

## Natural Threats

### Drought

#### Hazard/Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an areas' usual water-consuming activities. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought can often be defined regionally based on its effects:

*Meteorological* drought is usually defined by a period of below average water supply.

*Agricultural* drought occurs when there is an inadequate water supply to meet the needs of the states' crops and other agricultural operations such as livestock.

*Hydrological* drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels.

*Socioeconomic* drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

#### Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)

Historical data on droughts indicate an occurrence, on average every ten years in this area. Based on the sub-regions and the State's multi-year drought history, it is evident that the entire region is vulnerable to drought. With the majority of land area used for agricultural purposes, the region has significant exposure to drought. In addition to economic and public water supply impacts, soil erosion, dust, and wildfire hazard are also exacerbated by drought conditions.

#### Upper Arkansas (Custer, Fremont, Chaffee, Lake)

The risk of a drought is homogeneous across the sub-region. Annual precipitation is fairly, consistent across the sub-region with variations occurring as the topography changes from mountains to valley floors. Overall, the population centers in Chaffee, Fremont, and Custer Counties receive an average of 11 to 15 inches of moisture a year. With such a small amount of annual precipitation, any decrease in moisture over a single year or for a multiyear period can greatly affect the livelihood in the sub-region. The tourism and recreation economy, as well as individuals, can be disrupted by a drought at a parcel level.



*Open space, Chivington, Kiowa County*

#### South Central (Huerfano and Las Animas)

Average annual precipitation for much of Las Animas County is 13 to 19 inches. Colorado has a history of periods of low precipitation and drought. The county experienced drought in the years of 2000, 2002, 2003, 2005-2006, 2008-2009 and 2011-2015. The entire county is at risk for drought conditions.

The geographic extent of this hazard in Huerfano County is extensive—more than 50% of the sub-region is affected. Drought could have a devastating impact on Huerfano County's economy. As water resources become impacted, effects may be felt by any industry that uses large amounts of water. Prolonged drought would intensify these issues.

### **Pueblo**

Drought can severely impact the county both physically and economically. Adequate water is one of the most critical issues, which the citizens of this county are constantly forced to address. Agriculture, manufacturing, tourism, commercial, and domestic use all require a constant, reliable supply of water. As the population continues to grow, so too will the demand for water, which is why mitigating the future impacts of drought are so important. Pueblo County has been affected and received drought declarations several times in recent history. Pueblo will continue to have agricultural, farming, and economic loss at least yearly to some extent. Wildland fire and dust storms are also a greater risk due to drought.

## **Flooding**

### **Hazard/Problem Description**

Floods, usually caused by weather events, are among the most frequent and costly natural disasters in terms of human hardship and economic loss. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Certain health hazards are also common to flood events. Standing water and wet materials in structures can become breeding grounds for microorganisms such as bacteria, mold, and viruses. This can cause disease, trigger allergic reactions, and damage materials long after the flood. When floodwaters contain sewage or decaying animal carcasses, infectious disease becomes a concern.

### **Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)**

Each county in the sub-region contains areas of unique, nuisance, localized flooding. This type of flooding can be found in both incorporated and unincorporated areas. The sub-region contains 15 separate and distinct watersheds. Each watershed, or drainage basin, contains a river or creek. Flooding has occurred frequently across the sub-region. Historical records reference many floods in the Arkansas River Valley. The Colorado Water Conservation Board (CWCB) maintains a record of historical documents for the sub-region. The sub-region experiences an average of 2.7 floods per year. Most of these floods were less than the ten0-year flood. The probability for future occurrence of a ten0-year flood event in the sub-region is *occasional* while the probability for flash flooding is *likely*.

### **Upper Arkansas (Custer, Fremont, Chaffee, Lake)**

The extreme geography in the sub-region has the potential for severe flash flooding. There is also potential for floods that may not be weather related, but rather related to the failure of impoundment structures. By analyzing the HAZUS data there are 15 dams in the sub-region that require "Emergency Action Procedures" and are classified as having a "High" or "Severe" Hazard rating. There are two concentrated areas in the sub-region where dams are located. There are nine dams in and around Lake County; five dams are located around

Canon City; and one is near Westcliffe. Flash flooding has occurred many times throughout history in Canon City.

As the municipalities within the sub-region grow, so, too, do the quantities of impervious surfaces that accelerate the run-off from summer storm events. The vulnerability of community assets to flash floods is tending to decrease through time as mitigation measures, such as implementation of the NFIP program, show their effects.

