily by the number and type of occupied ground-contact buildings, testing rates, radon-resistant construction, mitigation, and occupancy patterns. This profile does not assign a climate-driven trend because the available evidence does not support a region-specific projection of indoor radon concentrations.⁹⁶ Differences in awareness, access to testing resources, and mitigation implementation across the five counties may further influence future risk. Without increased education, testing, and mitigation efforts, elevated radon levels may remain undetected for extended periods, prolonging exposure.

Radon remains a continuing planning concern because of the following factors:

- Region-wide geological conditions that continuously generate radon gas
- The presence of residential, public, and critical facilities with direct ground contact
- Ongoing population growth and development that increase the number of exposed structures

Radon exposure will remain a continuing planning concern. New development can increase the number of potentially exposed occupants and buildings, while testing, radon-resistant construction, and mitigation

⁹⁵ Utah Geological Survey, "Radon Gas Hazards."

⁹⁶ F. K. T. Stanley et al., "Radon Exposure Is Rising Steadily within the Modern North American Residential Environment, and Is Increasingly Uniform across Seasons," *Scientific Reports* 9 (2019): 18472, <https://www.nature.com/articles/s41598-019-54891-8>.

can reduce risk. The direction and magnitude of future risk depend on those offsetting factors and are not quantified in this profile.

Vulnerability Assessment

The five-county planning area is broadly vulnerable to radon because naturally occurring gas can migrate from soil and rock into any occupied ground-contact building and accumulate indoors. Vulnerability is governed by site-specific geology, soil permeability, foundation and ventilation conditions, occupancy, and whether a building has been tested and mitigated. EPA classifies Beaver, Garfield, Iron, Kane, and Washington Counties as Zone 2, indicating predicted average indoor screening levels between 2 and 4 pCi/L; however, this generalized classification does not predict conditions in an individual structure. Homes, rental housing, schools, childcare facilities, healthcare and assisted-living facilities, government buildings, workplaces, lodging, and other frequently occupied structures are therefore vulnerable throughout the region. Consequences are primarily chronic public-health, economic, and operational burdens rather than sudden structural damage, and representative countywide testing and mitigation data are not available to support a comparative county rating.

BEAVER COUNTY

Beaver County's exposed assets include homes and rental housing, schools and childcare facilities, healthcare and assisted-living facilities, government buildings, businesses, and other occupied ground-contact structures. EPA's Zone 2 classification indicates a predicted average indoor screening level of 2 to 4 pCi/L, but only building-specific testing can determine whether concentrations exceed EPA guidance.

Susceptibility is greater in buildings with basements, crawlspaces, slab-on-grade foundations, cracks, utility penetrations, or limited ventilation. The county's dispersed communities, older structures, and distance from testing or mitigation providers may delay detection and corrective action. Fewer people and buildings are exposed than in the region's larger counties, but prolonged undetected exposure can still create substantial individual health consequences.

The principal consequence is cumulative lung-cancer risk for occupants of untested or unmitigated buildings. Property owners and public agencies may also incur testing, follow-up, and mitigation costs. These expenses and provider travel may be especially burdensome for lower-income households, landlords, and owners of remote or older properties.

Cascading impacts: Delayed detection can extend exposure for years, increasing potential medical and household burdens. A high test result may lead to follow-up testing, contractor scheduling, temporary building-use disruptions, deferred maintenance, or complications during a property transaction. Elevated results in schools, healthcare facilities, or public buildings could also require risk communication, reprioritized capital funding, and operational adjustments while corrective work is completed.

Changes in development: Infill and rural development will add occupied ground-contact structures and may increase the number of people potentially exposed. New construction can reduce vulnerability when

radon-resistant features and post-construction testing are used; without them, development may create additional unrecognized exposure. Renovation, weatherization, or changes that tighten a building envelope may also alter indoor accumulation, supporting testing after major construction or occupancy changes.

GARFIELD COUNTY

Garfield County's exposed assets include homes and rental housing, schools and childcare facilities, healthcare and assisted-living facilities, government buildings, businesses, lodging, and other occupied ground-contact structures. EPA's Zone 2 classification indicates a predicted average indoor screening level of 2 to 4 pCi/L, but it is not a substitute for testing individual buildings.

Vulnerability is influenced by foundation type, soil contact, cracks and penetrations, and ventilation. Dispersed communities, older buildings, seasonal or visitor-serving properties, and long travel distances to qualified service providers may prolong the period between testing and mitigation. Although the county has relatively few permanent residents and structures, residents, workers, and visitors may all occupy buildings with unknown radon concentrations.

The primary impact is long-term lung-cancer risk from repeated exposure in untested or unmitigated spaces. Owners of homes, lodging, businesses, and public facilities may face testing and mitigation costs. Remote locations and a limited contractor base may add time or expense, while elevated results can affect occupancy decisions and property or lodging marketability.

Cascading impacts: Undetected radon can compound health and financial effects over time. When elevated levels are found, follow-up testing and corrective work may disrupt households, lodging operations, schools, or public services and may require additional outreach to residents and visitors. Limited local capacity can delay work, and households or small businesses unable to fund mitigation may defer action, extending exposure and increasing inequities.

Changes in development: New homes, visitor accommodations, and public-serving facilities will expand the inventory of potentially exposed buildings. Radon-resistant construction and verification testing can reduce that added vulnerability; absent those measures, growth in previously undeveloped areas may create structures with unknown conditions. Rehabilitation or energy-efficiency work that changes ventilation can also affect indoor concentrations, making testing appropriate after substantial building changes.

IRON COUNTY

Iron County's exposed assets include homes and multifamily housing, schools and childcare facilities, healthcare and assisted-living facilities, government buildings, commercial buildings, and other frequently occupied ground-contact structures. EPA's Zone 2 classification indicates a predicted average indoor screening level of 2 to 4 pCi/L, while individual buildings may be above or below that range and require testing to characterize exposure.

The concentration of population and development in and around Cedar City and other communities increases the number of residents, workers, and students potentially exposed. Buildings with basements, crawlspaces, slab-on-grade construction, foundation openings, or limited ventilation are susceptible, and older untested structures may retain long-standing vulnerability. Multifamily and rental occupants may have less control over testing and mitigation decisions.

The dominant impact is cumulative lung-cancer risk in residences and frequently occupied facilities. Testing, follow-up, and mitigation also impose costs on households, landlords, businesses, school districts, healthcare providers, and public agencies. Elevated results may delay property transactions or occupancy and require corrective work in facilities serving large populations.

Cascading impacts: Prolonged undetected exposure may increase future health and medical burdens across a growing population. Discovery of elevated radon in an apartment complex, school, healthcare facility, or government building can trigger additional testing, tenant or public notification, capital-funding decisions, and temporary operational disruption. Uneven access to testing and mitigation may disproportionately affect renters, lower-income households, and occupants of older facilities.

Changes in development: Continued residential, commercial, institutional, and multifamily construction will increase the number of occupied ground-contact spaces and the aggregate population potentially exposed. Consistent use of radon-resistant construction and post-construction testing can offset this increase; otherwise, rapid growth may add unrecognized exposure faster than testing and mitigation occur. Infill, renovation, and energy-efficiency upgrades also warrant attention because foundation or ventilation changes can affect indoor radon accumulation.

KANE COUNTY

Kane County's exposed assets include homes and rental housing, schools and childcare facilities, healthcare facilities, government buildings, businesses, lodging, seasonal housing, and other frequently occupied ground-contact structures. EPA's Zone 2 classification indicates a predicted average indoor screening level of 2 to 4 pCi/L, but generalized mapping cannot establish the concentration in any individual building.

Susceptibility is shaped by foundations and soil contact, cracks and penetrations, and ventilation. Dispersed communities, seasonal occupancy, visitor-serving properties, and long distances to testing and mitigation providers may delay detection or corrective action. The county's smaller permanent population limits aggregate exposure relative to larger counties, but residents, seasonal workers, and visitors can still experience prolonged exposure in untested buildings.

The principal consequence is cumulative lung-cancer risk, accompanied by testing and mitigation costs for households, lodging operators, businesses, and public agencies. Travel and contractor availability may increase costs or scheduling time, and elevated results may complicate property transfers, lodging operations, or continued occupancy.

Cascading impacts: Because radon produces no immediate warning, exposure may continue for years before testing identifies a problem. A high result can lead to repeat testing, public or guest communication, contractor scheduling, and temporary disruption of homes, lodging, schools, or government facilities. Limited service availability and mitigation affordability may extend exposure, while concern about elevated results can affect housing or lodging marketability.

Changes in development: Additional housing, seasonal residences, lodging, and public facilities will expand the number of structures requiring testing and potential mitigation. Radon-resistant construction and testing after occupancy can reduce vulnerability; without these practices, tourism-related and residential growth may increase both short- and long-term exposure. Renovations or weatherization that alter air exchange can also change indoor concentrations and should prompt testing.

WASHINGTON COUNTY

Washington County's exposed assets include homes and multifamily housing, schools and childcare facilities, healthcare and assisted-living facilities, government and commercial buildings, lodging, and other frequently occupied ground-contact structures. EPA's Zone 2 classification indicates a predicted average indoor screening level of 2 to 4 pCi/L; however, testing is needed because an individual building may have a substantially different concentration.

The county's large population, high housing concentration, and sustained development in and around St. George, Washington, Hurricane, Santa Clara, and other communities create the region's largest aggregate inventory of potentially exposed occupants and buildings. Susceptible structures include those with slabs, crawlspaces, basements, foundation openings, or limited ventilation. Older untested buildings remain vulnerable, while renters and multifamily occupants may depend on owners or managers to authorize corrective action.

The primary impact is cumulative lung-cancer risk across residences, schools, healthcare settings, lodging, workplaces, and public facilities. Testing and mitigation costs may affect households, landlords, lodging operators, businesses, school districts, healthcare providers, and local governments. The county's larger building inventory means that even a limited share of elevated structures could create substantial aggregate testing, communication, and capital needs.

Cascading impacts: Delayed detection can extend exposure across large households, apartment populations, student bodies, patients, employees, and guests. Elevated results in multifamily housing or major public-serving facilities may trigger broad follow-up testing, tenant or public notification, funding decisions, and temporary disruptions during mitigation. Property transfers or leasing may be delayed, and inability to afford corrective work can create disproportionate burdens for lower-income households and renters.

Changes in development: Continued residential, commercial, educational, healthcare, and lodging development will add occupied ground-contact buildings and increase potential aggregate exposure. Routine use of radon-resistant construction and post-construction testing can materially reduce this added risk; without those measures, rapid growth may expand the stock of untested buildings. Infill,

renovation, and energy-efficiency improvements that change foundations or ventilation also support retesting so that development does not unintentionally increase indoor accumulation.

Thunderstorm and Lightning

Thunderstorms

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder. Thunderstorms may occur as individual cells, clusters, or lines and can produce lightning, strong outflow winds, hail, tornadoes, and brief heavy rainfall. Duration, organization, and impacts vary by storm type and atmospheric conditions.

Associated hazards include damaging winds, hail, tornadoes, flash flooding, and wildfire ignition. Dry thunderstorms occur when precipitation evaporates before reaching the ground while cloud-to-ground lightning remains possible. These storms are an important wildfire-ignition concern in the western United States. Flash-flood consequences associated with thunderstorm rainfall are addressed in the flooding profile and are not quantified here without a defined, current source period.

TYPES OF THUNDERSTORMS⁹⁷

- **Single-Cell Thunderstorms:** Also called “popcorn” convection, these are small, brief, weak storms that grow and die within an hour or so. They are typically driven by heating on a summer afternoon. Single-cell storms may produce brief heavy rain and lightning.
- **Multicell Thunderstorms:** This is the most common type of thunderstorm, in which new updrafts form along the leading edge of rain-cooled air (the gust front). Individual cells usually last 30 to 60 minutes, while the system as a whole may last for many hours. Multicell storms may produce hail, strong winds, brief tornadoes, and/or flooding.
- **Squall Line:** A small group of storms arranged in a line, often accompanied by “squalls” of high wind and heavy rain, a squall line tends to pass quickly and is less prone to producing tornadoes than are supercells. Squall lines can be hundreds of miles long but are typically only 10 or 20 miles wide.
- **Supercell:** A supercell is a long-lived (greater than 1 hour) and highly organized storm feeding off an updraft (a rising current of air) that is tilted and rotating. This rotating updraft—as large as 10 miles in diameter and up to 50,000 feet tall—can be present as much as 20 to 60 minutes before a tornado forms. This rotation is called a mesocyclone when it is detected by Doppler radar. The tornado is a very small extension of this larger rotation. Most large and violent tornadoes come from supercells.

⁹⁷ National Oceanic and Atmospheric Administration, National Severe Storms Laboratory, “Severe Weather 101: Thunderstorms, Thunderstorm Types,” 2026, <https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/types/>.

Lightning

Lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges build up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning. The flash of lightning temporarily equalizes the charged regions in the atmosphere until the opposite charges build up again. Lightning can occur between opposite charges within the thunderstorm cloud (intra-cloud lightning) or between opposite charges in the cloud and on the ground (cloud-to-ground lightning).⁹⁸

Every thunderstorm produces lightning. Lightning can cause death, injury, fire, and damage to electrical and communications systems. This profile relies on documented Five County AOG events rather than generalized national annual averages.

COMMON LIGHTNING TYPES⁹⁹

- **Cloud-to-Ground Flashes:** The most common type of cloud-to-ground lightning, a channel of negative charge, called a stepped leader, will zigzag downward in roughly 50-yard segments in a forked pattern. Channels of positive charge reach upward, normally from taller objects in the area, such as a tree, house, or telephone pole, and, when the leader and upward streamer connect, a powerful electrical current begins flowing. The luminous return stroke travels about 60,000 miles per second back toward the cloud.
- **Cloud Flashes:** There are many flashes that do not reach ground. Most of these remain within the cloud and are called intra-cloud lightning flashes. Cloud flashes sometimes have visible channels that extend out into the air around the storm (cloud-to-air) but do not strike the ground.

Location

Thunderstorm and lightning hazards affect all jurisdictions within the five-county region, with spatial variability tied to elevation, land use, and exposure patterns.

- In Beaver County, thunderstorms and cloud-to-ground lightning most frequently impact rural communities, agricultural areas, exposed highways, and utility corridors, where open terrain increases lightning strike potential and gusty outflow winds can disrupt power infrastructure and farming operations.
- In Garfield County, thunderstorm and lightning events are concentrated in canyonlands, high-elevation terrain, backcountry, and recreation areas, including national parks and remote public lands,

⁹⁸ National Oceanic and Atmospheric Administration, "Severe Weather 101, Lightning Basics, What Is Lightning?" 2026, <https://www.nssl.noaa.gov/education/svrwx101/lightning/>.

⁹⁹ National Oceanic and Atmospheric Administration, "Severe Weather 101, Lightning Types," 2026, <https://www.nssl.noaa.gov/education/svrwx101/lightning/types/>.

where storms often produce frequent lightning, strong downdraft winds, and dry lightning capable of igniting wildfires.

- Iron County experiences thunderstorms and lightning across both developed areas and rural landscapes, with elevated risk to power infrastructure, wildland-urban interface zones, and population centers, making this county particularly vulnerable to lightning-related outages and wind damage.
- In Kane County, the highest thunderstorm and lightning exposure occurs in slot canyons, high-elevation terrain, parks, and outdoor recreation corridors, where localized storms can create life-safety hazards for residents and visitors due to lightning strikes, sudden wind shifts, and rapidly changing weather conditions.
- Washington County faces the most widespread thunderstorm and lightning impacts, with events affecting urbanized areas, expanding residential developments, transportation corridors, and adjacent desert and recreational landscapes, resulting in a higher concentration of structural exposure, population risk, and documented lightning-related damages. Together, these county-specific patterns demonstrate that thunderstorms and lightning are regionwide hazards with distinct geographic concentrations of risk within each jurisdiction.

