

IMPORTANCE OF WEATHER AND CLIMATE MONITORING TO LANDOWNERS AND PRODUCERS

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Throughout the western United States, the most pressing issues affecting agricultural producers are drought, higher temperatures, increasing variability in frequency and intensity of precipitation, and plant species invasion. Ranchers and farmers may wonder how long a drought will last or how their productivity will be influenced by weather in any given year. Landowners are aware of the challenges posed by these issues, but may not understand how climate and weather can drive those challenges. The purpose of this document is to define a number of weather and climate terms, and explain the importance to landowners and producers of monitoring climate patterns to make more informed decisions regarding their land, and to better anticipate, adapt and manage for changing climatic conditions. It also outlines resources available to landowners to assist them in their climate monitoring efforts.

Climate vs. Weather

What's the difference?

The terms weather and climate are sometimes confused because both describe the state of the atmosphere, but at different geographic and time scales. Weather is used to describe the atmospheric conditions at a specific place and time, while climate describes the long-term patterns of weather across a particular region (typically averaged over 30+ years). For example, you can step outside in a location that is unfamiliar to you and readily describe the weather, but without some time or historical context, you will not be able to describe the climate. To further illustrate the difference between weather and climate, your area may experience a sudden extreme drop in temperature one day (i.e., weather), but over the past decade, winters may be milder than they used to be (i.e., climate). To better prepare and adapt to weather patterns occurring on your land it helps to know if these patterns are consistent with climate trends in your area or if they are new and highly unusual and fall outside the normal climate patterns to which vegetation and biota have adapted.

Precipitation

Type, amount, duration, intensity: why does that matter?

Commonly observed types of precipitation include rain, drizzle, hail, sleet, and snow. The amount, duration, and type of precipitation will all affect the infiltration rate, which is the rate at which water will move into the ground from the surface. To further illustrate, imagine the different effects that a quick, high intensity rain has on the soil surface compared to a slow, long-lasting drizzle. One can lead to extreme surface runoff and erosion, while the other gives the rain water time to be absorbed deep into the soil profile and into the rooting zone for maximum plant availability. The most informative weather and climate summaries not only

contain the amount of precipitation that was received, but also the type and duration of each individual precipitation event.

Temperature

How does it affect rangeland plants and crops?

Atmospheric air temperature is a critical driver behind the rate and timing of plant growth and development. Commonly recorded temperature observations include the maximum and minimum temperatures reached, or the absolute average over a given time. Like precipitation readings, the more frequently the temperature readings are taken, the better. This helps to ensure that extreme temperature values are not missed or overlooked, which can happen when only average temperatures are considered. Intense fluctuations in temperature can disrupt the natural environmental cues that trigger growth and development in plants at specific times of the year to coincide with other organisms supported by these plants. For example, higher than expected temperatures earlier in the growing season can cause key species (plant species that are important indicators of rangeland health) to produce reproductive flowers sooner than normal. Once temperatures drop back down to normal values, those plants no longer have the thermal energy required to support that new growth, causing those species to be stunted the rest of the year. An effective way for producers to monitor and be prepared for such an occurrence is to identify key plant species on their property and take note of when they are reaching specific growth stages such as growing a certain number of leaves, reaching a particular height, or flowering stage. This will help producers to optimize the timing of management practices like grazing, herbicide application, and planting and harvesting dates.

Historical average and deviation from normal

What does that mean?

Historical average is term that is commonly used to describe weather conditions observed over a long period of time and is often used to characterize “normal” conditions. By identifying what historical/normal conditions are, scientists and climatologists can develop predictive models to better plan and manage for future climate conditions. There are many different predictive models available to landowners that aid in adaptive management decisions. **Adaptive management** refers to the active learning process whereby management plans continually evolve and adapt based on changes in the environment that are identified through monitoring. Examples of adaptive management can be as simple as deciding to keep a herd on a pasture longer based on current vegetative conditions, or may involve complex monitoring and evaluation procedures. Historical climate summaries not only help make predictions, but can also help identify and manage for **deviations from normal** (conditions that differ significantly from what is expected for that type of climate). The climate monitoring methods described in this document coupled with simple, but equally important, observations in the field can assist

producers in developing an adequate adaptive management plan to help mitigate the impacts of these deviations from normal.