### **South Central (Huerfano, Las Animas)**

All of Las Animas County is at risk to flood conditions. Flooding is predominantly the result of snowmelt and cloudbursts that result in flash flooding. Severe flash flooding poses the greatest risk. The geographic extent of this hazard in Huerfano County is *significant* -- 25-50% of the sub-region is affected. Based on historical data, flooding events less severe than a 100-year flood and those outside of the 100-year floodplain occur frequently during periods of heavy rains.

### **Pueblo**

In Pueblo County, floods usually occur during the spring and summer, during heavy rainfalls after prolonged dry periods, or in the spring following runoff from heavy mountain snowpack. In the early 1970's, Pueblo Dam was built to supply irrigation water into the lower Arkansas Valley as part of the Arkansas Water Shortage Project. It also provides flood control and water for industrial and municipal use. The Pueblo community is aware they must be as prepared as possible for the potential problem of flooding along the many streams in the area. The Arkansas River underwent channel improvement and levee construction following the 1921 flood. Then, in 1975, the Pueblo Dam was completed, which helped flood control on the Arkansas River downstream as well as upstream of the dam.

## **Wildfire**

### **Hazard/Problem Description**

The Colorado State Forest Service defines wildfires as “an open fire which spreads unconstrained through the environment. If not quickly controlled, the result can be a firestorm, often termed a conflagration which destroys large amounts of property and threatens lives”. Wildfires occur everywhere in Colorado. The most common kinds of wildfires are grassland fires, which occur along railroad tracks, in fields, and in the prairie land. Wildfires occur naturally (often through lightning strikes) and from human causes, both intentional and accidental.

### **Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)**

Wildfires are most likely to occur during the fire season, which extends from mid-spring to late fall, and are most prominent during the driest summer months of July and August. Drought conditions contribute to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases.

### **Upper Arkansas Area (Chaffee, Custer, Fremont, Lake)**

The potential for wildland fire is high and uniform across the four counties comprising the sub-region. The flanks of each valley are covered with dense coniferous forest and are increasingly popular locations for mountain homes. The continued migration of inhabitants to remote areas increases the probability of man-caused ignitions from vehicles, grills, campfires, and electrical devices. The penetration by SUV and all-terrain

vehicles to ever more remote areas, extends the risk of man-caused ignitions to pristine forests. For over a century, communities in the sub-region have cooperated to complete a wide range of actions to mitigate the flash flood hazard. Corresponding efforts to reduce wildland fire risks have not been the norm.

### **South Central (Las Animas, Huerfano)**

According to the *Colorado State Wildfire Risk Assessment Report for Las Animas County*, there is a strong probability that at least one wildfire will occur each year in Las Animas County. In the event of wildfire, there would likely be little damage to most of the infrastructure. Most roads and railroads would be without damage except in the worst scenarios. Several critical facilities and infrastructure are in the non-burnable threat areas. This is primarily in areas of urban centers, such as downtown Trinidad and includes several schools, protective functions, and bridges. Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts. Wildfires are of significant concern throughout Colorado and Huerfano County in particular. According to the Colorado State Forest Service, vegetation fires occur on an annual basis; most are controlled and contained early with limited damage.

### **Pueblo**

It is not unusual for Pueblo County to experience 200 or more man-caused and naturally occurring wildland fires each year. Most of those fires are easily suppressed and result in minimal impact to property or the environment.

## **Pandemic and Zoonotic Diseases**

### **Hazard/Problem Description**

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. Colorado state law requires the Colorado Department of Public Health and Environment (CDPHE) to monitor, investigate and control the causes of epidemic and communicable diseases affecting the public health in Colorado.

In the predominately agricultural region that makes up the district, zoonotic diseases are also a significant hazard to the population and livestock of the area. Zoonotic diseases are those which can be transmitted from animals and humans. The CDHPE indicates that the most common of these diseases in Colorado are hantavirus, plague, rabies, tularemia, West Nile Virus (WNV) (and other mosquito-borne diseases) and various tick-borne diseases.

### **Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)**

In the predominately agricultural region that makes up the sub-region, zoonotic diseases are also a significant hazard to the population and livestock of the area. Some zoonotic diseases may impact livestock, which may have a significant impact on the economics of the sub-region. The diseases are naturally occurring in the populations of animals which always reside in the region. Given these assumptions, the likelihood of future occurrence is likely.