Magnitude and Extent

THUNDERSTORMS

NWS classifies a thunderstorm as severe when it produces a tornado, hail at least 1 inch in diameter, or wind gusts of at least 58 mph. Lightning and heavy rainfall can be dangerous but are not severe thunderstorm criteria. Observed magnitude is described using documented wind gusts, hail diameter, lightning activity, rainfall, and associated impacts when those measures are available.

Table 34: Severe Thunderstorm Risk Categories

Severe Thunderstorm Risk Categories	Description
Thunderstorms (no label)	• No severe thunderstorms expected • Lightning and flooding threats exist with all thunderstorms • Winds to 40 mph • Small hail
1-Marginal (MRGL)	• Isolated severe thunderstorms possible • Limited in duration and/or coverage and/or intensity • Winds 40–60 mph • Hail up to 1 inch • Low tornado risk
2-Slight (SLGT)	• Scattered severe storms possible

Severe Thunderstorm Risk Categories	Description
	• Short-lived and/or not widespread, isolated intense storms possible • One or two tornadoes • Reports of strong winds/wind damage • Hail approximately 1 inch, isolated 2 inches
3-Enhanced (ENH)	• Numerous severe storms possible • More persistent and/or widespread, a few intense • A few tornadoes • Several reports of wind damage • Damaging hail, 1–2 inches
4-Moderate (MDT)	• Widespread severe storms likely • Long-lived, widespread and intense • Strong tornadoes • Widespread wind damage • Destructive hail, 2+ inches
5-High (High)	• Widespread severe storms expected • Long-lived, very widespread and particularly intense • Tornado outbreak • Derecho

The Storm Prediction Center categorical outlooks describe the forecast probability and expected organization of severe weather within a specified area and period. They are not an observed-event magnitude scale. The NWS severe-thunderstorm criteria are a tornado, hail at least 1 inch in diameter, or wind gusts of at least 58 mph. Table 34 is retained as forecast context only and is not used to rate the magnitude of historical Five County AOG events.

LIGHTNING

Lightning is responsible for many wildfires and can cause fatalities. The Lightning Activity Level (LAL) is a tool that was originally developed to characterize lightning risk for use as an input into the National Fire Danger Rating System (NFDRS). The LAL has a range of values from 1 through 6: a value of 1 represents no lightning, values from 2 through 5 represent an increasing coverage of wet thunderstorms and corresponding increases in the frequency of lightning strikes, while 6 represents rare dry lightning events with a lightning frequency similar to a LAL of 3.

Table 35: Lightning Activity Levels¹⁰⁰

Lightning Activity Level (LAL 1–6)	Description
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud-to-ground strikes in a 5-minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud-to-ground strikes in a 5-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud-to-ground strikes in a 5-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud-to-ground strikes in a 5-minute period.
LAL 6	Dry lightning (same as LAL 3 but without the rain). A dry lightning situation. Low lightning flash rate observed (less than one to three cloud-to-ground strikes per 5-minute period per storm cell passage). Scattered towering clouds with a few thunderstorms; bases of the clouds are high.

Previous Occurrences

Thunderstorms and lightning have caused injuries, fatalities, property damage, outages, and transportation and recreation disruptions in the five-county region. In canyon and slot-canyon settings, localized heavy rainfall can also generate dangerous flash flooding. Table 37 summarizes selected, verified NOAA NCEI thunderstorm wind and lightning records; it is not a complete NCEI event inventory.

In Five County AOG communities, severe weather can impact roads, infrastructure, and structures. Common damages reported include downed power lines, damaged roof structures from thunderstorm wind, and delays on roadways due to flooding. In the region, power outages are a noted vulnerability, especially for older adults throughout the region.

FEDERAL DECLARATIONS

Federal declarations for severe storms or flooding may include thunderstorm-related impacts, but declaration titles do not isolate lightning or thunderstorm wind as the cause of loss. The declaration table is therefore used as contextual evidence of broader severe-storm impacts and not as a complete occurrence record for this hazard.

¹⁰⁰ National Oceanic and Atmospheric Administration, National Weather Service, "Forecast Weather Glossary," 2024, <https://www.weather.gov/media/rnk/fire/LAL.pdf>.

STATE DECLARATIONS

Executive Order 2024-01 declared a statewide emergency due to flooding on August 23, 2024. Table 36 includes this state example alongside two federal severe-storm/flood declarations as broader hazard context; the order does not identify lightning as the cause of loss.

Table 36: Thunderstorm Previous Disaster Declarations¹⁰¹

Year	Declaration Number	Declaration Type	Title and Description
2005	DR-1576	Federal	Severe Storms and Flooding; incident period January 8–12, 2005; declared February 1, 2005.
2012	DR-4088	Federal	Severe Storm and Flooding; incident September 11, 2012; declared November 3, 2012. ¹⁰²
2024	Executive Order 2024-01	State	Statewide emergency due to flooding, issued August 23, 2024; not a lightning-specific declaration.

SELECTED PREVIOUS THUNDERSTORM AND LIGHTNING EVENTS

Table 37: Selected Verified NOAA NCEI Thunderstorm Wind and Lightning Records, 2000–May 2026

Date/Period	County and Location	Hazard / Reported Impact	Source/Event ID
12/26/2005	Washington County: St. George Municipal Airport	Thunderstorm wind; ten phone poles down northwest of St. George; \$20,000 reported property damage.	NOAA NCEI Event 5483711
7/30/2010	Washington County: Santa Clara	Thunderstorm wind; multiple power lines down; \$30,000 reported property damage.	NOAA NCEI Event 252319
2/16/2011	Washington County: Washington	Thunderstorm wind; barn and power-line damage; \$35,000 reported property damage.	NOAA NCEI Event 287606

¹⁰¹ Federal Emergency Management Agency, DR-1576-UT and DR-4088-UT disaster records, <https://www.fema.gov/disaster/1576> and <https://www.fema.gov/disaster/4088>; Utah Office of Administrative Rules, Executive Order 2024-01, <https://rules.utah.gov/wp-content/uploads/Utah-Executive-Order-No.-2024-01.pdf>. Reviewed October 9, 2026.

¹⁰² Federal Emergency Management Agency, “Disasters and Other Declarations: DR-4088-UT, Utah Severe Storms and Flooding,” 2022, <https://www.fema.gov/disaster/4088>.

Date/ Period	County and Location	Hazard / Reported Impact	Source/Event ID
8/18/2011	Garfield County: Bryce Canyon	Lightning; one fatality.	NOAA NCEI Event 345039
7/21/2012	Garfield County: Boulder	Lightning; one fatality.	NOAA NCEI Event 403653
7/25/2016	Beaver County: Milford	Thunderstorm wind / microburst; 16 power poles down and widespread outage; \$20,000 reported property damage.	NOAA NCEI Event 653341
9/14/2017	Kane County: Glen Canyon	Thunderstorm wind; three injuries and overturned boats; \$500,000 reported property damage.	NOAA NCEI Event 718349
4/7/2018	Washington County: Santa Clara record; narrative locates the home in St. George	Lightning-caused residential fire in St. George; \$400,000 reported property damage.	NOAA NCEI Event 748262
7/24/2021	Washington County: Rockville record; narrative reports impacts in Hildale	Thunderstorm wind; downed power poles and trees reported in Hildale; \$80,000 reported property damage.	NOAA NCEI Event 974340
8/21/2022	Garfield County: Cannonville	Thunderstorm wind; roof damage; \$20,000 reported property damage.	NOAA NCEI Event 1054501
10/18/2024	Washington County: Toquerville	Thunderstorm wind; property and solar-panel damage; \$50,000 reported property damage.	NOAA NCEI Event 1217203

Probability of Future Occurrences

Thunderstorms and lightning will remain recurring hazards across Beaver, Garfield, Iron, Kane, and Washington Counties. Consistent with the plan-wide scale, a county rating should be based on a reproducible analysis of historical event frequency over a stated period. Because that county-level calculation is not available in this profile, comparative probability labels are not assigned. Potential consequences are summarized below and evaluated further through the vulnerability and impact discussion.

- In Beaver County, future thunderstorms may produce cloud-to-ground lightning and gusty winds that disrupt utilities and agricultural operations.

- In Garfield and Kane Counties, storms in canyonlands, high-elevation terrain, and recreation areas may produce lightning, gusty outflow winds, and hazardous conditions for residents and visitors, including wildfire ignition during dry thunderstorms.
- In Iron County, thunderstorms may damage power infrastructure and buildings and expose rural areas to lightning and dry-lightning wildfire ignition.
- In Washington County, concentrated population and development can increase consequences when thunderstorms produce lightning, damaging winds, or localized flash flooding.

Future thunderstorms will continue to range from nonsevere to severe. The Fifth National Climate Assessment provides context for considering heavier precipitation and associated flash-flood consequences in the Southwest, but it does not establish a county-level increase in lightning frequency or severe thunderstorm occurrence for the five-county region. Accordingly, this profile does not assign an increasing local trend.¹⁰³

Table 38: Future Thunderstorm and Lightning Risk by County

County	Future Probability	Primary Thunderstorm and Lightning Hazards	Locations of Greatest Risk	Anticipated Intensity
Beaver County	Not assigned; a comparative county probability requires a documented event-frequency method.	Cloud-to-ground lightning; gusty thunderstorm winds; brief heavy rainfall	Rural communities, agricultural areas, exposed highways, utility corridors	Nonsevere to occasionally severe thunderstorms capable of utility disruptions and localized damage
Garfield County	Not assigned; a comparative county probability requires a documented event-frequency method.	Frequent lightning; gusty outflow winds; dry lightning with wildfire ignition potential	Canyonlands, high-elevation terrain, backcountry and recreation areas	Nonsevere to severe storms; lightning-driven life safety risk and localized wind damage
Iron County	Not assigned; a comparative county probability requires a	Cloud-to-ground lightning; damaging thunderstorm winds;	Developed areas, power infrastructure, rural and	Severe thunderstorms producing strong winds with recurring

¹⁰³ U.S. Global Change Research Program, Fifth National Climate Assessment, 2023, Overview and Chapter 28, Southwest; U.S. Global Change Research Program, Fifth National Climate Assessment (2023), Chapter 28, Southwest. <https://nca2023.globalchange.gov/chapter/28/>. This source provides regional climate context, not a county-level lightning-frequency projection.

County	Future Probability	Primary Thunderstorm and Lightning Hazards	Locations of Greatest Risk	Anticipated Intensity
	documented event-frequency method.	localized flash flooding	wildland-urban interface	infrastructure impacts
Kane County	Not assigned; a comparative county probability requires a documented event-frequency method.	Lightning strikes; gusty downdraft winds; hazardous conditions for outdoor recreation	Slot canyons, high-elevation terrain, parks and recreation corridors	Nonsevere to severe storms; localized high-impact lightning and wind events
Washington County	Not assigned; a comparative county probability requires a documented event-frequency method.	Cloud-to-ground lightning; damaging outflow winds; brief heavy rainfall; localized flash flooding	Developed communities, transportation and utility corridors, wildland-urban interface, and recreation areas	Nonsevere to severe thunderstorms; observed magnitude should be described using documented gusts, hail size, lightning activity, rainfall, and impacts

Vulnerability Assessment

Thunderstorms and lightning affect all five counties through cloud-to-ground lightning, damaging outflow winds, brief heavy rainfall, localized flash flooding, and, during dry storms, wildfire ignition. Vulnerability varies with population and asset concentration, terrain, utility and transportation exposure, outdoor recreation use, and the distance to shelter and emergency services. The county assessments below use documented events and reported losses already presented in this profile; the figures are examples rather than complete loss totals, and no comparative quantitative vulnerability rating is assigned without a consistent exposure-and-loss methodology.

BEAVER COUNTY

Beaver County's dispersed communities, agricultural lands, open terrain, exposed highways, and long above-ground utility corridors are vulnerable to lightning, microburst and outflow winds, hail, and brief heavy rainfall. Residents, travelers, recreationists, farms, outbuildings, irrigation equipment, and critical facilities may be affected, and limited system redundancy can allow localized damage to interrupt services over a broad rural area.

Documented impacts illustrate the county's sensitivity to concentrated storm damage. On July 25, 2016, a microburst near Milford downed 16 power poles, caused a widespread outage affecting most customers,

and resulted in approximately \$20,000 in reported property damage. Similar events could damage roofs and agricultural facilities, create hazardous travel conditions, interrupt communications and public services, or ignite rangeland wildfire through dry lightning.

Cascading impacts: Damage to electric distribution systems can affect homes, public facilities, communications, water and wastewater operations, fuel access, refrigeration, and agricultural pumps or pivots. Debris, reduced visibility, or damaged roadside infrastructure can delay emergency response and utility restoration. A lightning-caused wildfire could simultaneously threaten rangeland, utility corridors, transportation routes, and scattered development while drawing limited local response resources away from other storm incidents.

Changes in development: New housing, commercial activity, agricultural improvements, energy or utility facilities, and supporting roads can increase the number and value of assets exposed to thunderstorms, particularly where growth extends along rural utility lines or into open and wildland-adjacent areas. Current building and electrical standards can reduce wind and lightning losses, but continued development may also increase service demands and the consequences of a single corridor outage. Future land-use and capital planning should therefore account for backup power, utility hardening, defensible space, drainage, and reliable emergency access.

GARFIELD COUNTY

Garfield County's vulnerability is concentrated in remote communities, canyon and high-elevation terrain, transportation routes, public lands, and heavily used recreation areas such as Bryce Canyon and Boulder Mountain. Rapid storm development, limited shelter, long travel distances, and constrained communications can expose residents and visitors to lightning, strong outflow winds, brief heavy rainfall, and dry-lightning wildfire ignition while complicating warning and response.

The county's documented record includes lightning fatalities near Bryce Canyon in 2011 and on Boulder Mountain in 2012. A 2022 thunderstorm in Cannonville caused roof damage and approximately \$20,000 in reported property damage. These events show that a limited number of storms can produce severe life-safety consequences and localized structural losses where people are outdoors or access to shelter and emergency assistance is limited.

Cascading impacts: Lightning or wind damage to utilities can interrupt communications, water systems, park operations, public facilities, and visitor services. Road debris, localized flooding, or closures along canyon and recreation access routes can delay medical response, restrict evacuation, and isolate travelers. Dry-lightning wildfire starts may threaten campgrounds, trails, utilities, and remote development while diverting emergency resources, disrupting tourism, and extending recovery beyond the original storm area.

Changes in development: Additional housing, visitor facilities, utility extensions, and transportation improvements can increase exposure in communities and recreation corridors, even where overall population density remains low. Growth near canyon terrain, forest or rangeland, and remote access routes may place more people and assets in locations with limited shelter and response capacity. Updated

construction practices, lightning protection, resilient communications, drainage, wildfire-resistant siting, and evacuation planning can moderate risk as development and visitation increase.

IRON COUNTY

Iron County combines concentrated development around Cedar City with extensive rural, agricultural, recreation, and wildland areas. Population centers, Interstate 15 and other transportation routes, above-ground utilities, public facilities, businesses, and wildland-urban interface neighborhoods are exposed to lightning, damaging wind, hail, brief heavy rainfall, and localized flash flooding. Dry lightning also creates a pathway from a thunderstorm to wildfire in surrounding rangeland and forested areas.

The concentration of residents, structures, critical facilities, transportation infrastructure, and utility networks means that one severe storm could affect many people and services at once. Expected direct impacts include outages, roof and outbuilding damage, hazardous travel, localized flooding, outdoor lightning exposure, and storm-related wildfire ignition.

Cascading impacts: Damage to power lines, substations, or distribution equipment can interrupt service to homes, businesses, schools, medical facilities, water and wastewater systems, traffic controls, and communications networks. Incidents on Interstate 15 or local roads can delay emergency response and disrupt commuting and freight movement. If dry lightning ignites a wildfire, the event may threaten development and utility corridors, cause evacuations or closures, and divert firefighting and law-enforcement resources from concurrent storm impacts.

