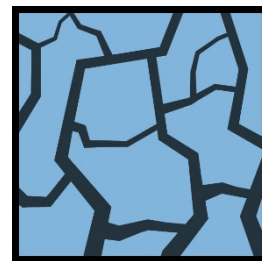


4.5 Drought Hazard Profile

Colorado gets new water supplies from only one source: precipitation, in the form of rain, hail, or snow. Colorado gets all of its water from precipitation because there are no major rivers that flow *into* Colorado. (State of Colorado Drought Mitigation and Response Plan, 2013) In La Plata County, virtually all available water comes from melting snow in the San Juan Mountains.



Drought is a complex and a gradual phenomenon in Colorado. Although droughts can be characterized as emergencies, they differ from other emergency events in that most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts typically 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 precipitation.
- **Agricultural drought** occurs when there is an inadequate water supply to meet the needs of the state's 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.

4.5.1 Drought in Colorado

With its semiarid conditions, drought is a natural part of the Colorado climate. Due to natural variations in climate and precipitation, it is rare for all of Colorado to be deficient in moisture at the same time. However, single season droughts over some portion of the State are quite common. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users that have a different water supply. Individual water suppliers may use different criteria, such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler, to define their water supply conditions. The drought issue is further compounded by water rights specific to a state or region.

4.5.2 Regulatory Oversight

4.5.2.1 State of Colorado HB 04-1365

State of Colorado HB 04-1365 mandates that all covered entities, defined as water retailers that distribute 2,000 acre-feet or more annually, have a water conservation plan approved by the Colorado Water Conservation Board.

4.5.2.2 Statewide Water Supply Initiative (SWSI)

The SWSI represents a major step toward addressing Colorado's future water supply and water needs. The goal of the SWSI is to help water providers and state policy makers ensure an adequate water supply for Colorado's citizens and the environment.



Section 4 of the SWSI provides the legal framework for water use in Colorado including specific tools for addressing water needs. The document can be found on the Colorado Water Conservation Board website here:

<http://cwcb.state.co.us/public-information/publications/Pages/StudiesReports.aspx>

4.5.2.3 Colorado Water Law

The Colorado Water Law provides an overview of water rights administration, the responsibilities of ditch owners, discusses wells and ground water, surface water, the court process and requirements, reservoirs, and fees. The Law can be read in its entirety here:

<http://water.state.co.us/DWRIPub/DWR%20General%20Documents/SynopsisofCOWaterLaw.pdf>

4.5.2.4 La Plata County Water Advisory Commission (WAC)

The purpose of the WAC is to act in an advisory capacity to the Board of County Commissioners (BOCC) with respect to water issues affecting the county. The WAC may make recommendations to the BOCC concerning positions on issues of importance to the county, but may not take any positions itself. The duties and responsibilities of the WAC are as follows:

- I. Consider, analyze and answer the following five specific questions:
 - a. Should La Plata County be concerned about our local water resources because of:
 - i. lack of water supplies,
 - ii. lack of water infrastructure or
 - iii. inefficiencies in the current water systems?
 - b. Should La Plata County operate "water docks?" If so, where should those "water docks" be located?
 - c. If La Plata County purchases water from the Animas - La Plata Project, how should the purchased water be used?
 - d. Concerning "proof of water" for central water systems, should the La Plata County Code be minimally amended to conform with State statutes or should it be amended to require more than the minimum requirements established by State statutes?
 - e. Will a County-wide ground water hydrological study: (1) tell the community anything we do not already know, or (2) be the best use of La Plata County's limited fiscal resources?
- II. Make recommendation to the BOCC with respect to any of the issues it considers, as appropriate; and
- III. Review any specific matters submitted to it for consideration and perform such other functions as prescribed by the BOCC.

(Res. No. 2013-40, § 9, 11-12-2013)

4.5.3 Past Events

Since 2003, 6 USDA Secretarial Disasters (listed in Table 4-16) have been declared in La Plata County. There has only been one Governor's Drought Emergency Declaration in La Plata County, occurring in 1951 (due to a shortage of feed for livestock). This type of declaration differs from USDA declarations because they can provide emergency assistance beyond that targeted for agriculture. (State of Colorado Drought Mitigation and Response Plan, 2013)



Table 4-16: USDA Secretarial Disasters 2003-May 2018

Year	Type	Declaration Number
2003	Drought, Insects	S1843
2006	Heat, High Winds, Insect pests, Late Freeze, Drought	S2329
2012	Drought, Wind/High Winds, Heat/Excessive Heat	S3260, S3282
2013	Drought, Wind/High Winds, Fire/Wildfire, Heat/Excessive Heat, Insects	S3461, S3539, S3545
2014	Drought, Wind, High Winds, Fire, Wildfire, Heat, Excessive Heat, high temp. (incl. low humidity), Insects	S3653, S3715
2015	Drought, Wind, high Winds, Fire, Wildfire, Heat, Excessive Heat, high temp. (incl. low humidity), Insects	S3788
2018	Drought-FAST TRACK*	S4300
2018	Drought-FAST TRACK*	S4320

