How to Obtain and Analyze Precipitation Data

(AACD Technical Reference #C-3)

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Why Do We Need Precipitation Data ?

The amount and timing of precipitation is the single most important factor affecting the growth and reproduction of range plants in arid and semiarid areas like Arizona. To interpret vegetation data as a basis for management plans, or monitoring data as a basis for modifying existing plans through adaptive management, it is necessary to consider the effects of precipitation over the past several years in order to identify resource concerns and causes for those concerns.

Reduced plant cover or production may be due mainly to low precipitation rather than improper grazing or other management or natural factors, and thus changing management may not be necessary. On the other hand, it is always tempting to blame any undesirable conditions on the weather rather than inadequate management. There is often a tendency to remember the wetter years as “normal” and everything else as “drought”. Precipitation data can help us see what the actual situation is, rather than what we would like it to be.

Obtaining Precipitation Data

On Site Monitoring

Range management specialists always recommend keeping rainfall records at every monitoring location on a ranch or allotment, or at least keeping records at one to several locations on a ranch. Most ranchers do measure rainfall at their headquarters and maybe a couple of other locations. But these are not always recorded in a systematic way. If there is a good record of rainfall at or near the area of interest, then that is the best source of rainfall records available, since any others are likely some distance away, at higher or lower elevations, or on the other side of mountains. We all know that rainfall, especially summer rain, can vary greatly over a short distance, so any source of data taken from an off-site location is subject to error.

Districts should encourage all of their cooperators to keep good rainfall records in at least one location. This would not only benefit the individual cooperator but provide the District with a much better source of data than is available from official weather stations. Rain gauges are cheap. They should be read daily if possible. If they are in a remote area, oil can be put in them to prevent evaporation – these should be read at least once a month if possible.

"This is shore an unusual spring.
We ain't had but two inches of dust!"

By Ace Reid

An easy way to keep good records is to join the CoCoRaHs network (https://cocorahs.org/). The name stands for Community Cooperative Rain, Hail, and Snow. They will sell you a very accurate rain gage and provide instruction on how to measure and report rain and snow events. You will have your own record online, so you don't have to keep a written record. Very easy to enter the data and you can obtain reports summarized by "water year" (Oct-Sept). Not only can you keep your own records, but also you can see what your neighbors got too, if they are cooperators – just to keep them honest! The only cost is the rain gauge.