Spatial Variability and Extreme Conditions

How are they defined?

Many landowners are familiar with the expression “rain doesn’t fall the same on all”, which is an example of *spatial* (geographic) *variability*. This phenomenon is not only used to refer to differences in intensity and amount of precipitation across a region, but also to differences in other weather and climate variables such as temperature, humidity, and wind. Differences in topography, elevation, soil type, and vegetation can all contribute to spatial variability.

Extreme weather events are those that differ significantly from the established historical averages. These include unusually high or low temperatures, unusually severe storm or precipitation events, and drought. These conditions can have devastating effects on plants and animals, regardless of their duration. Planning for extreme events is a large component of adaptive management and can save your operation from devastating losses.

Resources available to you

Climate monitoring systems use information obtained from satellite observations, ground-based data, and predictive models to monitor and forecast changes in weather and climate. Incorporating climate monitoring into producers’ management plans has become increasingly important, as weather patterns shift and climate variability increases. In recent years we have seen weather events and patterns that are unlike what historically constitutes the climate regime. This is commonly referred to as climate change. Agricultural productivity is vulnerable to these changes in climate, which is something that cannot be controlled. Producers can only anticipate those changes and adapt to them by adjusting the type and timing of management practices accordingly. There are several resources available to you as a landowner, created by professionals to help aid in these efforts. Here are a few examples:

Grassland Productivity Forecast: *Grass Cast* (<https://grasscast.unl.edu/>), provides producers with projections of forage production in their region based on below normal, normal, and above normal precipitation to aid in management decisions such as determining proper stocking rates for the expected forage amount. For this tool to be the most useful, landowners will need to know the amount of precipitation they have received and if it is normal, above normal, or below normal for their region.

Community Collaborative Rain Hail and Snow Network: *CoCoRaHS* (<https://www.cocorahs.org>) is a community-based volunteer network of landowners from across the country who measure and help map precipitation. The landowners themselves provide daily precipitation data on properties across all regions. CoCoRaHS distributes basic precipitation monitoring equipment that equips landowners with the proper materials and resources needed to conduct in-depth

precipitation monitoring. These data, all provided anonymously, are available to the public and provide scientists with precipitation data from areas that were previously unavailable.

The Climate Visualization Tool from New Mexico State University

(https://aridclim2020.shinyapps.io/climate_visual_demo/) is a data visualization tool that provides (1) Climate data from NOAA (National Oceanic and Atmospheric Administration) weather stations across New Mexico and (2) a platform for users to upload their own daily temperature and precipitation data and outputs visual graphs to aid in interpretation. Users can compare their weather data to historical climate data nearest to them with ease.

USDA Climate Hubs: (<https://www.climatehubs.usda.gov/>) are led and hosted by the Agricultural Research Service and Forest Service located at 10 regional locations (New Mexico falls into the Southwest Climate Hub). Developers work closely with universities and technical service providers, and the private sector to be a source of user-friendly information developed from a wide variety of resources.

Drought Monitor: (<https://droughtmonitor.unl.edu/>) is a map released every Thursday, showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), and extreme (D3) and exceptional (D4).

Ag Risk Viewer: (<https://www.climatehubs.usda.gov/hubs/southwest/tools/agrisk-viewer>) provides a web-based platform for crop insurance loss data from the USDA Risk Management Agency (RMA). This tool allows producers and decision makers to assess their climate risks, by commodity type, for each county scale over the last 30 years.

USA National Phenology Network: (<https://www.usanpn.org/usa-national-phenology-network>) provides data and information on the timing of seasonal events in plants and animals to ensure the well-being of humans, ecosystems, and natural resources. The USA-NPN collects, organizes, and shares phenological data and information to aid decision making, scientific discovery, and a broader understanding of phenology from a diversity of perspectives. Tools developed by the USA-NPN include predictive models. Agricultural producers might use this information to help them identify deviations from the normal seasonal timing of germination and growth of important rangeland plants on their land, crop development, pests and pathogen of concern, which could allow them to better target management efforts.