**Note: Fast Track Secretarial disaster designations for severe drought provide for a nearly automatic designation when, during the growing season, any portion of a county meets the D2 (Severe Drought) drought intensity value for eight consecutive weeks or a higher drought intensity value for any length of time as reported in the U.S. Drought Monitor (<http://droughtmonitor.unl.edu/>)*

4.5.4 Location

Drought is one of the few hazards with the potential to directly or indirectly impact the entire population of La Plata County, be it from water restrictions, higher water and food prices, reduced air or water quality, or restricted access to recreational areas. No portion of the County is immune from drought conditions; however drought may affect areas of the County differently. For example, droughts that occur in the mountainous regions during winter months may have devastating effects on the ski and tourism industry. Lack of winter snowfall in the mountains can eventually lead to agricultural impacts due to decreased streamflows. Droughts of just a few weeks during critical periods of plant development can have disastrous effects on agriculture production. Reduced reservoir storage from decreased runoff in the mountains can lead to water shortages. Droughts that occur in populated areas may not have direct effects to the residents, but may increase the threat of wildfire in the wildland urban interface areas.

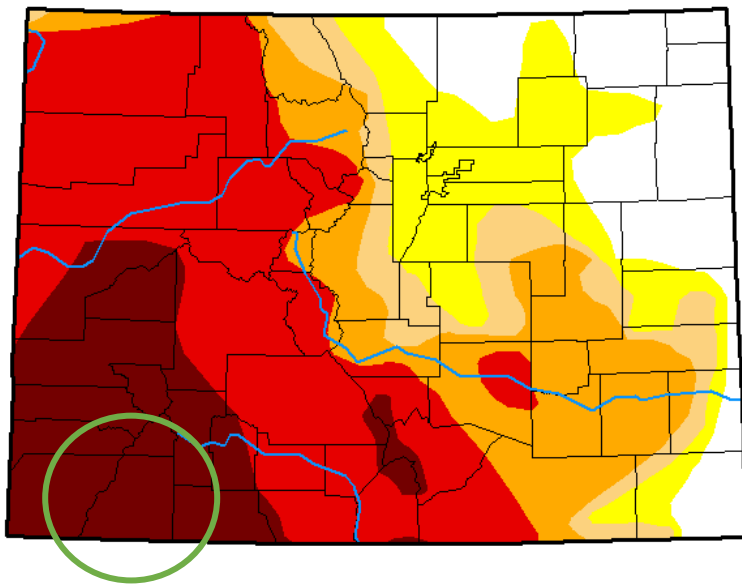
4.5.5 Frequency / Probability of Future Occurrences

A major component of the U.S. Drought Portal is the U.S. Drought Monitor. The U.S. Drought Monitor concept was developed jointly by the NOAA’s Climate Prediction Center, the National Drought Mitigation Center (NDMC), and the USDA’s Joint Agricultural Weather Facility in the late 1990s as a process that synthesizes multiple indices, outlooks and local impacts into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state, and academic scientists who are intimately familiar with the conditions in their respective regions.

The probability of drought occurring in the planning area is possible (between 1 & 10% annual probability). A snapshot of the current drought conditions in Colorado can be found in Figure 4-12. The figure indicates exceptional drought for La Plata County. Most of southern Colorado is currently experiencing extreme to exceptional drought.

U.S. Drought Monitor Colorado

September 25, 2018
(Released Thursday, Sep. 27, 2018)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	14.19	85.81	72.30	64.41	48.47	16.21
Last Week 09-18-2018	16.89	83.11	71.59	63.93	44.29	12.62
3 Months Ago 06-26-2018	21.33	78.67	66.90	52.31	36.46	8.81
Start of Calendar Year 01-02-2018	6.57	93.43	33.53	7.27	0.00	0.00
Start of Water Year 09-26-2017	67.63	32.37	3.72	0.00	0.00	0.00
One Year Ago 09-26-2017	67.63	32.37	3.72	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Jessica Blunden
NCEI/NOAA



<http://droughtmonitor.unl.edu/>

Figure 4-12: September 2018 Colorado Drought Conditions

4.5.6 Severity

Drought impacts are wide-reaching and may come in different forms, such as economic, environmental, and/or societal. The most significant impacts associated with drought in Colorado are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. On the “dry side” of the County where there is no irrigation, water supplies for fire suppression are limited, especially during drought years. A reduction of electric power generation and water quality deterioration are also potential effects. Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. Drought may also weaken trees in areas already affected by spruce pine beetle infestations, causing more extensive damage to trees and increasing wildfire risk, at least temporarily. An ongoing drought



which severely inhibits natural plant growth cycles may impact critical wildlife habitats. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