Changes in development: Continued residential, commercial, institutional, and infrastructure growth—particularly around Cedar City, transportation corridors, and wildland-urban interface areas—will increase the number and value of exposed assets. New development can improve resilience when it incorporates current wind-resistant construction, lightning protection, drainage, backup power, redundant communications, and emergency access. Conversely, expansion into areas served by long utility feeders or near wildfire-prone vegetation can increase outage, evacuation, and response demands during severe thunderstorms.

KANE COUNTY

Kane County's remote communities, Lake Powell and Glen Canyon facilities, slot canyons, campgrounds, highways, and extensive public lands create substantial outdoor and visitor exposure. Lightning, microburst and outflow winds, brief heavy rainfall, and rapidly changing conditions can threaten boaters, hikers, campers, motorists, marina operations, utilities, and scattered development. Limited shelter, constrained communications, and long response distances can amplify consequences.

On September 14, 2017, severe thunderstorm winds in Glen Canyon injured three people, overturned multiple boats on Lake Powell, and caused approximately \$500,000 in reported property damage. The event demonstrates how a short-duration storm can create concentrated life-safety and economic consequences among exposed visitors and high-value recreational assets. Other credible impacts include

lightning injury, marina or campground damage, hazardous canyon conditions, road disruption, and dry-lightning wildfire ignition.

Cascading impacts: Damage to power, communications, marina utilities, or access routes can interrupt visitor safety operations and access to fuel, water, medical assistance, and other essential services. Wind on open water, road closures, debris, or flooding in confined drainages can delay rescues and isolate residents or visitors. Dry-lightning wildfire starts may threaten campgrounds, utilities, and scattered development, divert response resources, close recreation areas, and disrupt tourism-dependent businesses well beyond the storm period.

Changes in development: Growth in communities and recreation-supporting development can place more residents, visitors, buildings, marina assets, and utility demands in exposed settings. Improvements to roads and facilities may enhance access and response, but they can also increase occupancy in areas subject to sudden wind, lightning, flooding, and wildfire. Future development can reduce vulnerability through weather-warning coverage, resilient communications and utilities, safe shelter, wind-resistant construction, drainage, evacuation planning, and careful siting near slot canyons, shorelines, and wildland vegetation.

WASHINGTON COUNTY

Washington County contains the planning area's largest concentration of population, housing, businesses, critical facilities, transportation corridors, utilities, and recreation assets. St. George, Washington, Santa Clara, Rockville, Toquerville, and other growing communities are exposed to lightning, damaging outflow winds, brief heavy rainfall, localized flash flooding, and fire ignition. High asset concentration means a localized storm can affect many people and community functions simultaneously.

Selected NCEI records document at least five thunderstorm-wind events in St. George, Santa Clara, Washington, Rockville, and Toquerville with approximately \$215,000 in reported property damage, plus a 2018 lightning-caused residential fire in St. George with approximately \$400,000 in reported damage. Together, these selected records total about \$615,000, excluding unreported outages, emergency costs, business interruption, and other indirect losses. They demonstrate substantial exposure but are not a complete county loss inventory.

Cascading impacts: Power or communications failures can affect homes, schools, healthcare facilities, water and wastewater systems, traffic controls, businesses, and emergency coordination. Signal outages, debris, localized flooding, or damaged roads can disrupt commuting, freight movement, and emergency access. Lightning-caused structure or wildland fire can threaten neighborhoods and utilities while drawing resources from concurrent incidents, and resulting closures, service interruptions, and cleanup needs can extend community and economic impacts beyond the storm itself.

Changes in development: Continued residential and commercial growth will increase the number and value of people, structures, vehicles, and lifeline systems exposed to thunderstorms, particularly along expanding transportation and utility networks and at the wildland-urban interface. Modern codes, buried or hardened utilities, drainage improvements, backup power, redundant communications, and well-

designed emergency access can reduce vulnerability. Without these measures, expanding development may increase outage consequences, stormwater demands, traffic disruption, fire exposure, and the complexity of response and recovery.

Tornadoes

A tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground. A tornado may be visible as a condensation funnel or through rotating dust and debris. Tornadoes can occur at any time of year and at any time of day. Tornadoes may form from supercell or non-supercell thunderstorms. Supercells contain persistent rotating updrafts and can also produce large hail, damaging straight-line winds, lightning, and heavy rainfall. Not every supercell produces a tornado, and some tornadoes form through non-supercell processes. This profile relies on the documented five-county event record rather than a generalized national annual count.

Types of Tornadoes

Tornadoes are commonly described as supercell or non-supercell tornadoes. Supercell tornadoes develop from thunderstorms with rotating updrafts; vertical wind shear contributes to storm-scale rotation. Only a subset of supercells produces tornadoes. Tornadogenesis depends on multiple interacting atmospheric conditions; warm, moist surface air alone is not sufficient.

Non-supercell tornadoes include landspouts and some waterspouts. A landspout develops from near-surface vertical vorticity beneath a growing convective cloud and does not require a preexisting rotating mesocyclone. Waterspouts occur over water and may be tornadic or fair-weather. These phenomena are not assigned a specific Enhanced Fujita Scale (EF) rating unless supported by an official damage survey.

Location

Tornadoes can occur in any location within the five-county region, as these hazards are associated with severe thunderstorms that may develop over both urbanized and rural areas. Historical records indicate that tornado occurrences in Beaver County have been scattered across the county, affecting open landscapes and areas near developed communities. In Garfield County, tornadoes have been documented near populated areas such as Panguitch as well as in surrounding rural portions of the county, demonstrating broad geographic exposure. The 2000–2025 NCEI query returned one Iron County tornado record, a landspout near Cedar City and Enoch on April 18, 2025. Kane County has no tornado event identified in the cited historical summary; however, consistent with statewide patterns identified in the 2024 Utah Enhanced State Hazard Mitigation Plan (SHMP), isolated weak tornadoes or landspout-type events remain possible anywhere within the county under favorable atmospheric conditions. Washington County has two documented tornado events during 2000–2025—one rated EF0 and one rated EFU—both recorded near Hurricane Airport. Consistent with Utah SHMP guidance, because tornadoes are short-lived and highly localized, their exact touchdown points cannot be predetermined; therefore, all areas within each county are considered potentially exposed to tornado hazards.

Magnitude and Extent

The Enhanced Fujita Scale became operational in the United States on February 1, 2007. The National Weather Service assigns an official EF0 through EF5 rating by evaluating damage indicators and degrees of damage and estimating the three-second gust associated with observed damage. EF Scale wind speeds are estimates, not direct measurements. Historical events before 2007 may be reported using the original Fujita Scale and should not be relabeled as EF ratings unless an authoritative source does so.

The EF Scale uses 28 damage indicators and eight degrees of damage to estimate three-second gusts at points of damage. The rating reflects the highest supported damage-based wind estimate along the surveyed path. Table 39 summarizes the EF Scale wind ranges; local extent should also report available path length, maximum path width, duration, rating, and affected locations.

Table 39: Enhanced Fujita Scale Ratings¹⁰⁴

EF Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
EF0	Light tornado	65–85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	Moderate tornado	86–110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	Significant tornado	111–135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	Severe tornado	136–165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	Devastating tornado	166–200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	Incredible tornado	>200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters

¹⁰⁴ National Oceanic and Atmospheric Administration, National Weather Service, "Enhanced Fujita Scale," https://www.weather.gov/tae/ef_scale.

EF Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
			(109 yards); high-rise buildings have significant structural deformation; incredible phenomena occur.

Previous Occurrences

Tornadoes can cause deaths, injuries, property damage, utility outages, and transportation disruption, but impacts vary substantially with path, intensity, exposure, and warning or shelter conditions. In communities, tornadoes can impact road access, infrastructure, and structures. Common damages reported include downed power lines, damaged roof structures from tornadoes, and delays on roadways due to debris blockage. In the region, power outages are a noted vulnerability, especially for older adults throughout the region.

FEDERAL DISASTER DECLARATIONS

Federal disaster declarations are not used as a complete tornado-occurrence record because tornado damage may be included within broader severe-storm declarations. No declaration specifically titled for tornadoes is used in this profile to establish event frequency.

STATE DISASTER PROCLAMATIONS

State emergency proclamations are likewise not used as a complete tornado-occurrence record because tornado impacts may occur within broader severe-weather emergencies.

PREVIOUS HAZARD EVENTS IN FIVE COUNTY REGION FROM NCEI DATABASE

Table 40 lists the 10 NCEI Tornado records returned for county-coded observations in Beaver, Garfield, Iron, Kane, and Washington Counties from January 1, 2000, through December 31, 2025. The records occurred on 10 distinct calendar dates and report \$300,000 in property damage, no crop damage, and no injuries or deaths. They comprise three Beaver, four Garfield, one Iron, and two Washington County records; none was returned for Kane County. Absence of a reported record does not establish that tornado occurrence is impossible. F ratings precede use of the EF Scale; EFU denotes an unknown EF rating.

Table 40: NCEI Storm Events Database Tornado Records, 2000–2025¹⁰⁵

Date	Event Type	Location	Magnitude	Fatalities	Injuries	Property Damage	Crop Damage
9/8/2000	Tornado	Panguitch, Garfield County	F0	0	0	\$0	\$0
9/4/2001	Tornado	Milford, Beaver County	F0	0	0	\$0	\$0
5/24/2009	Tornado	Milford, Beaver County	EF0	0	0	\$0	\$0
8/24/2011	Tornado	Hurricane Arpt, Washington County	EF0	0	0	\$0	\$0
8/21/2012	Tornado	Newhouse, Beaver County	EF0	0	0	\$0	\$0
8/26/2016	Tornado	Panguitch, Garfield County	EF0	0	0	\$0	\$0
9/22/2016	Tornado	Panguitch, Garfield County	EF1	0	0	\$300,000	\$0
7/8/2017	Tornado	Hurricane Arpt, Washington County	EFU	0	0	\$0	\$0
7/10/2017	Tornado	Hatch, Garfield County	EFU	0	0	\$0	\$0
4/18/2025	Tornado	(Cdc)Cedar City Arpt, Iron County	EF0	0	0	\$0	\$0

Figure 41 depicts mapped historical paths for 1950 through 2025.

¹⁰⁵ NOAA National Centers for Environmental Information, Storm Events Database, annual details CSV files retrieved October 10, 2026. <https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/>. Filters: Utah; county-coded Tornado; five planning-area counties; January 1, 2000–December 31, 2025. Event IDs: 5177903, 5275423, 170869, 346603, 409087, 658301, 660568, 715693, 715687, 1235810.

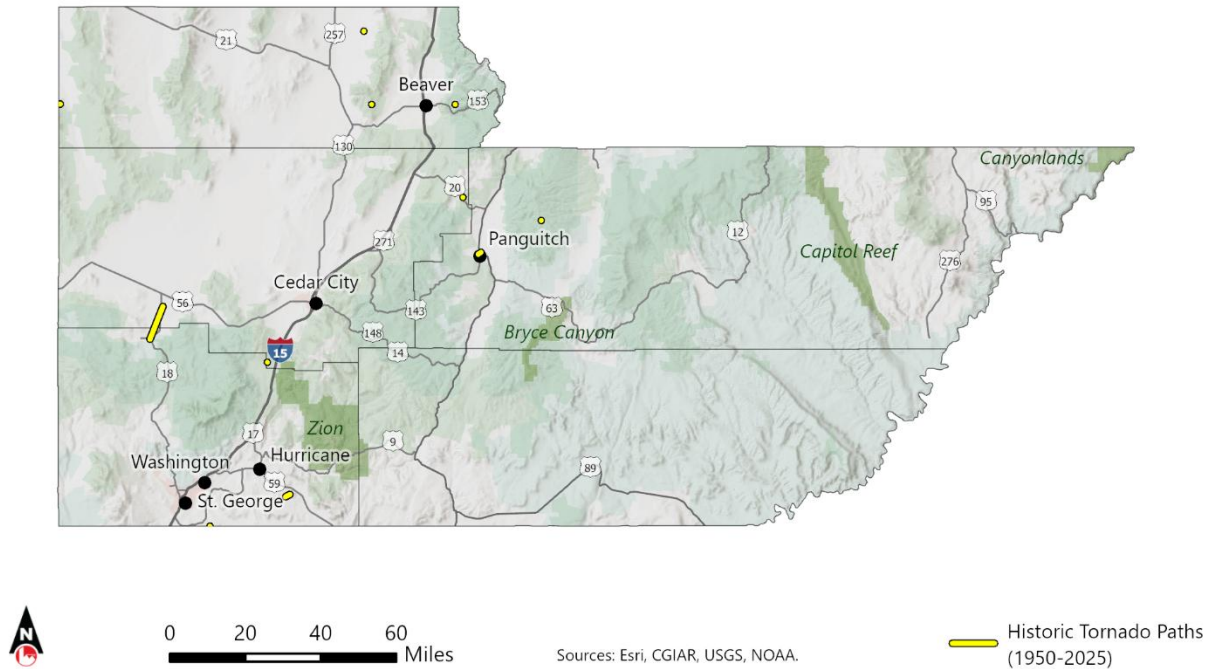


Figure 41: Historic Tornado Paths for Five County AOG Region (1950–2025)

Probability of Future Occurrences

While tornadoes are relatively infrequent in southwestern Utah compared to the central and southeastern United States, they remain a credible future hazard for Beaver County, Garfield County, Iron County, Kane County, and Washington County. The mapped record indicates tornado paths in Beaver, Garfield, Iron, and Washington Counties during 1950 through 2025. No mapped path is shown in Kane County in Figure 41; this does not establish that tornado occurrence is impossible or that every event would have been observed and reported. Table 40 provides the verified 2000–2025 county-coded record; the older supplied path map is used only for historical location context.

Tornado occurrence is rated Likely for the five-county region, consistent with the plan's more than once in 10 years but less than annual category. The 10 reported event dates over the 26-year 2000–2025 period average approximately 0.38 reported tornado days per year. This historical reporting frequency supports a qualitative regional classification; it is not an annual occurrence probability or a county- or property-specific rate. The record does not support a separate probability for EF3-or-greater tornadoes. Future consequences depend on development, manufactured housing, warning access, shelter availability, and lifeline dependence.

Vulnerability Assessment

Tornado vulnerability in the five-county region is concentrated where a short, localized path intersects people, development, critical facilities, transportation corridors, utilities, or agricultural and visitor-serving assets. The verified 2000–2025 record includes three tornadoes in Beaver County, four in Garfield County, one in Iron County, two in Washington County, and none in Kane County; collectively, the records report no deaths or injuries and \$300,000 in property damage. This history indicates generally low frequency but potentially meaningful localized consequences. Manufactured and older housing, large-span buildings, outdoor locations, schools, medical and public safety facilities, and areas with limited warning reception or shelter options are comparatively vulnerable. Countywide population, housing, and facility figures below provide planning context only and are not estimates of direct exposure, which would require a documented tornado-path or scenario overlay.

BEAVER COUNTY

Beaver County has documented tornado activity, including records near Milford in 2001 and 2009 and near Newhouse in 2012; all three events were rated F0 or EF0 and reported no deaths, injuries, or property or crop damage in Table 40. Future impacts would most likely be localized to developed areas such as Beaver, Milford, and Minersville or to exposed rural and agricultural sites. Roofs, siding, windows, manufactured homes, barns, outbuildings, fencing, irrigation components, vehicles, trees, and overhead utilities could be damaged even in a weak tornado.

Exposed assets include 7 Beaver County School District public schools serving 1,471 students, Beaver Valley Hospital, Milford Valley Memorial Hospital, public safety facilities, water and wastewater systems, electric and communications infrastructure, and Interstate 15 and connecting roads.

Cascading impacts: Damage to power or communications systems could interrupt homes, businesses, medical services, public safety operations, and water or wastewater facilities. Debris, overturned vehicles, or downed lines could block Interstate 15, state routes, or rural roads, delaying emergency response, mutual aid, repairs, and access to medical care. Outages could also disrupt irrigation, agricultural operations, cold storage, and temperature-controlled medicines, with greater consequences for isolated residents and facilities where service redundancy is limited.