### **Pueblo**

Insect and mammal vectors in Colorado carry numerous diseases. Rabies, plague, tularemia, avian flu, and various forms of encephalitis viruses are a few diseases that are carried by insects, birds, or mammals. These

vectors occur naturally and can be more prolific or pronounced after a natural disaster such as flooding, drought, or even wildland fire. Mosquitoes are of great concern because they are known to carry various diseases that cause meningitis, St. Louis Equine Encephalitis (SLE), Western Equine Encephalitis (WEE), and West Nile Virus (WNV). West Nile Virus has been the greatest concern in Pueblo County.

## Earthquake

### Hazard/Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. The amount of energy released during an earthquake is usually expressed as a Richter magnitude and is measured directly from the earthquake as recorded on seismographs. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface as felt by humans and defined in the Modified Mercalli scale.

### Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)

Data indicates that the expected severity of earthquakes in the region is limited, as damage from earthquakes typically occurs at peak accelerations of 30% or greater. However, as demonstrated by the HAZUS modeling documented earlier, the potential, though remote, does exist for damaging earthquakes. This relatively higher risk applies primarily to Bent, Crowley, Kiowa, and Otero Counties, due to their proximity to the Cheraw fault. Based on the history of previous occurrences there is also indication that counties without known, active faults are at risk for earthquakes. No geographically extensive earthquakes have occurred in the sub-region, but the potential remains. Because the occurrence of earthquakes is relatively infrequent in Colorado and the historical earthquake record is short (only about 130 years), it is not possible to accurately estimate the timing or location of future dangerous earthquakes in Colorado. Seismologists predict that Colorado will again experience a magnitude 6.5 earthquake at some unknown point in the future. The major factor preventing the precise identification of the time or location of the next damaging earthquake is the limited knowledge of potentially active faults.

### Upper Arkansas (Custer, Fremont, Chaffee, Lake)

The entire region is considered low risk for significant earthquake occurrence. Each county has some faults and Chaffee County does contain several major faults, including the Sawatch Fault that runs north/south through the center of the county on the eastern side of the Sawatch Mountain Range. There are potentially active faults in or near Chaffee County and in all of Colorado, respectively. More than 700 earthquake tremors of magnitude 2.5 or higher have been recorded in Colorado since 1867. This is considered relatively infrequent for a western state. According to the U.S. Geological Survey, the probability that a magnitude 5 or greater earthquake will occur in the next 50 years in Fremont County is ten percent or less.

### South Central (Las Animas, Huerfano)

Available data lists 17 recorded earthquake events in Las Animas County. The county experienced the largest earthquake in Colorado in the past fifty years in 2011, a 5.2 magnitude earthquake. Las Animas County does not contain major faults, but the Sangre de Cristo Fault runs north/south (at the base of the Sangre de Cristo Mountains along the eastern edge of the San Luis Valley just west of Las Animas County and the smaller, Cheraw Fault, lies north in Las Animas County and runs thru Kiowa, Otero, and Crowley Counties.

Huerfano County is located directly to the east of the Sangre De Cristo Fault. The Sangre De Cristo Fault is the youngest and one of the most prominent potentially active faults in Colorado. CGS recorded two instrumentally located epicenters with 3-3.9 magnitude in Huerfano County between 1962 and 2007. Reports indicate a probability of future occurrence as “Occasional”, which is a 1-10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.

**Pueblo** – Hazmat Mitigation Planning has determined, through review of FEMA and Colorado Geology Survey websites and the input of local agencies that the potential risk associated with seismic events of substantial frequency or intensity for the county is negligible.

### Erosion and Deposition, Expansive Soil, and Subsidence

#### Hazard/Problem Description

**Erosion and Deposition** – The Colorado Geological Survey defines erosion as ‘the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice.’ Deposition is defined as ‘the placing of eroded material in a new location.’ According to the Colorado Geological Survey, all material that is eroded is later deposited in another location.

**Expansive Soil** – Expansive and collapsible soils are some of the most widely distributed and costly geologic hazards. Collapsible soils are a group of soils that can rapidly settle or collapse the ground. They are also known as metastable soils and are unsaturated soils that undergo changes in volume and settlement in response to wetting and drying, often resulting in severe damage to structures. The sudden and usually large volume change could cause considerable structural damage. Expansive soil and rock are characterized by clayey material that shrinks as it dries or swells as it becomes wet.