Impacts from drought can also be exacerbated due to the effects of dust settling on snow, which causes increased solar energy absorption. As a result, snowmelt takes place earlier in the season and runoff magnitudes increase. Recent research has shown that dust deposition has increased throughout the western United States in the past 17 years, with the largest increases in western Colorado. Rigorous sampling and analyses of dust by the Colorado Dust-on-Snow program (CODOS) and USGS show that most dust being deposited to the Colorado mountain snowpack is originating from source areas located outside of Colorado, scattered throughout the greater Colorado Plateau. Drought conditions in those dust source areas can increase the availability of dust for wind transport and, thereby, increase the dust-on-snow hazard in Colorado, even when the Colorado mountains are not experiencing drought conditions. In addition to earlier snowmelt due to dust-on-snow, runoff yields can be reduced, in some years, due to increased evapotranspiration by plants. This is caused by the plant community becoming active sooner than normal as a result of earlier snowmelt and loss of snowcover.

The impacts related to early runoff pose problems for many important sectors in Colorado including agriculture, recreation, tourism, and municipal water supplies. If runoff happens in a shorter timeframe, sometimes months early, it could mean a shorter season for the rafting industry and less water available for irrigation diversions in the summer. Reservoirs may also be filled to capacity during these constrained runoff periods, causing spills to be necessary. Ideally, to avoid releases of water downstream, water is captured over a longer timeframe with gradual melting of snowpack.

Alternatively, dust produced from the hardening and drying of bare soil can also be exposed as vegetative cover decreases due to extended periods of drought. The Eastern Plains of Colorado, where much of the agricultural economy exists, can suffer from dust storms originating from topsoil that is easily airborne. Entire crops can be damaged in one storm, affecting the livelihood of the farmers and ranchers. (Colorado Natural Hazards Mitigation Plan, 2013)

Results of a literature review performed in the 2013 Colorado Drought Mitigation and Response Plan are summarized in Table 4-17. In La Plata County, drought may impact the aquatic environment, forest health, the frequency and severity of wildfires, and noxious weeds.

Table 4-17: Drought Impacts from Literature Review (as part of the 2013 Colorado Drought Mitigation and Response Plan)

Topic	Impacts	Source
General environment	Extreme climate events can interact with other disturbances (e.g., catastrophic wildfire, insect outbreak, grazing, erosion) to drive semi-arid ecosystems past ecological thresholds, leading to changes in vegetation and desertification.	Enquist et al. 2008
Aquatic environment	Wildfires in the South Platte, Animas, La Plata, Los Pinos, and Mitchell Creek Watersheds, and their aftermath, resulted in serious loss of quality habitat in these watersheds.	DWSA, 2004



Topic	Impacts	Source
Mountain pine beetle	Extreme cold temperatures are a key factor to controlling the spread of beetle populations. The spread of mountain pine beetle can be exacerbated through warmer temperatures that often accompany drought, and because trees that are weakened by lack of water are more susceptible to infestation.	Leatherman 2007
Extreme wildfires	Reports from the summer of 2002 indicate that elk were incinerated, watersheds were at risk, streams were choked with ash and sediment, and reservoirs that were already low were at risk of filling up with ash and sediment.	Holsinger, 2002
	The 2002 fire season was heightened by extended drought conditions that caused well below average fuel moistures in wildland fuels. This resulted in increased potential for fire starts and more intense fire behavior. Wildfires are a separate hazard from drought, but the dry and hot conditions accompanying a drought exacerbate the wildfire problem.	DWSA, 2004
	Debris flows that result from wildfires deliver large amounts of sediment to stream channels. The sedimentation of the channel deteriorates habitat vital for aquatic life.	CPW, 2012
Noxious weeds	Noxious weeds can proliferate when native vegetation is stressed by lack of water due to drought. They also create heightened competition for water, which in a drought can damage surrounding vegetation by consuming excess soil moisture.	CSFS, 2008

Source: 2013 Colorado Drought Mitigation and Response Plan

4.5.7 Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

4.5.8 Secondary Hazards

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. Drought also limits the water supply available for fire suppression, which is critical in isolated areas of the County. Post fire runoff can damage water sheds and contaminate already limited water supplies as experienced after the 2018 416 Fire.

4.5.9 Climate Change Impacts

Climate change threatens to alter how and when precipitation falls in the state, and warmer temperatures will affect runoff, stream flow, evaporation and soil moisture. Examining how our most precious natural resource will be affected and working to conserve and adapt where necessary will help to ensure a more secure water future.