Changes in development: Continued development near Interstate 15 and established communities may place additional housing, businesses, and public infrastructure within potential tornado paths. New manufactured housing, large-span buildings, and utility-dependent facilities could increase exposure if protective design, warning reception, and shelter access do not keep pace. Conversely, current building-code enforcement, resilient utility design, backup power, and incorporation of safe shelter areas into new or substantially improved facilities can limit growth in vulnerability.

GARFIELD COUNTY

Garfield County has four verified tornado records for 2000–2025, including events near Panguitch in 2000 and twice in 2016 and near Hatch in 2017. The September 22, 2016, EF1 Panguitch tornado accounts for the profile’s reported \$300,000 in property damage; the county’s other records were rated F0, EF0, or EFU and reported no deaths or injuries. A future path through Panguitch, Escalante, Tropic, Boulder, Hatch, or a visitor-serving area could damage homes, businesses, lodging, campgrounds, schools, agricultural buildings, vehicles, trees, and overhead utilities.

Exposed community assets include 10 Garfield County School District public schools serving 1,509 students, Garfield Memorial Hospital in Panguitch, public safety and emergency response facilities, water and wastewater systems, and the U.S. 89 and State Route 12 corridors. Seasonal visitors in lodging, RV parks, campgrounds, and recreation areas may be unfamiliar with warnings and may lack substantial shelter.

Cascading impacts: Tornado damage to power, communications, or transportation infrastructure could interrupt medical care, public safety functions, water and wastewater service, school operations, and tourism activity. Debris or downed lines on U.S. 89, State Route 12, or local access roads could delay response, visitor movement, mutual aid, and delivery of repair crews and supplies. Agricultural effects could extend through damaged fencing, irrigation, livestock support systems, or loss of power, while business interruption and lodging closures could affect the tourism-dependent local economy.

Changes in development: Incremental growth in community centers and continued expansion of tourism-related lodging, recreation facilities, campgrounds, and supporting services can increase the number of residents, visitors, and assets exposed to localized wind damage. Development along constrained transportation corridors may also increase dependence on a limited number of access routes. Applying current codes, improving warning coverage, identifying shelter options at visitor-serving sites, and hardening utilities and critical facilities can reduce the vulnerability associated with future growth.

IRON COUNTY

Iron County’s verified record includes an EF0 landspout near Cedar City and Enoch on April 18, 2025, with no reported deaths, injuries, or property or crop damage. The event confirms that localized tornadoes can affect the county even though the historical frequency is low. The greatest potential consequences would occur where a path intersects the concentrated development of Cedar City, Enoch, Parowan, or other communities, including residential neighborhoods, manufactured or student housing, schools, commercial areas, public buildings, and facilities along Interstate 15 or State Route 56.

Exposed assets include 18 Iron County School District schools serving 14,125 students, Intermountain Health Cedar City Hospital and its emergency department, university-related facilities, public safety and dispatch systems, utilities, and regionally important transportation and service centers.

Cascading impacts: Damage to electric, communications, traffic-control, water, or wastewater systems could disrupt residential areas, schools, university functions, medical care, businesses, and emergency

operations beyond the tornado path. Debris or downed lines on Interstate 15, State Route 56, and local roads could delay response and mutual aid and impair regional travel and freight movement. Because Cedar City functions as a regional service center, interruption of hospitals, government services, retail, lodging, or communications could affect residents and visitors from surrounding areas as well as Iron County.

Changes in development: Continued population and housing growth in and around Cedar City and Enoch, expansion along transportation corridors, and additional commercial, institutional, and student-oriented development will increase the number and value of assets potentially exposed to a narrow tornado path. Greater dependence on interconnected utilities and communications may also increase indirect consequences. Enforcing current wind-resistant construction provisions, addressing manufactured-housing shelter access, protecting critical systems, and incorporating shelter areas and backup power into new facilities can moderate this increase in vulnerability.

KANE COUNTY

No Kane County tornado record was returned in the 2000–2025 NCEI query, and no mapped path is shown for the county in Figure 41; these absences do not establish that tornado occurrence is impossible. Isolated weak tornadoes or landspout-type events may occur when severe thunderstorms develop. Potential direct impacts would be greatest in Kanab, Orderville, Glendale, Big Water, Alton, and other developed or visitor-serving areas, where localized winds and debris could damage roofs, windows, signs, manufactured housing, outbuildings, vehicles, trees, and overhead utilities.

Exposed assets include 10 Kane County School District schools serving 1,510 students, Kane County Hospital in Kanab, public safety and emergency response facilities, water and wastewater systems, and U.S. 89, U.S. 89A, State Route 9, and local access roads. Visitors in campgrounds, RV parks, lodging, and recreation areas may have limited shelter options or warning familiarity.

Cascading impacts: Damage to power, communications, or utility systems could interrupt the hospital, public safety operations, water and wastewater service, schools, businesses, and visitor facilities. Debris or downed lines on U.S. 89, U.S. 89A, State Route 9, or remote local roads could delay emergency access, visitor movement, mutual aid, and repairs. Closures of lodging, fuel, food, or recreation services could produce broader tourism and business impacts, while infrastructure damage in remote areas may take longer to identify and restore.

Changes in development: Population growth, seasonal visitation, and additional development in Kanab and along major travel corridors may increase exposure even if tornado frequency remains low. Expansion of lodging, RV parks, campgrounds, and recreation-support facilities may add occupants who lack nearby substantial shelter. Land-use decisions that maintain emergency access, warning coverage, and utility redundancy, together with code-compliant construction and identified shelter options in new visitor-serving and public facilities, can help prevent development-related increases in vulnerability.

WASHINGTON COUNTY

Washington County has two verified tornado records for 2000–2025: an EF0 event near Hurricane Airport in 2011 and an EFU event in the same area in 2017; neither record reports deaths, injuries, or property or crop damage. The county's comparatively large and concentrated development footprint means that a future tornado path could affect more people and assets than in less urbanized portions of the region. Areas of concern include St. George, Washington, Hurricane, Santa Clara, Ivins, and other growing communities, where housing, schools, hospitals, commercial centers, visitor facilities, and major transportation and utility systems are concentrated.

Exposed community assets include 55 Washington County School District schools serving 36,961 students, St. George Regional Hospital and its River Road Emergency Department, public safety facilities, dense residential and commercial development, water and wastewater systems, and Interstate 15, State Route 9, State Route 18, and key local roads.

Cascading impacts: Damage to electric, communications, water, wastewater, traffic-control, or medical-support systems could interrupt essential services well beyond the immediate path. Debris, damaged signals, overturned vehicles, or downed lines on Interstate 15 and major state or local routes could delay response, mutual aid, hospital access, school transportation, and regional travel. Outages and facility closures could displace residents, interrupt business and government operations, disrupt tourism and outdoor events, and impose disproportionate hardship on older adults, lower-income households, people with access and functional needs, manufactured-home residents, and visitors.

Changes in development: Rapid population growth and continued residential, commercial, institutional, and visitor-oriented expansion are increasing the number and value of assets within the county's developed footprint. Growth along Interstate 15 and other transportation corridors may increase both direct exposure and dependence on infrastructure that can be disrupted by a localized event. Applying current construction standards, providing shelter options in manufactured-housing communities and high-occupancy facilities, protecting critical utilities, preserving emergency access, and incorporating backup power and continuity measures into new development can reduce the increase in vulnerability.

Wildfire

Wildfire is an unplanned, unwanted fire burning in vegetated areas such as forests, shrublands, grasslands, or mixed wildland-urban interface (WUI) environments. Wildfire behavior and impacts are driven by the interaction of fuels, weather, and topography, and can range from low-intensity surface fires to fast-moving wind-driven fires and high-intensity crown fires. The 2024 Utah Enhanced State Hazard Mitigation Plan (SHMP) defines wildfire as an uncontrolled fire spreading through vegetative fuel and distinguishes wildland fires from WUI fires where structures and other development adjoin wildlands. At the national scale, wildfire is a recurring and seasonally predictable hazard, but year-to-year fire activity varies widely due to patterns of precipitation, drought, heat, wind, and lightning. The National Interagency Coordination Center (NICC) reports that, in 2025, there were 77,850 wildfires reported nationally and

these fires burned 5,131,474 acres.¹⁰⁶ The same national summary reports 18,385 structures destroyed by wildfires in 2025.

In the U.S. Southwest, wildfire risk is strongly shaped by arid-to-semiarid climates, highly seasonal precipitation, and periods of hot, dry, windy conditions that can rapidly dry fuels and support extreme fire behavior. Once a wildfire starts, vegetation (fuels), topography, and weather are key contributors to the rate of spread and overall fire growth, and that interannual variability in precipitation, snowpack, temperature, and fuel conditions can drive substantial variability in wildfire outcomes.¹⁰⁷

In southwestern Utah specifically, wildfire is not limited to remote public lands; it is also a community hazard where development has expanded into fire-prone landscapes. This pattern is commonly described as the wildland-urban interface, the line, area, or zone where structures and other human development adjoin or intermingle with undeveloped wildland or vegetative fuels. The Utah SHMP classifies wildfire as either wildland (limited development) or WUI wildfire (where homes, infrastructure, and other built assets are exposed at the edge of or within vegetated fuels). The Five County AOG Hazard Mitigation Plan similarly defines the WUI as the zone where human development meets undeveloped wildlands, and notes that projected regional growth can increase both the number of people living in fire-prone areas and the number of residents unfamiliar with local fire risk.

Location

Wildfire can occur across all five counties in the Five County AOG planning area (Beaver, Garfield, Iron, Kane, and Washington Counties); however, the most consequential locations are those where burnable fuels overlap with communities, critical infrastructure, and high-use corridors.

Wildfire hazard potential refers to the relative likelihood of burning (burn probability) and related fire-environment conditions that support wildfire occurrence at a planning scale. Within the Five County AOG area, locations of greatest concern generally include (1) WUI areas around cities, towns, and resort and recreation communities where development and vegetation intermix; (2) transportation and utility corridors where ignition potential is elevated and where closures or damage can isolate communities and disrupt services; and (3) source watersheds and upland landscapes that support drinking water supplies and recreation assets, where wildfire can create longer-term downstream impacts.

Figure 42 through Figure 46 depict properties labeled as high-risk WUI properties in the supplied maps. The map legends identify Esri, CGIAR, USGS, and Utah DNR as sources, but the source-layer vintage, WUI definition, risk metric, classification threshold, and parcel-selection method are not documented. These maps are retained as qualitative screening illustrations; their labels do not establish verified WUI boundaries or an independently validated risk class. They provide screening context and do not establish

¹⁰⁶ National Interagency Coordination Center (NICC), *Wildland Fire Summary and Statistics Annual Report 2025* (National Interagency Fire Center, 2025), "National Fire Activity Synopsis" and "Structures Destroyed."

¹⁰⁷ Utah Division of Emergency Management, Utah Enhanced State Hazard Mitigation Plan (2024), Section 4.13, Wildfire Hazards, <https://hazards.utah.gov/wp-content/uploads/WildfireChapterHMP.pdf>.

quantified exposure of people, buildings, critical facilities, evacuation routes, utilities, or source watersheds.