**Subsidence** – The Colorado Geological Survey defines land subsidence as the sinking of the land over manmade or natural underground voids. Subsidence can result in serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. Weight, including surface developments such as roads, reservoirs, and buildings and manmade vibrations from such activities as blasting or heavy truck or train traffic can accelerate the natural processes of subsidence. Fluctuations in the level of underground water caused by pumping or by injecting fluids into the earth can initiate sinking to fill the empty space previously occupied by water or soluble minerals. The consequences of improper use of land subject to ground subsidence can be excessive economic losses, including the high costs of repair and maintenance for buildings, irrigation works, highways, utilities, and other structures. This results in direct economic losses to citizens as well as indirect economic losses through increased taxes and decreased property values.



*Dried up farm land, Ordway, Crowley County*

## Stream Bank Erosion/Stability

### Hazard/Problem Description

Any flowing body of water (brook, creek, stream, river) is a stream. Stream flow is expressed as volume per unit time, usually cubic meters per second, cubic feet per second, sometimes cubic kilometers per second, or acre-feet per second or day. Stream flow varies tremendously with time. Short term controls include rainfall, snowmelt, and evaporation conditions. Long term controls include land use, soil, groundwater state, and rock type.

Streams erode by a combination of direct stream processes, like down cutting and lateral erosion, and indirect processes, like mass-wasting accompanied by transportation. Water tends to move downstream in slugs that extend all the way across a channel. When the channel bends, water on the outside of the bend (the cut-bank) flows faster and water on the inside of the bend (the point) flows slower. This distribution of velocity results in erosion occurring on the outside of the bend (cut) and deposition occurring on the inside of the bend.

## Extreme Temperatures: Extreme Cold

### Hazard/Problem Description

Temperature extremes - both cold and hot - cause more deaths every year than any other disaster, including hurricanes. Both extreme cold and extreme heat are hazards present in the sub-regions.

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

### Southeastern Colorado (Baca, Bent, Crowley, Kiowa, Otero, Prowers)

Both extreme cold and extreme heat are hazards present in the sub-region.

In 2001, the National Weather Service implemented an updated Wind Chill Temperature index. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. In a region known for extremely cold weather, exacerbated by high winds, temperature extremes and particularly severe cold present a danger to the inhabitants of the sub-region. Surprisingly, the National Climate Data Center database reflects no extreme cold and extreme wind-chill events in the sub-region between 1996 and 2010. Temperature variations are expected in the sub-region. While extremes are usually statistical outliers, they still present a useful picture of potential ranges. These events are expected to occur yearly, in general, and are considered highly likely.

Baca County has the highest average summer temperatures in the State of Colorado. Portions of Baca County may have 80 or more days of 90°F or greater temperatures a year. Most of the county may experience fifteen to eighteen days of 100°F or greater. All the counties in the sub-region have higher average temperatures than most counties in the State.

Some extrapolations for the severity of extreme heat in the sub-region can be drawn based on the national weather service heat index. The Colorado Climate Center notes that the humidity of the eastern plains is very low, but that the highest temperatures in the state occur in this region. This indicates that while many hot days in the sub-region fall in the “danger” or “extreme danger” area of the heat index, the low humidity may make the heat feel less uncomfortable on the population. It is possible; therefore, that the population may not notice the effects of extreme heat on themselves until serious injury occurs.

### Severe Weather: Thunderstorms/Lightning/Hail

#### Hazard/Problem Description

**Thunderstorms** - Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards Earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

**Lightning** - Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

Lightning is one of the more dangerous weather hazards in the United States and in Colorado. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires, and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning causes more than 26,000 fires in the United States each year. The institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be more than \$6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

**Hail** - Hail is associated with thunderstorms that can also bring high winds and tornados. It forms when updrafts carry raindrops into extremely cold areas of the atmosphere where they freeze into ice. Hail falls when it becomes heavy enough to overcome the strength of the updraft and is pulled by gravity towards the earth. Hailstorms occur throughout the spring, summer, and fall in the region, but are more frequent in late spring and early summer. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 mph. Hail causes nearly \$1 billion in damage to crops and property each year in the United States. Hail is also one of the requirements which the National Weather Service uses to classify thunderstorms as severe. If hail more than  $\frac{3}{4}$  of an inch is produced in a thunderstorm, it qualifies as severe.

#### Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)



*Pronghorn outside Eads, Kiowa County*



Storms in the area are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately ten percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is 1 inch or greater, winds more than 50 knots (57.5 mph), or a tornado. The area sees 9 -14 severe thunderstorm watches per year. Damage, injury, and death due to lightning have been recorded in the area and specific incidents of hail have caused significant damage throughout.

### **South/Central (Las Animas, Huerfano)**

According to the National Lightning Detection Network, Las Animas County has approximately 1 – 4 flashes of lightning per square kilometer per year. The overall significance of hail events in the county have been rated medium to high.

The geographic extent of this hazard in Huerfano County is *extensive*. Hail, heavy rain, and lightning can occur anywhere in the County. It is highly likely that lightning and hail will occur every year in Huerfano County, but not all will be damaging.

### **Pueblo**

Pueblo County averages between 40 and 80 thunderstorm days per year, with the average number of cloud-to-ground lightning strikes per year around 15,000, amounting to nearly 7 cloud-to-ground flashes per square mile per year. Colorado's Front Range receives the highest frequency of large hail (3/4 inch and greater) in the United States. The high frequency of larger stone sizes contributes directly to the excessive property damage that occurs. Large stones can fall at speeds approaching 90 mph and livestock fatalities from hail are fairly common. Hailstorms cause a major amount of damage to property and crops across the United States and in Colorado every year. Hail has occurred in every part of Pueblo County, with no one area favored over other areas. Future predictions of hail incidents for the whole of Pueblo County is yearly with large damaging hail. Hail occurrences are high is probability and a high risk of damage to agriculture, farming, structure and vehicle damage and the economy.

## **Landslide, Mud/Debris Flow, Rockfall**

### **Description**

A landslide is a general term for a variety of mass movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence.

### **Upper Arkansas (Custer, Fremont, Chaffee, Lake)**

There are many locations in the Upper Ark where the potential for a landslide is high. The Soil Conservation Service acknowledged the existence of debris fans in Chaffee County in the early to mid-1970's in their Flood Plain Studies. The south slope of Mt. Princeton and north of Chalk Creek and along County Road 162 from Mt. Princeton Hot Springs to the town site of Alpine is well-defined and slides almost annually. A rainstorm in the area precipitates the slide. In 2002 it was discovered that a similar situation to Chalk Creek exists on the north slope of Mt. Princeton. Issues related to landslides are uniform across the Upper Arkansas.

### **South/Central (Las Animas, Huerfano)**

The geographic extent of this hazard in Huerfano County is **limited**—10-25% of the sub-region affected. Huerfano County has occasional landslide-related problems, especially in the western part of the County. Areas of concern include areas southwest of Gardner near Sheep Mountain and north of Gardner near Highway 620.

## Dam/Levee Failure

### Description

A sudden and uncontrolled release of large amounts of water impounded in a man-made barrier constructed above the natural level of the ground for the purpose of impounding water and caused by structural deficiencies in the barrier.

### **Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)**

According to HAZUS, and data from the National Inventory of Dams (NID) and National Performance Dam Program (NPDP), there are dams in each county that pose a risk to people or property should the dam fail. There are no reports of significant dam failures in the sub-region. However, the NPDP tracks dam incidents (events that affect the structural and functional integrity of dams, though not necessarily causing failure and not including ordinary maintenance and repair, vandalism, acts of war, recreational accidents, and sabotage), some of which have affected the sub-region. There are ten levees in the sub-region based on levees that are mapped on Flood Insurance Rate Maps and four that are not. The sub-region remains at risk to dam failures from the high and significant hazard dams that protect the sub-region. Given the varying density of population, the area that would be affected by flooding, and the varying ages and conditions of these dams, the potential exists for future dam failures which could result in property damage and possible loss of life. Nonetheless, it should be noted that there have not been any major failures of dams or levees in the sub-region.

### **South Central (Las Animas, Huerfano)**

Databases list twelve high hazard and three low hazard dams in this sub-region. According to the Association of State Dam Safety Officials, there haven't been any reported dam failures in Las Animas County. The Hazards, United States-Multi Hazard (HAZUS-MH) database and the U.S. Army Corps of Engineers (USACE) National Levee Database lists no known levees in Las Animas County. It is possible that there are levees located within the county that are not listed in these databases. In Huerfano County, risk to dam failure is greatest to Walsenburg downstream of the Martin Lake Dam. Fowler, in Otero County is at risk if the Cucharas #5 dam were to fail in Huerfano County.