The most likely impact on water supplies from climate change will be a shift in the timing of runoff. Projections indicate that runoff timing will shift an additional one to three weeks earlier by mid-century because of increased temperatures. This may affect water-right holders who traditionally divert surface water during the crop growing season, for example, or those with limited access and rights to water storage options. It is also likely to result in decreased late-summer streamflow because of both increased temperatures, resulting in earlier snowmelt, and the projection that precipitation is likely to increase in the winter months but decrease in the summer months. At the same time, increased population, higher crop irrigation requirements, and longer growing seasons will put additional pressure on a changing water supply.

While projections of future precipitation change do not agree about whether Colorado's annual precipitation will increase or decrease, the future warming—which is shown in all projections— will reduce the runoff produced for a given amount of precipitation. Therefore, the projections show a tendency towards decreasing future annual streamflows for all of Colorado's rivers. Runoff and streamflow may be further altered by the presences of dust-on-snow events that lead to early snowmelt.

In addition to changes in runoff caused by warming, the widespread tree mortality caused by bark beetle infestations in Colorado's lodgepole pine and spruce forests has likely affected both the amount and timing of runoff, as well as water quality, in the most-affected watersheds. Working to preserve and improve forest and ecosystem health will help protect our watersheds and have beneficial effects on both water quality and supply. (Colorado Climate Plan- State Level Policies and Strategies to Mitigate and Adapt, 2015)

4.5.10 Drought Vulnerability Analysis

4.5.10.1 Population

According to the 2017 La Plata County Comprehensive Plan, the County's total population is expected to grow from the surveyed Colorado Department of Local Affairs figure of 53,446 in 2010 to 91,422 by 2040, a 71% increase (expected average of 2.5% annually). By most accepted standards, growth rates of 2.5% or greater are considered high rates of growth. This projected population growth would add additional strain to the groundwater supply. No significant life or health impacts are anticipated as a result of drought within the planning area.



4.5.10.2 Property

Drought normally does not directly impact structures. Although water and sewer infrastructure may be affected by drought, other critical facilities are generally not. Data are not available to identify particular hazard areas and/or estimate potential losses to structures. The greatest risk to people from drought is the loss of drinking water supply from water systems, underground aquifers, and domestic water wells. There are several thousand domestic water wells within La Plata County. Secondary impacts from drought, such as wildfire and erosion, can have a significant impact on structures and municipal infrastructure.

4.5.10.3 Critical Facilities

Water supply on the “Dry Side” of the County (west of Highway 140) is already limited and would be severely impacted by drought conditions. With a reduced supply of water available for fire suppression and dry vegetation, fires can spread more quickly resulting in widespread damage.

Other critical facilities, as defined for this plan, will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area’s critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

4.5.10.4 Environment

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; soil erosion, water wells and septic systems. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Another example of this is the destruction caused by bark beetles. Drought places additional stress on trees, making them more vulnerable to bark beetle attacks. This can cause large outbreaks of beetles, which can have long term effects on the planning area.

Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

4.5.10.5 Economic Impact

Long lasting droughts could be detrimental to industries such as agriculture and tourism that use water or depend on water for their business. Year-round recreation and sightseeing anchor the local tourism industry, as it has for over 100 years. For example, both the rafting industry and ski industry are important economic drivers of tourism in the County. Drought can affect streamflows and ski conditions, shortening the season for these sports and bringing in fewer tourism dollars.

4.5.11 Future Trends in Development

One of the most significant impacts of drought is the decreased supply of water for the county’s inhabitants. As growth continues, so does the vulnerability for residents and business owners to drought impacts. Careful monitoring of the area’s water supply will help drive conservation efforts aimed at minimizing drought impacts.



Durango has a *Long-Range Water Efficiency Management Plan* for the City of Durango and the properties served by the City's water utility system. This plan encourages efficient use of water, calls for an evaluation of existing land use planning and zoning laws affecting water use, and promotes the regional awareness and planning that is essential to all water resource management in the San Juan Basin.

The Town of Bayfield has adopted a policy to maintain 1,000 gallons of water storage per household per day in order to ensure adequate water availability for fire-fighting, drought reserve, and minor river contamination due to forest fires or soil run-offs. The Town is also constructing another 250,000 gallon storage tank that will be located at a higher elevation in order to service the subdivisions that are located in the higher areas of Town. (La Plata County Hazard Mitigation Plan, 2013)

4.5.12 Summary of Drought Issues

Important issues associated with the drought hazard include the following:

- Lack of proper contingency planning for property wells in rural areas.
- Keeping water consumption low during non-drought years.



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