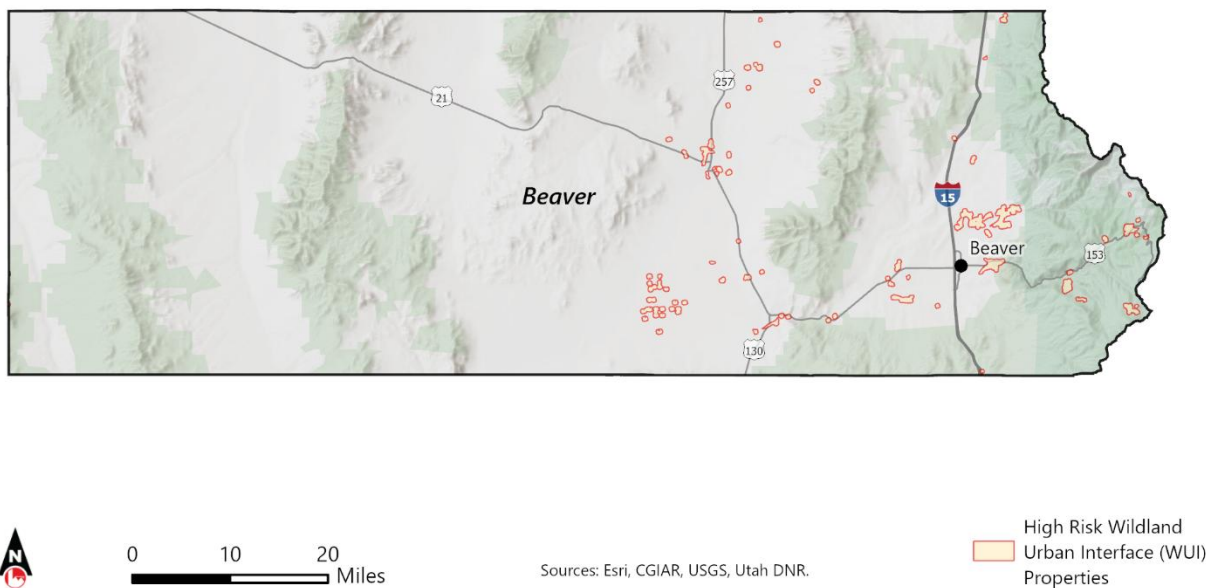


Figure 42: Beaver County High-Risk WUI Properties

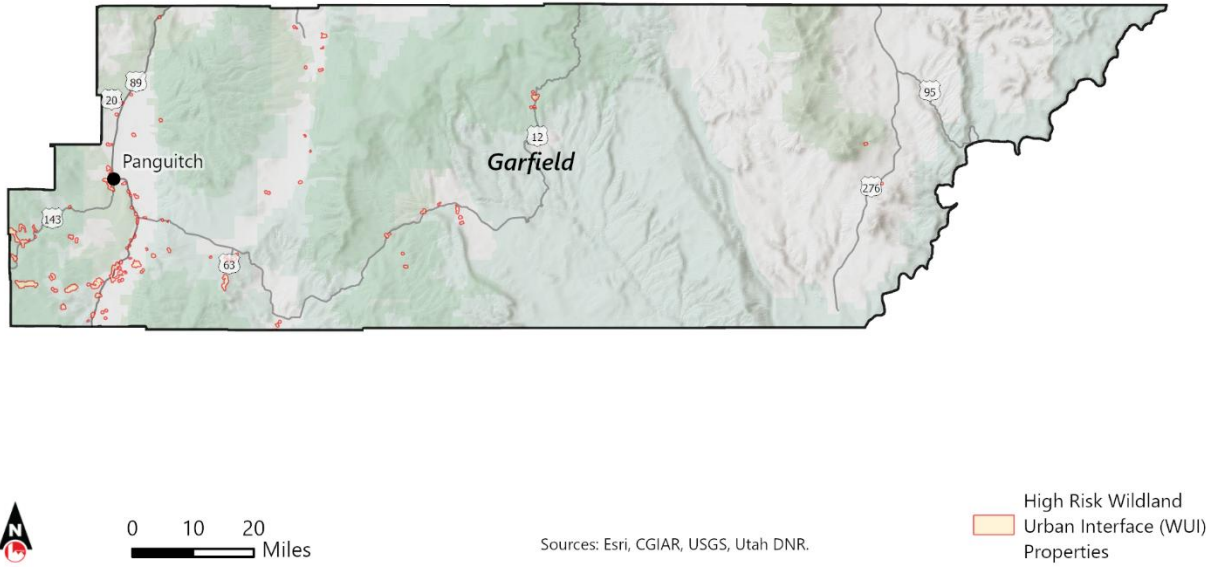


Figure 43: Garfield County High-Risk WUI Properties

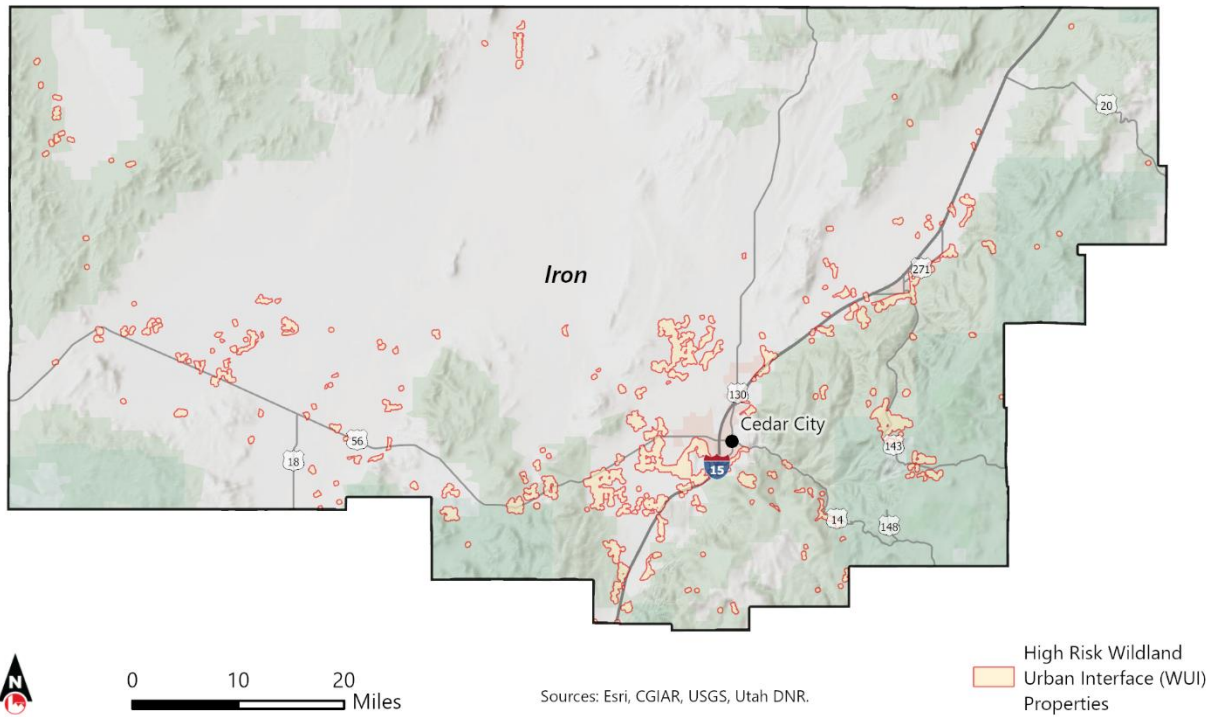


Figure 44: Iron County High-Risk WUI Properties

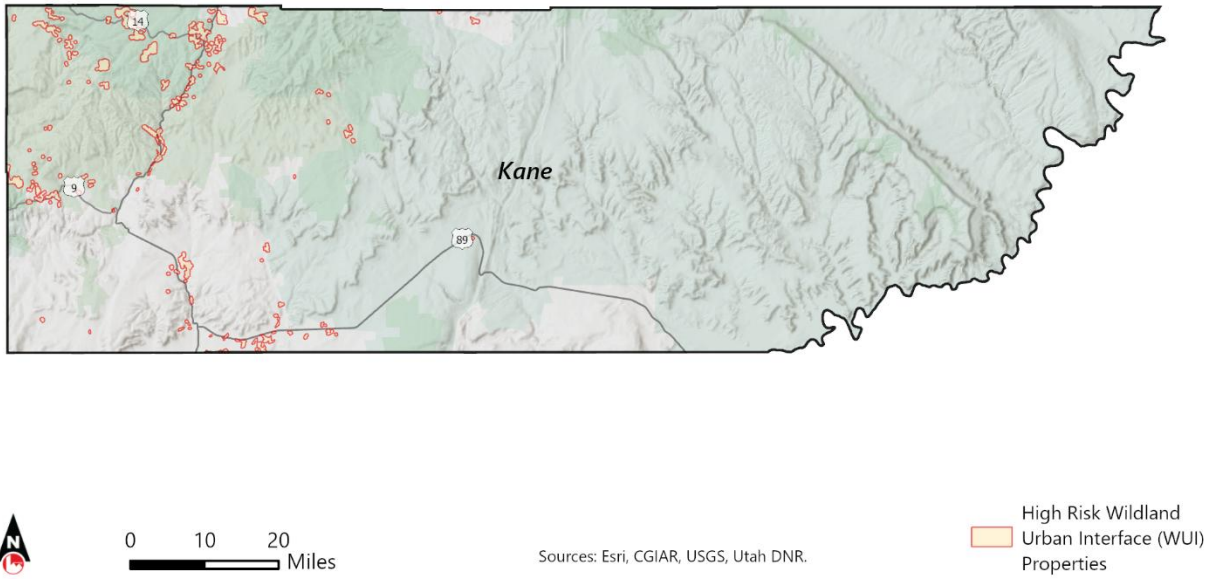


Figure 45: Kane County High-Risk WUI Properties

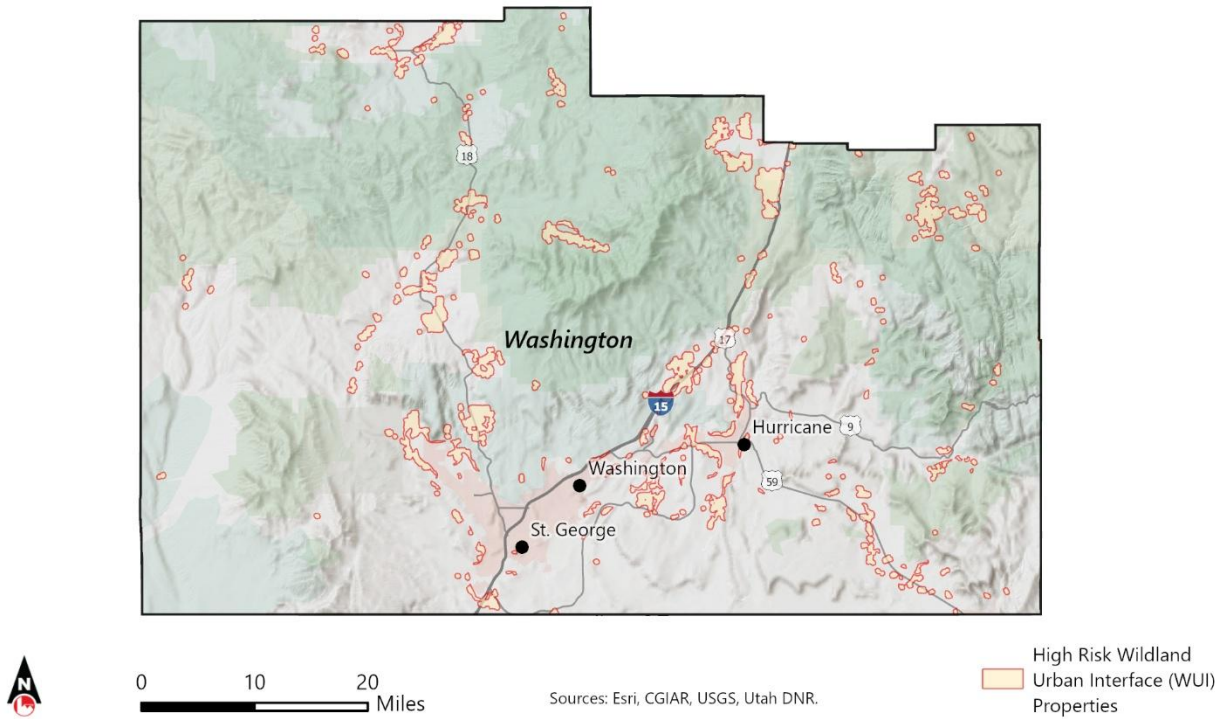


Figure 46: Washington County High-Risk WUI Properties

Magnitude and Extent

Wildfire extent includes the geographic area, intensity, and severity of an event. Fire-danger categories characterize potential ignition, spread, and suppression difficulty under prevailing conditions; they do not measure the acres, structures, people, or lifelines affected by a specific fire. Documented events are characterized, where data are available, by acreage, perimeter, duration, fire behavior or severity, structures affected, evacuations, smoke impacts, and community-lifeline disruption.

The following National Fire Danger Rating System adjective classes describe potential ignition, spread, and suppression difficulty under prevailing conditions:¹⁰⁸

- **Low:** Grasses and brush do not ignite readily from small firebrands. Dead and down timber fires spread slowly on the ground with little danger of spotting.
- **Moderate:** Fires in open grasslands can burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast.
- **High:** Fires could easily start from most causes. Unattended brush and campfires are likely to escape with fire spreading rapidly. Short-distance spotting is common.
- **Very High:** Fires start easily from all causes and spread rapidly immediately after ignition and intensity increases quickly. Spot fires starting new fires is a constant danger.
- **Extreme:** All fires are potentially serious because fires start quickly, spread furiously, and burn intensely. It is often too dangerous for firefighters to engage with direct attack suppression tactics.

Previous Occurrences

The Five County AOG Region has experienced local and large multi-jurisdictional wildfires that burned substantial acreage, prompted evacuations and closures, damaged structures and infrastructure, affected smoke-sensitive populations and economic activity, and contributed to post-fire flooding, erosion, and watershed impacts. Table 41 lists identified federal Fire Management Assistance declarations and a state emergency order. Fire Management Assistance declarations provide context for significant response needs but are not a complete inventory of wildfire occurrence.

¹⁰⁸Wildland Fire Application Information Portal, "Adjective Fire Danger Ratings," reviewed October 9, 2026, <https://www.wildfire.gov/page/adjective-fire-danger-ratings/>. The descriptions below summarize the published adjective classes, not event-specific damage or acreage.

Table 41: Wildfire Previous Disaster Declarations¹⁰⁹

Year	Declaration Number	Declaration Type	Title and Description
2025	FM-5591-UT	Federal	Forsyth Fire, Washington County.
2025	EO 2025-08	State	State of emergency due to fires and the risk of additional fires during the 2025 fire season.
2021	FM-5388-UT	Federal	Mammoth Fire, Garfield County.
2020	FM-5321-UT	Federal	Veyo West Fire, Washington County.
2017	FM-5185-UT	Federal	Brian Head Fire, Iron County.
2016	FM-5130-UT	Federal	Saddle Fire, Washington County.
2012	FM-2994-UT	Federal	Shingle Fire, Kane County.
2009	FM-2831-UT	Federal	Mill Flat Fire, Washington County.
2005	FM-2564-UT	Federal	Blue Springs Fire, Washington County.
2004	FM-2521-UT	Federal	Brookside Fire, Washington County.

2025 WILDFIRE SEASON EVENTS

FRANCE CANYON FIRE (GARFIELD COUNTY)

The France Canyon Fire burned more than 2,159 acres near Bryce Woodlands in Garfield County in June 2025 and was reported at 0% containment (by June 16, 2025) while burning in very difficult terrain within the Dixie National Forest. According to reporting based on U.S. Forest Service updates, rugged and limited-access terrain complicated suppression operations, while dry fuels and forecast fire behavior increased concerns for additional growth. Smoke impacts occurred near Bryce Canyon National Park, Ruby's Inn, the Bryce Valley area, and Escalante, and the Bryce Woodlands community was placed on alert in case the fire moved south; however, no other communities or structures were reported as threatened at the time. Firefighting resources included approximately 180 personnel, hotshot crews, engines, hand crews, helitack crews, helicopters, and fixed-wing aircraft, and temporary National Forest System land closures were implemented to support public safety and suppression activities.¹¹⁰

¹⁰⁹ FEMA, OpenFEMA Disaster Declarations Summaries, version 2, Utah records retrieved October 10, 2026.

<https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2> FM-5591-UT (Forsyth) designates Washington County; FM-2994-UT (Shingle) designates Kane County. State EO 2025-08: <https://governor.utah.gov/wp-content/uploads/2025-08-EO-State-Declaration-for-the-2025-Wildfires-1.pdf>.

¹¹⁰ KUTV.com, Megan Brugger, "France Canyon Fire Burns Over 2100 Acres in 'Very Difficult Terrain' Near Bryce Woodlands," June 15, 2025, <https://kutv.com/news/local/france-canyon-fire-burns-over-2100-acres-in-very-difficult-terrain-near-bryce-woodlands>.

FORSYTH FIRE (WASHINGTON COUNTY)

The Forsyth Fire was reported near Pine Valley in Washington County on June 19, 2025. The NCEI event narrative describes a suspected holdover lightning ignition in the Pine Valley Mountains and hot, dry, windy conditions before discovery. It records evacuations of Pine Valley, Grass Valley, and Pinto, 14 homes and four outbuildings destroyed in Pine Valley, and 15,563 acres affected. The Southern Mountains forecast zone record reports \$35 million in property damage; this is a reported event estimate, not an independently audited loss total.¹¹¹

2026 WILDFIRE SEASON EVENTS

COTTONWOOD FIRE, JUNE–AUGUST 2026 (BEAVER COUNTY AND ADJACENT AREAS)

The 2026 wildfire season began under unusually severe fire-weather conditions across Utah, with drought, low fuel moisture, warm temperatures, and wind contributing to rapid fire growth well before the traditional late-summer peak. By mid-June, statewide wildfire reporting noted that wildfire activity was increasing earlier than usual, with multiple large fires burning across Utah and critical fire weather conditions forecast for much of the state.¹¹² These early conditions reflected the rapid drying of grasses, sagebrush, and other fine fuels that can carry fire quickly across open landscapes and into WUI areas.¹¹³

By July 22, 2026, the Governor of Utah reported that the Cottonwood Fire had burned more than 97,000 acres in Beaver and Piute Counties. Wildfires and subsequent flooding prompted evacuations and damaged State Route 153 in Beaver Canyon and water infrastructure serving Beaver and neighboring communities. The event demonstrates wildfire exposure, access disruption, and post-fire flood and debris-flow consequences.¹¹⁴

Low fuel moisture, low relative humidity, and strong winds can increase wildfire spread and suppression difficulty. NWS Red Flag Warnings identify dangerous fire-weather conditions; they do not quantify the perimeter or impacts of a particular wildfire.¹¹⁵

¹¹¹ NOAA National Centers for Environmental Information, Storm Events Database, annual details CSV files retrieved October 10, 2026. [https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/ Wildfire Event 1278611, Southern Mountains forecast zone, beginning June 19, 2025](https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/Wildfire%20Event%201278611%20Southern%20Mountains%20forecast%20zone%2C%20beginning%20June%2019%2C%202025).

¹¹² ABC4.com, Amelia Hobson and Ava Hart, "Most Destructive in State's History: Governor Cox Speaks on Cottonwood Fire, Which Has Burned Over 61,000 Acres," June 24, 2026, <https://www.abc4.com/utah-weather/wildfire/cottonwood-fire-beaver-utah/>.

¹¹³ National Weather Service, Salt Lake City, "Extreme Fire Weather Southern Utah," 2026, <https://www.weather.gov/slc/>.

¹¹⁴ Office of the Governor of Utah, Gov. Cox Declares State of Emergency for Beaver, Piute and Sevier Counties Following Wildfires and Catastrophic Flooding, July 22, 2026, <https://governor.utah.gov/uncategorized/gov-cox-declares-state-of-emergency-for-beaver-piute-and-sevier-counties-following-wildfires-and-catastrophic-flooding/>.

¹¹⁵ National Weather Service, Fire Weather Watch and Red Flag Warning, <https://www.weather.gov/safety/fire-weather>.