### **Upper Arkansas (Custer, Fremont, Chaffee, Lake)**

There have not been any reported dam failures in the sub-region since 1921 (Fremont County) and dam failure risk is rated at low to medium in all counties. There are 11 high hazard and six significant hazard rated dams in the sub-region according to the respective Hazard Mitigation Plans (HMP) of each of the counties. There are an uncounted number of 'non-jurisdictional' dams on public and private lands in the sub-region. These are small dams that normally do not store water but may impound water during heavy precipitation events. Because they are not monitored or maintained, there is potential for them to overtop or fail and cause flooding and property damage during a significant rainfall event. The extent and risk associated with these dams is not known. If failure were to occur on dams north of Chaffee County that lie along the Arkansas

River or associated tributaries, there would be significant impacts for the people and property within the county. The Hazards, United States-Multi Hazard (HAZUS-MH) database and the U.S. Army Corps of Engineers (USACE) National Levee Database lists no known levees in Custer, Fremont, or Chaffee County and none were reported in the HMP of Lake County. It is possible that there are levees located within the region that are not listed in these databases.

## Tornadoes

### Hazard/Problem Description

According to the 2008 Colorado Hazard Mitigation plan, a tornado is a localized, violently destructive windstorm occurring over land, especially in the Midwestern U.S., characterized by a long, funnel-shaped cloud composed of condensation and containing debris that extends to the ground and marks a path of great destruction. The National Weather Service Glossary provides further technical definition, stating that a tornado is —A violently rotating column of air, usually pendant to a cumulonimbus, with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise. On a local scale, it is the most destructive of all atmospheric phenomenon.

### Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)

Tornadoes have occurred across the sub-region frequently and are possible in all areas. The vast majority of tornados affecting the sub-region are rated between F0 and F2, according to the data collected by the National Climactic Data Center. According to available data, only one event greater than F3 has been documented in the sub-region. The Holly tornado, an F3, resulted in a State Disaster Declaration, two fatalities, nine injuries, and over \$4 million in property damage. Tornadoes have been costly in the sub-region. The sub-region has experienced an average of 4.8 tornados per year, or an occurrence rating of 100%. This leads to a probability of future occurrence rating of *highly likely*.

### South Central (Huerfano, Las Animas)

Tornadoes are an annual threat in the sub-region. Historically, tornadoes have not typically been severe in the sub-region. Based on available information, overall significance of tornadoes in the area is low to moderate. Thirty-six tornadoes have been recorded in the sub-region over the last 60 plus years.

### Upper Arkansas (Custer, Fremont, Chaffee, Lake)

The geography of the Upper Arkansas Area limits the occurrence of tornadoes in the region, but they have been known to occur. In a 45-year period from 1950 – 1995 there were ten reported tornadoes in the Upper Arkansas Area. None of the events resulted in death or injury. Significant occurrence of tornados is restricted to the Eastern portions of Fremont County. Five tornadoes that have or may have caused property damage have been recorded in the County since 1950, although none have been rated as higher than EF 1.

### Pueblo

In Pueblo County, tornados that do occur are usually weak (EF0 category), last for less than 15 minutes, and cause little damage. However, one cannot rule out the possibility of a strong, damaging tornado in the county. A few tornados of EF3 intensity (150-200 mph winds) have occurred on and near the slopes of the eastern mountains of Colorado. Since 1950, only 19 tornados have been reported in Pueblo County, although, it is likely that more have gone undetected. As the population in the rural areas grow, the number of reported tornados may increase. In the Colorado Front Range, tornados have been reported nine months of the year, and the peak season for tornados extends from mid-May through mid-August. June is by far the month with

the most recorded tornados. Tornados have occurred at every time of the day, with over half of them developing between 3 p.m. and 6 p.m., and 88% occurring between 1 p.m. and 9 p.m. MDT. On average, less than one tornado is reported per year in Pueblo County.

## Avalanche

### Hazard/Problem Description

Avalanches can occur whenever a sufficient depth of snow is deposited on slopes steeper than approximately 20 degrees, with the most dangerous coming from slopes in the 35 to 40-degree range. Avalanche-prone areas can be identified with some accuracy, since they typically follow the same paths year after year, leaving scarring on the paths. However, unusual weather conditions can produce new paths that cause avalanches to extend beyond their normal paths.

### South/Central (Las Animas, Huerfano)

Although infrequent, avalanches do occur periodically in Las Animas County in non-populated areas. Generally, avalanches in Las Animas County are relatively minor. There have not been any recorded property damages or fatalities attributable to avalanches in Las Animas County.

### Upper Arkansas (Custer, Fremont, Chaffee, Lake)

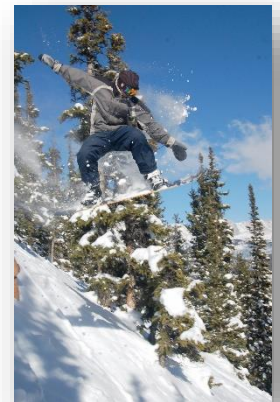
The Sawatch Range is a steep and rugged mountain range that flanks the western boundary of Lake and Chaffee Counties. It receives a considerable amount of snow in the winter months which draws many people to the area for backcountry skiing and snowmobiling. As larger numbers of recreationists travel to avalanche-prone areas, the potential for death and injury is increased.

Fremont County lacks the high elevations and heavy snowpack that contribute to avalanche danger.

## Windstorm

### Hazard/Problem Description

High winds, as defined by the NWS glossary, are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. Straight-line winds may also exacerbate existing weather conditions, as in blizzards, by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snowstorms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel, such as tumbleweeds, around the region, and increasing the ferocity of exiting fires. These winds may damage crops, push automobiles off roads, damage roofs and structures, and cause secondary damage due to flying debris.



*Snowboarding, Chaffee County*

### Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)

The sub-region is subject to significant, non-tornadic (straight-line), winds. There have been 320 reported straight-line events in the last 60 years in the sub-region, which equates to a 100% chance of occurrence in the next year. The probability of a future occurrence is *highly likely*.

### **South/Central (Las Animas, Huerfano)**

High winds can occur year-round in Las Animas County. In the spring and summer, high winds often accompany severe thunderstorms. The varying topography in the area has the potential for continuous and sudden gusting of high winds. High winds occur year-round in Huerfano County. In the spring and summer, high winds often accompany severe thunderstorms. These winds are typically straight-line winds, which are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). In the mountains of Colorado, strong winds are also common throughout the winter months and can exceed 50 to 100 mph in exposed locations.

### **Upper Arkansas (Custer, Fremont, Chaffee, Lake)**

The varying topography in the Upper Arkansas Area has the potential for continuous and sudden gusting of high winds. Although these high winds may not be life-threatening, they can disrupt daily activities, cause damage to buildings and structures and increase the potential of other hazards. Many locations in the region have minimal vegetative ground cover and the high winds can create a large dust storm which becomes a hazard for travelers and a disruption for local services. High winds in the winter can turn small amounts of snow into a complete whiteout and create drifts in roadways. A wildland fire can be accelerated and rendered unpredictable by high winds, which makes a dangerous environment for firefighters.

### **Pueblo**

High winds in Pueblo County cause more damage in insurance claims than hailstorms. Severe winds will continue to occur at least yearly to some extreme which causes dust storms along the transportation corridors and extremely dangerous for wildfire spread.

## **Winter Storms**

### **Hazard/Problem Description**

Heavy snow, ice, severe winter storms, and blizzards are common occurrences in Colorado. The size of such events varies and may range in size from isolated (impacting only a portion of a county) to statewide. Generally, severe winter storm events are considered a regional occurrence, impacting multiple counties simultaneously and for extended time periods.

### **Southeastern Plains (Baca, Bent, Crowley, Kiowa, Otero, Prowers)**

Within the sub-region there have been 42 snow and ice storms reported between 1993 and 2010. This equates to an average of 2.47 severe winter storm events each year and a probability of future occurrence rating of highly likely.

### **South Central (Las Animas, Huerfano)**

While the entire sub-region is susceptible to severe winter storm conditions, they are especially prevalent in the higher elevation portion of these counties

**Upper Arkansas (Custer, Fremont, Chaffee, Lake)**

This sub-region receives varying amounts of snow. Multiple winter weather events occur throughout the sub-region every year. The entire sub-region is susceptible to severe and dangerous winter storms. Higher snowfall amounts are typically found at the higher elevations within the counties.

**Pueblo**

Average annual snowfall in Pueblo County ranges from around 30 inches in eastern and central sections to over 120 inches on the slopes of the Wet Mountains. Blizzards are infrequent in Pueblo County. In Pueblo County, in the aftermath of snow accumulations (which usually are much less than a foot), a quick return to sunny days is normal, which helps melt snow and clear roads and other pathways in a matter of hours.