On July 19, 2026, the National Weather Service issued a Flash Flood Emergency for Beaver after heavy rainfall over the Cottonwood Fire burn scar generated life-threatening flooding and debris flows. Runoff and debris moved down Beaver Canyon, overtopped a diversion dam, and continued along State Route 153 and the Beaver River toward the Grove area of Beaver City and North Creek, prompting evacuations and warnings for residents to move to higher ground. Reported impacts included major flooding in Beaver, debris and muddy floodwaters moving through residential areas, road and driveway washouts, water-quality concerns, and continuing transportation disruptions, illustrating how wildfire can rapidly transition into a post-fire flood and debris-flow hazard during subsequent storm events.

The 2026 events also triggered broader preparedness and risk-reduction actions across Utah. State officials issued emergency measures restricting fireworks during the Independence Day holiday period because of extreme fire danger,¹¹⁶ and Rocky Mountain Power warned customers in several high-risk areas, including locations around Cedar City, Dixie, Enterprise Valley, Milford, Panguitch, and other central and southern Utah communities, of possible public safety power shutoffs.¹¹⁷ Federal and state land managers also implemented fire restrictions on public and private lands, including Stage 1 restrictions across southwestern Utah counties and Stage 2 restrictions on Dixie and Fishlake National Forests and Bureau of Land Management lands. Together, these actions illustrate the regional scale of wildfire risk during the 2026 season and the potential for fire-weather conditions to affect transportation, utilities, recreation access, emergency response, and community preparedness even outside the immediate burn perimeter.

For the Five County AOG Region, the 2026 wildfire season underscores the continuing relevance of wildfire as a recurring, potentially high-consequence hazard. The Cottonwood Fire and associated red flag conditions demonstrate how quickly a wildfire can expand in southwestern Utah when dry fuels, low humidity, and strong winds align. They also show how wildfire impacts can extend beyond burned acreage to include evacuations, roadway closures, damage to recreation and residential assets, smoke impacts, utility concerns, and heightened demand on local, state, and federal response resources. These conditions reinforce the need for continued mitigation actions focused on defensible space, fuel reduction, public education, evacuation planning, utility resilience, interagency coordination, and post-fire recovery planning throughout Beaver, Garfield, Iron, Kane, and Washington Counties.

SAWMILL FIRE, JUNE 2026 (IRON COUNTY)

The Sawmill Fire was first reported on June 16, 2026, east of Steamboat Mountain and northwest of Lund in northern Iron County. The fire grew rapidly during its first operational periods as dry fuels, low relative humidity, and windy conditions supported fast spread across the fire area. Initial reports described the fire at approximately 100 acres, with growth to more than 2,000 acres within about a day and subsequent reporting indicating that the fire had exceeded 3,000 acres as crews continued suppression work.

¹¹⁶ US News and World Report.com, Associated Press, "Utah Governor Restricts Fireworks as Largest US Wildfire Surges Uncontained," June 26, 2026, <https://www.usnews.com/news/us/articles/2026-06-26/utah-governor-restricts-fireworks-as-largest-us-wildfire-surges-uncontained>.

¹¹⁷ ABC4.com, Derick Fox, "Rocky Mountain Power Issues Public Safety Power Shutoff Watch for Central, Southern Utah," June 20, 2026, <https://www.abc4.com/news/southern-utah/rocky-mountain-power-wildfire-power-shutoff/>.

As a precaution, the Iron County Sheriff's Office ordered the evacuation of several cabins and yurts on private land located within several miles of the fire. No homes were reported lost, and firefighters focused on structure protection while strengthening containment lines around the perimeter. Suppression resources included aircraft, engines, hand crews, and dozers, with crews working to secure fire edges, improve containment, and mop up hot spots as conditions allowed.¹¹⁸

The Sawmill Fire also produced community-level impacts beyond the active burn area. Residents in western and northern Iron County were advised that smoke could remain visible, and fire managers cautioned that gusty winds, possible thunderstorms, hot temperatures, and dry vegetation could continue to influence fire behavior. These conditions illustrate how wildfire in Iron County can affect dispersed rural properties, recreation cabins, access routes, emergency response resources, and nearby communities even when primary residences are not directly damaged.¹¹⁹

Within the broader 2026 wildfire season, the Sawmill Fire demonstrates Iron County's continued exposure to fast-moving wildfire under severe early-season fire-weather conditions. The event reinforces the importance of defensible space around seasonal and rural structures, timely public warning systems such as reverse 911 alerts, pre-identified evacuation routes, interagency suppression coordination, and continued fuel-reduction and public education measures in the county's WUI and rural recreation areas.¹²⁰

PREVIOUS HAZARD EVENTS IN FIVE COUNTY REGION FROM NCEI DATABASE

Table 42 presents two verified NCEI Wildfire records during the January 1, 2020–May 31, 2026, review period: the October 29, 2023, brush fire near Leeds and the June 19, 2025, Forsyth Fire. The events are forecast-zone records; their narratives identify the affected locations in Washington County. NCEI is not a complete wildfire-incident inventory. No France Canyon record was returned in the reviewed Utah Wildfire-coded bulk data; that absence does not establish that the fire did not occur. Cottonwood and Sawmill occurred after the query end date and are described separately.

¹¹⁸ Iron County Today, "Sawmill Fire Continues Burning in Northern Iron County," June 24, 2026 (URL date), updated June 26, 2026, 2:00 p.m., <https://ironcountytoday.com/2026/06/24/sawmill-fire-continues-burning-in-northern-iron-county/>.

¹¹⁹ Iron County Today, "Sawmill Fire Continues Burning in Northern Iron County," June 24, 2026 (URL date), updated June 26, 2026, 2:00 p.m., <https://ironcountytoday.com/2026/06/24/sawmill-fire-continues-burning-in-northern-iron-county/>.

¹²⁰ Iron County Today, "Sawmill Fire Continues Burning in Northern Iron County," June 24, 2026 (URL date), updated June 26, 2026, 2:00 p.m., <https://ironcountytoday.com/2026/06/24/sawmill-fire-continues-burning-in-northern-iron-county/>.

Table 42: Selected Verified NCEI Storm Events Database Wildfire Records, January 2020–May 2026¹²¹

Date	Event Type	Location	Magnitude	Fatalities	Injuries	Property Damage	Crop Damage
10/29/2023	Wildfire	Near Leeds / Lower Washington County Zone	N/A	0	0	\$50,000	\$0
6/19/2025	Wildfire	Forsyth / Southern Mountains	N/A	0	0	\$35,000,000	\$0

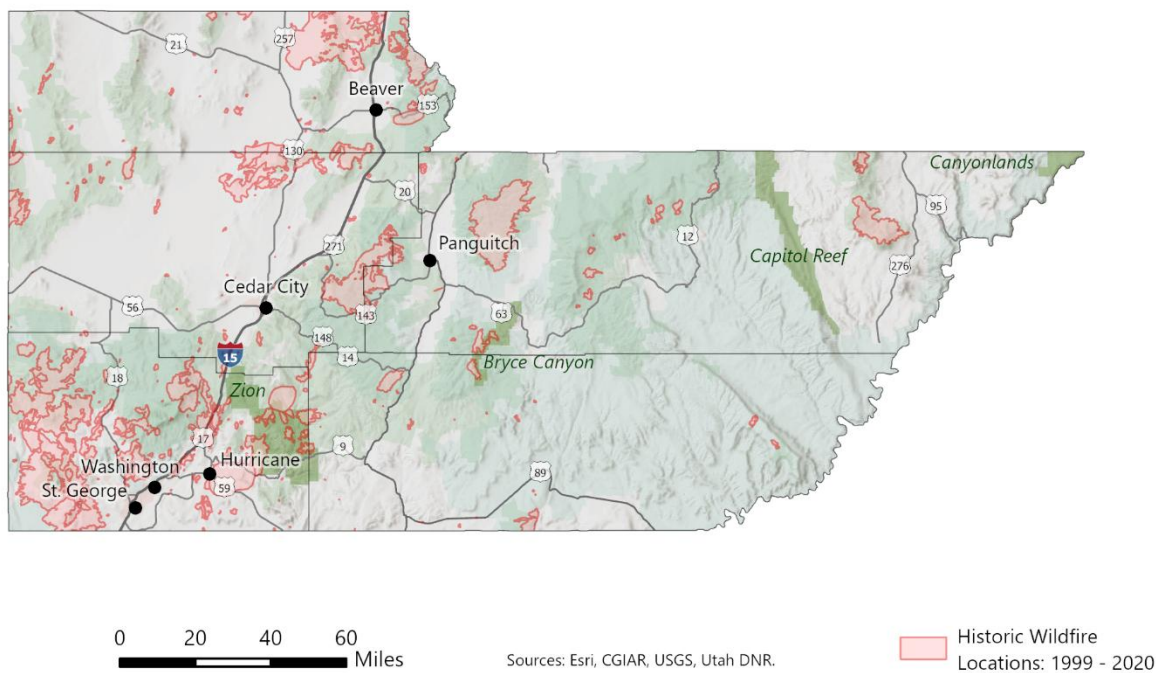


Figure 47: Historic Wildfire Events for the Five-County Region (1999–2020)

Figure 47 shows mapped historic wildfire locations for 1999 through 2020 and provides long-term geographic context. Later incidents are described separately because they fall outside the map period. Proximity to a mapped perimeter does not by itself establish asset exposure or impact; direct exposure requires a documented intersection or distance analysis.

¹²¹ NOAA National Centers for Environmental Information, Storm Events Database, annual details CSV files retrieved October 10, 2026. <https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/>, Wildfire Events 1140822 and 1278611. Event narratives identify the locations; zone boundaries do not provide county-level loss allocations.

Probability of Future Occurrences

The probability score is Highly Likely (expected to occur one or more times per year, based on the source and period of record identified in this hazard profile). Wildfire is expected to occur within the Five County AOG planning area during the five-year planning horizon and is likely to occur in any given year somewhere in the region due to the area's documented fire history, persistent seasonal fire-weather patterns, continued growth in the WUI, and the presence of widespread areas mapped with elevated wildfire hazard potential (i.e., relative likelihood of burning) in statewide wildfire risk assessment products. These hazard potential maps do not predict where the next ignition will occur; instead, they provide a defensible basis for concluding that, across the planning area, conditions that support wildfire occurrence will persist and periodically align with ignition sources and extreme weather, producing damaging events. In terms of anticipated intensities, future wildfire occurrence is expected to include a range of conditions, from frequent small fires (often lower-intensity) to occasional large incidents under severe weather that can exhibit high-intensity behavior and produce regional smoke, evacuations, and infrastructure disruptions.

State and regional planning documents support a Highly Likely rating for future wildfire occurrence in southwestern Utah. The Utah SHMP concludes that, although wildfire activity varies substantially year to year, the occurrence of wildfire across Utah is near certain and notes that southwestern and central Utah have among the highest probabilities of experiencing wildfire in any one year, based on NRI probability mapping.

Recent fire history and state planning information support continued wildfire occurrence during the five-year planning horizon. The Fifth National Climate Assessment (NCA5) reports that higher temperatures have intensified drought and will contribute to a more arid Southwest, and it identifies increases in drought, wildfire activity, and related health impacts. NCA5 also reports more intense precipitation events in the Southwest, which supports consideration of post-fire flooding and debris-flow consequences. These regional findings strengthen the basis for climate-informed mitigation but do not quantify a uniform change in fire frequency, acreage, or severity for every Five County jurisdiction.¹²²

Vulnerability Assessment

In southwestern Utah, wildfire vulnerability is shaped by the combination of fire-prone landscapes, recurring hot, dry, and windy conditions, and continued growth in communities and infrastructure located near vegetated areas. This assessment considers the people, buildings, critical facilities, infrastructure, economic assets, natural resources, and community functions that may be affected by wildfire, as well as the secondary and long-term consequences that can follow a fire. Across the Five County Region, vulnerability is generally greatest where wildland fuels overlap with homes, transportation corridors, utilities, recreation areas, grazing lands, and watershed resources, particularly in WUI areas where evacuation challenges, structure exposure, smoke impacts, and post-fire flooding or erosion can

¹²² U.S. Global Change Research Program, Fifth National Climate Assessment, Chapter 28, Southwest, 2023.

compound losses. The county-level discussions below describe how regional wildfire conditions translate into specific local vulnerabilities within the planning area.

BEAVER COUNTY

Beaver County's wildfire vulnerability reflects extensive grass, shrub, pinyon-juniper, and forest fuels; recurrent hot, dry, and windy conditions; and dispersed communities, agricultural lands, recreation areas, and infrastructure located near burnable vegetation. WUI areas and road corridors around Beaver, Milford, Minersville, and rural development are of greatest concern because fast-moving fire can threaten structures, constrain evacuation and emergency access, and interrupt utilities and communications across a large service area. Exposed assets include homes, businesses, schools, government and public works facilities, Beaver Valley Hospital, the Sheriff's Office and dispatch functions, fire stations in Beaver, Milford, and Minersville, roads and bridges, power and communications systems, water infrastructure, grazing lands, watersheds, and recreation assets.

Wildfire could cause injury or loss of life; destroy homes, outbuildings, fencing, and public or private facilities; damage utilities and transportation infrastructure; and close roads needed for evacuation and response. Smoke and service interruptions could affect schools, outdoor workers, medically sensitive populations, agriculture, tourism, recreation, and local businesses. The county's broad geography and limited number of critical service nodes can magnify consequences if a hospital, fire station, water system, communications site, or connecting corridor is impaired.

Cascading impacts: Damage to electrical, communications, transportation, and water infrastructure can isolate residents, delay response and reentry, and disrupt essential services and agricultural operations beyond the burn perimeter. Loss of vegetation can increase runoff, erosion, sedimentation, and debris-flow potential during later storms, threatening roads, culverts, irrigation works, water systems, and downstream property. The 2026 Cottonwood Fire and subsequent flooding in Beaver Canyon illustrate how wildfire can transition rapidly into access, water-quality, and post-fire flood emergencies.

Changes in development: Continued residential, agricultural, utility, and recreation-related development near vegetated lands can increase the number and value of exposed assets, add ignition sources, and place additional demand on warning, evacuation, fire suppression, and water systems. New or infill development along limited-access corridors may also increase evacuation congestion and response travel times. Applying defensible-space, ignition-resistant construction, access, water-supply, and vegetation-management standards as growth occurs can reduce the extent to which future development increases wildfire vulnerability.

GARFIELD COUNTY

Garfield County is vulnerable to wildfire because extensive vegetated public and private lands, rugged terrain, recurring drought and severe fire weather, and dispersed communities overlap across a very large area. Communities including Panguitch, Escalante, Boulder, Hatch, and Tropic, as well as development near Bryce Canyon and other recreation destinations, contain homes, visitor facilities, utilities, and

transportation routes adjoining grass, shrub, pinyon-juniper, and forest fuels. WUI conditions, steep terrain, and limited access can complicate suppression and evacuation.

Bryce Canyon National Park recorded 1,967,367 recreation visits in 2025, adding substantial seasonal population and travel demand. Exposed assets include housing, lodges, campgrounds, businesses, schools, Garfield Memorial Hospital, Sheriff and ambulance functions, municipal and volunteer fire departments, highways and local roads, utilities, grazing lands, watersheds, and public-land recreation resources.

Wildfire could threaten life safety; damage homes, outbuildings, lodges, campgrounds, fencing, utilities, and public facilities; and close roads needed for evacuation, emergency access, and visitor travel. Smoke, power or communications outages, and protective closures could interrupt schools, medical access, public services, grazing, tourism, and recreation. Because visitor-serving activity and public-land access are central to the local economy, even a fire that does not destroy structures can reduce business revenue and disrupt employment.

Cascading impacts: Fire or smoke affecting highways, local roads, communications, power, or water systems can isolate communities, delay response and reentry, and interrupt visitor movement and essential services. Burning on steep terrain can remove vegetation and destabilize soils, increasing runoff, erosion, sedimentation, post-fire flooding, and debris-flow potential during later storms. These effects can threaten roads, culverts, water systems, campgrounds, downstream property, and watershed function for multiple seasons after containment.

Changes in development: Additional housing and visitor-serving development in or near vegetated areas can expand the WUI, increase seasonal evacuation loads, and place more structures and infrastructure along constrained travel corridors. Growth near recreation gateways may also increase dependence on a small number of highways and utility systems. Coordinating land-use review with defensible-space, ignition-resistant construction, emergency access, water-supply, evacuation, and fuel-management requirements can limit the vulnerability created by future development.

IRON COUNTY

Iron County's wildfire vulnerability results from extensive grass, shrub, pinyon-juniper, and forest fuels; recurring hot, dry, and windy conditions; and continued growth in and near fire-prone landscapes. Cedar City, Enoch, Parowan, Paragonah, Brian Head, and rural residential and recreation areas contain homes, businesses, critical facilities, and transportation and utility corridors that adjoin burnable vegetation. Prior events, including the Brian Head Fire and the 2026 Sawmill Fire, demonstrate the potential for rapid growth, evacuations, structure exposure, and prolonged recovery needs.

Iron County welcomed approximately 1.6 million visitors in 2025, with estimated local spending of \$251.6 million. Exposed assets include homes, businesses, schools, Southern Utah University facilities, Cedar City Hospital, Sheriff and dispatch functions, municipal and volunteer fire departments, highways, utilities, communications sites, water systems, grazing lands, watersheds, and recreation resources.

Wildfire could cause casualties; destroy homes, outbuildings, businesses, and public facilities; damage roads, utilities, communications equipment, and water systems; and impede evacuation or emergency access. Smoke, closures, and utility failures could disrupt schools and university operations, medical care, commuting, tourism, recreation, and commerce. Concentrated growth around Cedar City and Enoch and dispersed exposure near Brian Head and rural areas create different operational demands but can draw on the same regional response resources.

Cascading impacts: Damage or shutdowns affecting highways, local roads, power, communications, or water networks can isolate neighborhoods, interrupt emergency response, and disrupt education, workforce mobility, visitor travel, and essential services. Fire on steep slopes and in source watersheds can increase erosion, sedimentation, runoff, post-fire flooding, and debris flows, threatening culverts, roads, water infrastructure, recreation areas, and downstream property after the fire is contained.

Changes in development: Rapid population and housing growth, continued expansion at community edges, and recreation-oriented development can enlarge the WUI and increase the number of residents, visitors, and assets requiring protection and evacuation. New development can also increase ignition potential and demands on roads, dispatch, suppression, and water supplies. Integrating wildfire hazard information into siting and subdivision review, while requiring defensible space, ignition-resistant materials, secondary access, adequate fire flow, and long-term vegetation maintenance, can reduce growth-related increases in vulnerability.

KANE COUNTY

Kane County is vulnerable to wildfire because extensive vegetated landscapes, prolonged drought and severe fire weather, rugged terrain, and widely dispersed communities overlap with homes, visitor facilities, transportation corridors, and utilities. Kanab, Orderville, Alton, Glendale, Big Water, Mount Carmel, and rural recreation areas contain development adjoining grass, shrub, pinyon-juniper, and forest fuels. WUI conditions and long travel distances can complicate warning, evacuation, suppression, and continuity of essential services.

Exposed assets include homes, lodges, campgrounds, businesses, schools, Kane County Hospital, Sheriff and 911 functions, fire and EMS agencies, highways and local roads, power and communications systems, water infrastructure, grazing lands, watersheds, and public-land recreation resources.

Wildfire could threaten life safety; damage homes, outbuildings, visitor facilities, utilities, public buildings, and transportation infrastructure; and close routes needed for evacuation, community connectivity, supply movement, and visitor travel. Smoke, outages, and access restrictions could interrupt medical care, schools, public services, tourism, recreation, and local business activity. Because the economy depends heavily on outdoor recreation and public-land access, wildfires both within and outside the county can create substantial indirect losses when regional routes or destinations close.

Cascading impacts: Fire, smoke, or damage affecting highways, local roads, communications, power, or water systems can isolate communities, delay response and reentry, and interrupt essential services and visitor movement. Loss of vegetation on steep or erodible terrain can increase runoff, erosion,

sedimentation, post-fire flooding, and debris-flow potential during later storms, threatening roads, culverts, campgrounds, water systems, and downstream property for multiple seasons.

Changes in development: Continued residential and tourism-related development near vegetated areas can expand the WUI, increase seasonal evacuation demand, and place more assets along a limited network of roads and utilities. Growth around Kanab and recreation gateways may increase exposure even where countywide density remains low. Hazard-informed siting, defensible space, ignition-resistant construction, reliable secondary access, adequate fire flow, evacuation planning, and sustained fuel management can reduce the vulnerability added by future development.

WASHINGTON COUNTY

Washington County's wildfire vulnerability reflects rapid population growth, extensive WUI development, fire-prone grass, shrub, and pinyon-juniper fuels, and recurring hot, dry, and windy conditions. St. George, Washington, Hurricane, Santa Clara, Ivins, and smaller communities including Pine Valley, Diamond Valley, Veyo, Gunlock, Brookside, and Central contain neighborhoods, businesses, critical facilities, and transportation and utility corridors adjoining burnable vegetation. Recent events, including the Forsyth Fire, demonstrate the potential for evacuations, structure loss, smoke, and high-consequence community impacts.

Exposed assets include homes, businesses, schools, St. George Regional Hospital, public health facilities, Sheriff and 911 functions, municipal and volunteer fire departments, highways and local roads, power and communications systems, reservoirs and water infrastructure, and Greater Zion recreation resources.

Wildfire could cause casualties; destroy homes, outbuildings, businesses, and public facilities; damage transportation, utility, communications, and water infrastructure; and force large or complex evacuations. Smoke, road closures, and power or communications disruptions could affect schools, medical and public health services, commuting, tourism, recreation, supply movement, and business continuity. High population and visitor volumes increase the consequences of disruptions along key corridors and the demand placed on emergency services and shelters.

Cascading impacts: Damage or shutdowns affecting roads, power, communications, reservoirs, or water and wastewater systems can delay response and reentry, isolate neighborhoods, and interrupt essential services across the county. Burning in watersheds and on steep terrain can increase runoff, erosion, sedimentation, post-fire flooding, and debris-flow potential, threatening roads, culverts, reservoirs, water systems, recreation areas, and downstream neighborhoods long after containment. Smoke and protective closures can also produce countywide public-health and economic effects beyond the fire perimeter.

Changes in development: Rapid residential and commercial expansion at community edges can enlarge the WUI, increase the value and density of exposed property, add ignition sources, and create greater evacuation and suppression demands. Infill and new subdivisions may also increase congestion on constrained routes and dependence on shared utility and water systems. Integrating wildfire risk into land-use and subdivision review and requiring defensible space, ignition-resistant construction, adequate

access and fire flow, evacuation connectivity, and long-term vegetation maintenance can reduce development-driven increases in vulnerability.

Winter Storms

Winter storms encompass heavy snowfall, freezing rain, ice, sleet, and blizzards. These storms vary in intensity and size, posing significant risks, especially when accompanied by extremely cold temperatures and strong winds. Winter storms are characterized by varying intensity, duration, and weather conditions that can significantly affect communities. Snowfall rate varies by storm and location. Higher snowfall rates can produce rapid accumulation and reduced visibility, but no single rate defines every winter storm addressed in this profile. Winter storms may last only a few hours or extend over several days, and prolonged events can compound impacts on transportation, infrastructure, and emergency services, while also increasing the risk of flooding during melt periods.

Winter storms are often accompanied by hazardous weather conditions that intensify their impact. Blizzard conditions require sustained wind or frequent gusts of at least 35 mph, considerable falling or blowing snow that frequently reduces visibility below one-quarter mile, and persistence for at least three hours. Poor visibility and treacherous road conditions make driving hazardous for both motorists and first responders. Heavy snowfall can cause roofs and power lines to collapse, resulting in prolonged power outages. Those without adequate shelter during these storms are at risk of frostbite, hypothermia, or even death. Cold temperatures also contribute to icy road conditions that endanger travel. In some cases, snowstorms are preceded by or transition into freezing rain, leading to ice accumulation on surfaces, fallen branches, and potential power outages due to ice-laden trees and utility lines.

Location

Winter storm impacts occur throughout the five-county region, though their spatial distribution is strongly influenced by elevation, terrain, and transportation infrastructure.

In Beaver County, winter storms are concentrated in higher-elevation areas and mountainous terrain, particularly along the Interstate 15 corridor west of the Tushar Mountains and surrounding plateaus, where elevations exceed 5,500 feet and support frequent snowfall, blowing snow, and extreme cold; these impacts affect rural communities and major freight and travel routes.

Garfield County experiences winter storm impacts across its extensive high-elevation plateaus, mountainous areas, and remote road networks, including portions of the Aquarius Plateau and Boulder Mountain, where elevations above 7,000 feet contribute to prolonged snow cover and isolation of small population centers and unincorporated areas.

In Iron County, winter storms affect both valley population centers, including Cedar City, and higher-elevation terrain surrounding the community; impacts are especially concentrated along Interstate 15, state highways, and mountain passes where elevation changes, snow squalls, and rapid visibility reductions create hazardous travel conditions.

Kane County experiences winter storm impacts primarily in higher-elevation areas and along key transportation corridors such as U.S. Highway 89 and State Route 9, which traverse mountainous terrain and serve as critical access routes; lower-elevation communities in the county are more likely to experience freezing rain and icy road conditions rather than sustained snowfall.

Washington County generally experiences winter storm impacts in its higher-elevation areas, including the Pine Valley Mountains and northeastern portions of the county, while lower-elevation population centers such as St. George experience less frequent snow; however, even minor winter weather events in these lower elevations can disrupt travel on arterial roadways and access routes connecting to higher terrain. Overall, winter storm locations across the Five County AOG Region are closely aligned with elevation gradients, mountain ranges, and major transportation corridors, with higher elevations experiencing more frequent and severe winter conditions and lower elevations experiencing episodic but disruptive winter weather events.

Magnitude and Extent

The extent of severe winter weather can be classified using meteorological measurements and by evaluating its societal impacts. The NWS Winter Storm Severity Index (WSSI) communicates the general level and spatial distribution of potential societal impacts based on the official forecast. It considers snow amount, snow load, ice accumulation, and blowing snow. The WSSI does not depict official warnings, is not a specific forecast of individual impacts, and should be used with other NWS forecasts and warnings.

Table 43: Winter Storm Severity Index¹²³

Impacts	Potential Winter Storm Impacts
Minor	- Expect a few inconveniences to daily life. - Winter driving conditions. Use caution while driving.
Moderate	- Expect disruptions to daily life. - Hazardous driving conditions. Use extra caution while driving. - Closures and disruptions to infrastructure may occur.
Major	- Expect considerable disruptions to daily life. - Dangerous or impossible driving conditions. Avoid travel if possible. - Widespread closures and disruptions to infrastructure may occur.
Extreme	- Expect substantial disruptions to daily life. - Extremely dangerous or impossible driving conditions. Travel is not advised. - Extensive and widespread closures and disruptions to infrastructure may occur. - Life-saving actions may be needed.

¹²³ National Oceanic and Atmospheric Administration, National Weather Service, Weather Prediction Center, "The Winter Storm Severity Index," 2026, <https://www.wpc.ncep.noaa.gov/wwd/wssi/wssi.php>

Previous Occurrences

Historical information indicates that winter weather occurs across the five-county region and can produce hazardous travel, roadway closures, infrastructure damage, power outages, injuries, and fatalities. Historical records from FEMA disaster declarations (see Table 44) and NOAA NCEI storm events show that winter weather has affected multiple counties throughout the region, particularly along major transportation corridors and in higher-elevation communities. These past events help illustrate the frequency, geographic extent, and consequences of winter storms in the region and provide an important foundation for evaluating current vulnerability and future risk.

Table 44: Winter Storms Previous Disaster Declarations¹²⁴

Year	Declaration Number	Declaration Type	Title and Description
2011	DR-1955-UT	Federal	Severe Winter Storm and Flooding; Garfield, Kane, and Washington Counties. Incident: December 20–24, 2010; declared February 11, 2011.

The reviewed Utah OpenFEMA records identify DR-1955-UT as the winter-storm-titled declaration with designated counties in the planning area. Other winter-storm-titled Utah declarations designated counties outside this region. Declaration records are not a complete winter-weather occurrence inventory.

PREVIOUS HAZARD EVENTS IN FIVE COUNTY AOG REGION FROM THE NCEI DATABASE

Table 45 presents selected verified Winter Storm, Winter Weather, and Heavy Snow records for the Southwest Utah and South Central Utah forecast zones from January 1, 2020, through May 31, 2026. Zone records may span county boundaries and are not allocated to individual jurisdictions. Fatalities and injuries include both direct and indirect casualties reported in each record; reported losses are not a complete accounting of actual impacts.

¹²⁴ FEMA, OpenFEMA Disaster Declarations Summaries, version 2, Utah records retrieved October 10, 2026. <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2> DR-1955-UT: incident December 20–24, 2010; declaration February 11, 2011; designated planning-area counties Garfield, Kane and Washington. OpenFEMA title: Severe Winter Storm and Flooding.

Table 45: Selected NCEI Storm Events Database Winter Weather Records, 2020–May 2026¹²⁵

Date	Event Type	Location	Magnitude	Fatalities	Injuries	Property Damage	Crop Damage
10/12/2021	Winter Storm	Southwest Utah (Zone)	N/A	0	0	\$100,000	\$0
2/13/2023	Winter Weather	Southwest Utah (Zone)	N/A	0	1	\$500,000	\$0
2/13/2023	Winter Weather	South Central Utah (Zone)	N/A	0	1	\$50,000	\$0
3/21/2023	Winter Weather	South Central Utah (Zone)	N/A	3	1	\$40,000	\$0
4/3/2023	Heavy Snow	Southwest Utah (Zone)	N/A	0	0	\$175,000	\$0
1/6/2024	Winter Weather	Southwest Utah (Zone)	N/A	1	3	\$50,000	\$0
2/13/2024	Winter Weather	Southwest Utah (Zone)	N/A	0	0	\$1,000,000	\$0
2/13/2024	Winter Weather	South Central Utah (Zone)	N/A	0	1	\$75,000	\$0
2/17/2026	Winter Storm	Southwest Utah (Zone)	N/A	0	0	\$80,000	\$0
2/18/2026	Winter Weather	Southwest Utah (Zone)	N/A	0	2	\$300,000	\$0

Probability of Future Occurrences

Winter storms are a recurring hazard in southwestern Utah and have caused transportation disruption, infrastructure damage, power outages, injuries, and fatalities. Winter weather is rated Highly Likely for occurrence somewhere in the region, consistent with the plan’s annual-or-more-frequent category and recurring cold-season conditions documented in the reviewed regional NOAA records. This qualitative regional rating is not an annual probability calculated from the selected loss table or a uniform rate for every county or elevation. The Utah Enhanced State Hazard Mitigation Plan identifies winter storms as part of the state’s severe weather profile, and the state’s severe weather chapter notes that, in Utah, winter storms cause more weather-related deaths than any other hazard. For the five-county region, the probability of future winter storm occurrence is influenced by elevation, topography, and exposure along

¹²⁵ NOAA National Centers for Environmental Information, Storm Events Database, annual details CSV files retrieved October 10, 2026. <https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/>, Event IDs in table order: 989432, 1084037, 1084038, 1088869, 1095837, 1150637, 1163302, 1163303, 1306219, 1306284. Event 1084037 reports 500.00K (\$500,000) in property damage. Table casualties sum the direct and indirect fields.

major travel corridors, with snow, cold, and travel impacts varying across higher- and lower-elevation areas of all five counties. Based on the state plan and historical regional experience, winter storms are expected to remain a recurring hazard in southwestern Utah, with future events continuing to produce snowfall, blowing snow, icy roads, extreme cold, and related secondary impacts.¹²⁶

The following county summaries describe elevation-dependent winter conditions and potential impacts within the regional Highly Likely classification; comparative county probabilities are not calculated.

- Beaver and Garfield Counties can experience moderate to major winter storm impacts due to their higher elevations and colder winter temperatures, which support frequent snowfall, prolonged snowpack persistence, and hazardous travel conditions; these counties are more likely to experience heavy snow, blowing snow, and extreme cold that can disrupt transportation and utilities.
- Iron County experiences winter weather in valley and higher-elevation areas, including snowstorms, snow squalls, and freezing conditions capable of producing roadway and infrastructure disruption.
- Kane County experiences winter storms, with impacts varying considerably by elevation; higher-elevation areas are more susceptible to heavy snowfall and winter travel hazards, while lower elevations may experience freezing rain, brief snow events, and icy conditions.
- Washington County experiences less frequent snow accumulation in its lower-elevation communities because winter temperatures are generally warmer there; however, winter storms do occur periodically, particularly in higher-elevation areas, and can still produce snow, ice, and transportation disruptions.

NCA5 concludes that warming has already decreased western snowpack and will continue to do so, with a greater share of precipitation falling as rain rather than snow, reduced snow extent, earlier snowmelt, and more rain-on-snow events. These changes may reduce average snowpack, particularly at lower elevations, while individual winter storms and cold-weather disruptions will continue to occur. Future vulnerability depends on changing precipitation phase, elevation-dependent snow, earlier melt, rain-on-snow and flooding potential, development, transportation dependence, and utility and heating needs.¹²⁷

¹²⁶ NOAA National Centers for Environmental Information, Storm Events Database, annual details CSV files retrieved October 10, 2026. <https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/> Regional history check: Winter Weather, Winter Storm and Heavy Snow records for the Southwest Utah and South Central Utah forecast zones, January 1, 2000–December 31, 2025. The query returned 85 records in 18 consecutive calendar years (2007–2024); records are not independent storms or county-level probabilities.

¹²⁷ U.S. Global Change Research Program, Fifth National Climate Assessment, 2023, Chapters 4 and 28; U.S. Global Change Research Program, Fifth National Climate Assessment (2023), Chapter 28, Southwest. <https://nca2023.globalchange.gov/chapter/28/>. Regional findings do not establish a uniform change in local winter-storm intensity.

Table 46: Regional Probability and Future Winter Storm Conditions by County

County	Regional Probability Basis	Anticipated Winter Storm Type	Anticipated Intensity and Impacts
Beaver County	Highly Likely regionally; local occurrence varies with elevation.	Heavy snowfall, blowing snow, extreme cold, prolonged snowpack	Due to higher elevations and colder winter temperatures, Beaver County can experience moderate to major winter storm impacts. Future storms are expected to produce heavy snowfall, reduced visibility, hazardous travel conditions, and increased risk of power outages and infrastructure disruptions, particularly impacting transportation corridors.
Garfield County	Highly Likely regionally; local occurrence varies with elevation.	Snowstorms, heavy snow, extreme cold, winter weather events	Garfield County's high elevations and rural road network contribute to winter storm impacts. Anticipated intensities range from moderate to major events, including heavy snowfall and prolonged cold periods that can impede emergency response, isolate communities, and strain utilities and critical services.
Iron County	Highly Likely regionally; local occurrence varies with elevation.	Snowstorms, snow squalls, freezing temperatures, occasional ice	Iron County is expected to continue experiencing winter storm events. Both valley and higher-elevation areas face risks from heavy snowfall and rapid snow squalls, resulting in dangerous driving conditions, infrastructure disruptions, and episodic power outages during more intense storms.
Kane County	Highly Likely regionally; local occurrence varies with elevation.	Snowfall at higher elevations, freezing rain, icy road conditions	Kane County's winter conditions vary by elevation, with higher elevations experiencing more frequent snowstorms and lower elevations susceptible to freezing rain and icy conditions. Future events are expected to range from minor to moderate impacts, with localized major impacts in mountainous areas affecting highways and access routes.
Washington County	Highly Likely regionally; local occurrence varies with elevation.	Occasional snow, freezing temperatures at higher elevations, winter weather events	Washington County experiences less frequent snow accumulation in lower-elevation communities because winter temperatures are generally warmer there. However, future winter storms remain possible, particularly in higher-elevation areas, and may produce moderate impacts such as snow-covered roadways, travel delays, and limited power disruptions during stronger events.

Vulnerability Assessment

Winter storms create widespread vulnerability across the Five County AOG Region by affecting people, buildings, infrastructure, transportation networks, utilities, and critical services, with risk varying according to elevation, exposure, and community characteristics. Higher-elevation communities and mountainous transportation corridors are generally the most susceptible to heavy snowfall, blowing snow, prolonged cold, and road closures, while lower-elevation areas may still experience disruptive freezing conditions, icy roadways, and episodic snow events. Vulnerability is particularly shaped by dependence on major highway corridors, the presence of rural and isolated communities, aging or exposed utility infrastructure, and populations that may be more sensitive to cold and service disruptions, including older adults, medically vulnerable individuals, and travelers. The following assessment evaluates these vulnerabilities by considering the extent to which winter storms can damage property, disrupt essential services, isolate communities, and threaten public safety throughout southwestern Utah.

BEAVER COUNTY

Beaver County's high-elevation terrain, dispersed rural settlement pattern, and dependence on a limited number of transportation and utility corridors create significant winter storm vulnerability. Heavy snow, blowing snow, black ice, and prolonged cold can affect Interstate 15, State Route 21, local roads, and mountain passes, disrupting resident travel, freight movement, emergency response, school operations, and access to medical care. Rural residents, older adults, medically vulnerable people, and travelers are especially at risk when closures or outages delay assistance or isolate communities.

Exposed assets include Beaver Valley Hospital, schools, fire and EMS facilities, law enforcement functions, water and wastewater systems, electric distribution lines, communications systems, and residential structures susceptible to snow loading, frozen pipes, falling limbs, heating interruptions, and prolonged cold.

The most consequential effects are expected along transportation lifelines and where critical services have limited redundancy. Road crashes and closures can delay medical access and supply deliveries, while power or communications outages can affect homes, businesses, schools, public safety operations, utility systems, and Beaver Valley Hospital. Economic consequences may include business interruption, delayed freight, reduced workforce mobility, livestock and agricultural operational challenges, and increased snow removal and emergency-response costs.

Cascading impacts: Transportation disruption can delay emergency response, isolate residents, interrupt fuel and food deliveries, and restrict access to health care, schools, and workplaces. Power loss may then impair heating, communications, water and wastewater operations, and fuel availability; communications failures can further complicate coordination among road crews, utilities, and public safety agencies. In a rural county with limited alternate routes and service redundancy, these linked failures can extend outages, increase public-health risks, and slow recovery.

Changes in development: New residential, commercial, recreation, and infrastructure development can increase the number and value of assets exposed to snow, ice, and cold, particularly where growth extends along Interstate 15, State Route 21, or into higher-elevation and rural areas. Development outside established service areas may lengthen emergency-response and utility-restoration times and increase road-maintenance demands. Applying current building standards, protecting backup power and communications, maintaining reliable access, and considering snow storage, drainage, and road treatment needs as development occurs can limit growth in vulnerability.

GARFIELD COUNTY

Garfield County is vulnerable because extensive high-elevation terrain, widely separated communities, and limited transportation redundancy expose residents and visitors to heavy snow, drifting, ice, extreme cold, and prolonged snow cover. Risk is pronounced on Boulder Mountain, the Aquarius Plateau, U.S. Highway 89, State Route 12, State Route 22, and remote local roads. Closures can isolate communities and disrupt emergency response, school transportation, freight, tourism, and access to medical care.

Key exposed assets include Garfield Memorial Hospital in Panguitch, a 15-bed critical access hospital, along with schools, public safety facilities, water and wastewater systems, electric and communications infrastructure, homes, businesses, and tourism services. Countywide totals provide planning context and are not estimates of direct exposure to a single storm.

Winter storms may cause crashes and closures, delay emergency and utility crews, interrupt deliveries, and damage buildings through snow loading, frozen pipes, falling limbs, and heating-system disruption. Outages can constrain operations at the hospital, schools, public safety facilities, utility systems, and businesses. Because essential services are concentrated in a small number of communities and travel distances are long, even a moderate event can produce disproportionate impacts and extended restoration times.

Cascading impacts: Closure of U.S. Highway 89, State Route 12, State Route 22, or mountain connections can isolate residents, strand visitors, delay medical access, and interrupt fuel, food, and other deliveries. Power loss may impair heating, communications, water and wastewater operations, while inaccessible roads can prevent repair crews from reaching failures. These interactions can extend tourism and business interruption, increase risks to older and medically vulnerable residents, and complicate coordinated response across a large rural county.

Changes in development: New housing, visitor accommodations, recreation facilities, and supporting infrastructure can increase exposure, especially in high-elevation or remote locations and along corridors with few alternate routes. Seasonal and tourism-related development may also increase the number of unfamiliar travelers present during storms and place added demand on road maintenance and emergency services. Directing growth toward areas with reliable year-round access and utilities, while applying snow-load standards, backup-power provisions, and winter access and maintenance requirements, can reduce added vulnerability.

IRON COUNTY

Iron County combines growing population centers with high-elevation communities and travel routes regularly exposed to snowfall, snow squalls, black ice, and prolonged cold. Vulnerability is concentrated in and around Cedar City, along Interstate 15 and State Route 14, and on mountain roads serving Brian Head and nearby areas. Winter conditions can rapidly reduce visibility and disrupt travel, emergency response, education, commerce, tourism, and regional access to services.

Exposed assets include Cedar City Hospital, schools and higher-education facilities, public safety facilities, water and wastewater systems, utilities, communications infrastructure, homes, businesses, and regional government services. These countywide values provide planning context rather than direct exposure estimates for a single storm.

Snow and ice can cause major crashes, closures, delayed emergency response, and interruptions to school, university, hospital, business, freight, and visitor operations. Physical damage may include roof stress, frozen or burst pipes, falling limbs, and utility failures. Because Cedar City functions as a regional center for health care, education, government, and commerce, disruption can affect residents, students, workers, travelers, and surrounding communities that depend on county services.

Cascading impacts: Closures on Interstate 15, State Route 14, or mountain routes can interrupt freight, restrict access to Cedar City Hospital and other services, isolate higher-elevation areas, and delay utility restoration. Power loss may affect heating, communications, water and wastewater operations, fuel access, and institutional continuity; communications failures can impede coordination among public safety agencies, transportation officials, utilities, and major institutions. These linked effects can broaden a short winter event into regional public-health, education, economic, and continuity-of-operations impacts.

Changes in development: Continued growth in and around Cedar City and development in higher-elevation recreation and residential areas can increase the number of people, structures, and trips exposed to winter weather. Expansion along Interstate 15 and mountain corridors may add traffic to routes already susceptible to sudden squalls, ice, and closures, while dispersed growth can increase snow-removal, emergency-response, and utility-restoration demands. Current building standards, protected utilities, backup power, redundant communications, and development review that addresses winter access, slope, drainage, and snow storage can help prevent vulnerability from increasing with growth.

KANE COUNTY

Kane County's sharp elevation differences, dispersed communities, limited highway network, and year-round visitor travel create varied winter storm vulnerability. Higher-elevation areas and U.S. Highway 89, State Route 9, and mountain and canyon routes serving Orderville, Glendale, Mount Carmel Junction, Alton, and Zion National Park access points are exposed to snow, drifting, black ice, and reduced visibility. Kanab and other lower-elevation areas experience less sustained snowfall but remain susceptible to freezing rain, icy roads, brief snow events, and cold-related service disruption.

Exposed assets include Kane County Hospital in Kanab, schools, public safety facilities, water and wastewater systems, electric and communications infrastructure, homes, businesses, and tourism-dependent services. These countywide values provide planning context rather than direct exposure estimates for a single winter storm.

Winter storms can cause crashes, road closures, delayed emergency response, school disruption, utility outages, and interruption of freight and visitor travel. Buildings may experience frozen or burst pipes, localized roof stress, falling limbs, and heating-system problems. Limited alternate routes and the concentration of critical services in a few communities mean that short-duration road or utility disruptions can affect residents, workers, visitors, and access to health care and supplies across a large area.

Cascading impacts: Closures on U.S. Highway 89, State Route 9, or mountain and canyon routes can isolate communities, strand travelers, delay emergency medical access, and interrupt deliveries and tourism activity. Power loss may impair heating, communications, water and wastewater operations, fuel availability, and business continuity; poor communications can then hinder coordination among transportation, utility, public safety, and visitor-service organizations. These linked effects can prolong disruption and disproportionately affect older adults, medically vulnerable residents, and isolated households.

Changes in development: Additional housing, lodging, commercial, and recreation development can increase exposure along visitor routes and in elevated or remote areas where winter access is less reliable. Growth may increase unfamiliar winter drivers, traffic volumes, evacuation and response needs, and demand for road treatment, utilities, and emergency services. Locating growth where dependable access and utilities are available, preserving alternate access where feasible, and applying snow-load, freeze-protection, backup-power, and winter-maintenance requirements can reduce development-related increases in risk.

WASHINGTON COUNTY

Washington County combines rapidly growing lower-elevation communities with higher-elevation mountains and travel corridors exposed to snowfall, black ice, and freezing temperatures. St. George, Washington, and Hurricane receive less frequent snow accumulation than higher parts of the region, but even minor events can cause disproportionate disruption where road users and infrastructure are less accustomed to winter conditions. Vulnerability is greater in the Pine Valley Mountains, northeastern highlands, and along Interstate 15, State Route 9, State Route 18, and connecting roads.

Exposed assets include St. George Regional Hospital, schools, public safety and government facilities, water and wastewater systems, utilities, communications infrastructure, homes, businesses, and major regional service centers. These countywide values provide context and are not estimates of direct exposure to one winter storm.

Icy roads, snowfall, and rapid temperature changes can cause crashes, travel delays, freight and commuter disruption, delayed emergency response, and interruption of school, medical, government, and visitor services. Physical damage is generally localized but may include frozen pipes, falling limbs, power

interruptions, and snow-load concerns in higher elevations. Because the county is the region's largest population and economic center, even a short event can affect many residents, workers, visitors, businesses, and surrounding communities that depend on services in the St. George area.

Cascading impacts: Disruption on Interstate 15, State Route 9, State Route 18, or routes to higher terrain can delay emergency response, interrupt commuting and freight, and restrict access to health care and public services. Power outages may affect heating, communications, water and wastewater operations, fuel supply, and business continuity; communications failures can complicate coordination among utilities, transportation agencies, first responders, and major institutions. The county's large service population can amplify these linked effects and extend impacts beyond the immediate storm area.

Changes in development: Rapid residential and commercial growth increases the number and value of assets that may be affected by icy roads, cold, and localized snowfall, while expansion toward higher terrain or along major corridors can add traffic and service demands in exposed locations. A larger and older population may also increase medical, sheltering, and continuity needs during outages. Integrating winter access, road treatment, drainage and freeze protection, protected utilities, backup power, and emergency-service capacity into development and capital planning can help keep exposure from growing faster than community resilience.

5 Capability Assessment

Purpose and Scope

Local capabilities influence whether a jurisdiction can develop, fund, implement, and maintain actions that reduce long-term natural hazard risk. This assessment identifies the authorities, policies, programs, personnel, technical resources, funding mechanisms, outreach methods, and floodplain management functions available to each participating jurisdiction. The findings were used with the risk assessment and identified community needs to screen action feasibility, assign implementation responsibility, identify potential resources, and identify opportunities to improve or expand capability.

This regional summary presents common and county-level findings. It does not replace the participant-specific capability assessments provided in the jurisdiction sections of this plan. Those assessments document the capabilities and improvement opportunities of each participating county, municipality, Tribe, and special district, as applicable. Where a capability could not be confirmed, the plan does not assume that it exists; the relevant participant section identifies the item as a capability improvement opportunity or addresses it through an applicable mitigation action.