Official CoCoRaHS gauge

~~$48.00~~ $32.75 Sale

ADD TO CART

Buy with G Pay

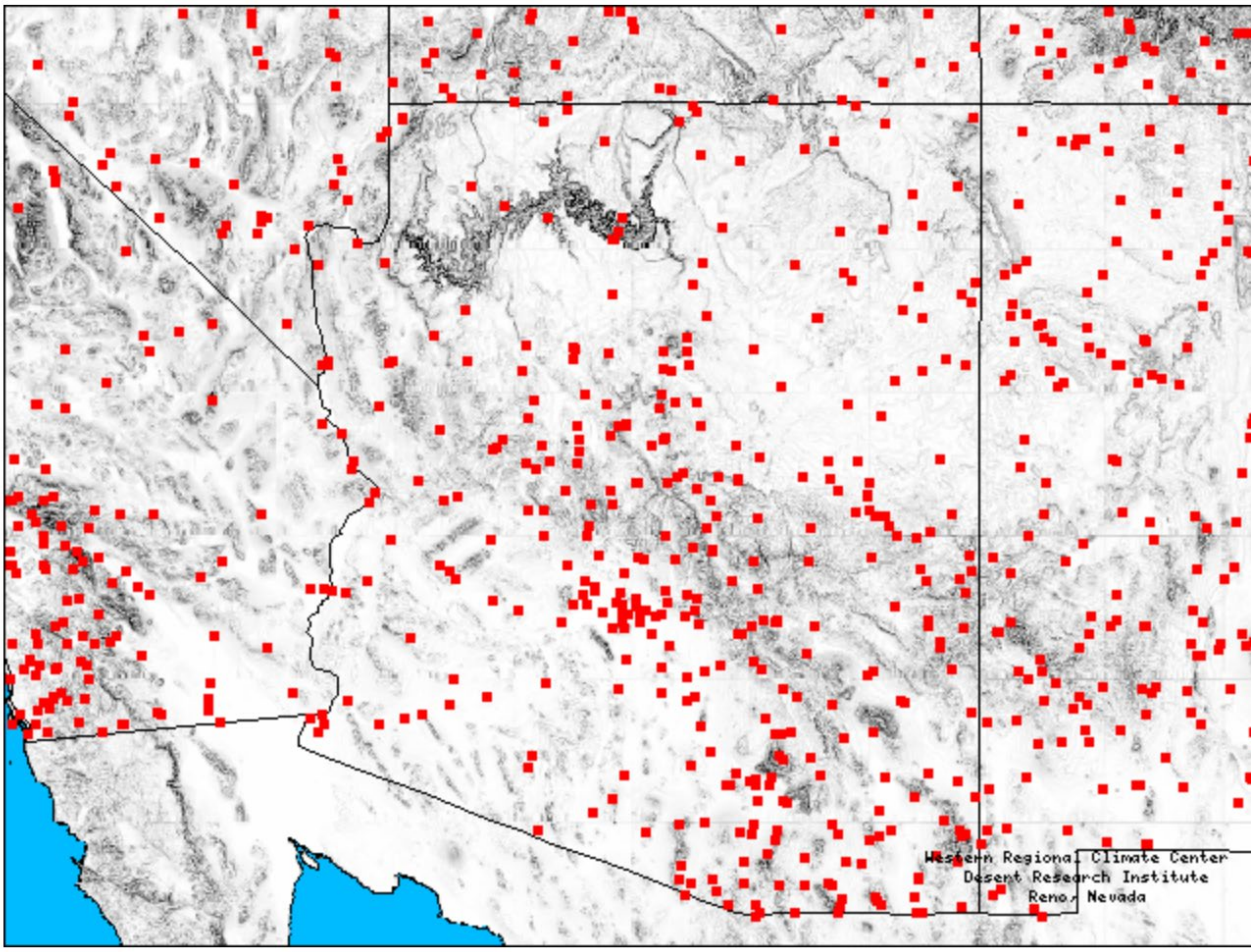
More payment options

Our most popular item!
Each gauge ships with a complimentary CoCoRaHS brochure!!

- Heavy-duty clear butyrate plastic gauge
- Measures a full 11 inches of precipitation
- Inner measuring tube has a capacity of 1 inch and is graduated to one hundredth of an inch
- Rainfall exceeding 1.00 inch automatically overflows into the outer cylinder
- Funnel and measuring tube are removed for collecting sleet and snow
- Melted snowfall is emptied into the measuring tube to measure the moisture content of snow/sleet
- Opening diameter is 4 inches, rain gauge height is 14 inches
- Package Contents:
  - Rain Gauge (including funnel and inner measuring tube)
  - Post Mounting Bracket and Hardware
  - Detailed Instructions
  - Daily Precipitation Log

Official Weather Stations

The second source of weather data is official weather stations, which are usually located in towns, ranger stations, experiment stations, etc. In some cases, these records go back to the early 1900s, but many have shorter records. Some have very complete records and others have missing data for some months or even years. In some cases, the station location has been moved one or more times. These data can be obtained through the Western Regional Climate Center in Reno, Nevada (https://wrcc.dri.edu/). An example of how to get precipitation data from this source will be presented later in this document.



PRISM

The PRISM Climatic Group (https://prism.oregonstate.edu/) is headquartered at Oregon State University and provides various kinds of weather data based on a huge network of weather stations and observers, including the CoCoRaHS observers. They can provide an estimate of precipitation for any given point. The estimate is based on extrapolation from all nearby weather stations, with corrections for elevation and other factors.

NOTE: If there are several weather stations in the vicinity of your ranch or home, but they are all located at a lower elevation, the model will make a correction for that difference. Of course, like weather station data, they might not be able to account for the variation in the distribution of individual storms, but they are better than just using the nearest weather station because they interpolate among different stations with corrections for topography and weather patterns. An example, of how to obtain PRISM data will be shown later in this document.

Analyzing Precipitation Data

Rainfall data and maps usually show annual averages, or monthly averages, based on a calendar year (Jan -Dec). But this is usually not the best way to summarize precipitation data because this breakdown does not fit well with plant growth patterns. It is usually more informative to use either “forage years” or “seasonal precipitation.” (See Page 53 in Guide to Rangeland Monitoring and Assessment, AACD Online Library for further information on this topic.)

Forage Years

Hydrologists use the term “water year” to mean the precipitation that comes from October 1 through the following September 30. This is because the availability of water during the summer growing season is affected by precipitation that falls starting about October 1 of the previous year, not just that from January 1. The same concept is the basis for a “forage year”.

Seasonal Precipitation

Using forage years is very useful in some regions. For example, in the Great Basin, most of the forage produced is by cool-season grasses that use stored soil moisture from the fall-winter-spring. Forage prediction equations have been developed based on winter precipitation.

However, in most of Arizona, there are two fairly distinct growing seasons – winter and summer (winter, as used here, includes spring also) separated by a dry period starting about mid-May to mid-June. Thus, it is useful to look at precipitation for each of these seasons. The "winter" period is from October 1 – May 31 and the "summer" period is from June 1 -September 30.

NOTE: These dates were selected because precipitation after October 1 produces little if any growth on warm season plants, except a limited amount the next spring when temperatures get warm enough. Cool season plants and many shrubs may grow through the winter until warm temperature and/or dry conditions make them go dormant in the spring. The main growing season for warm season plants is from the time the "monsoon" starts about July 1 until it ends about mid to late September, typically. If any rain is received in May it likely helps the winter growth period and if the monsoon starts in June, it will benefit the summer growing season.

Ways to Express Data

When summarizing precipitation data either by months, forage years or seasons, the data can be presented in tables or graphs using three different methods:

1. Actual Inches
2. Percentage of Long–Term Average
3. Deviation from Long – Term Average

Examples will be shown later – all basically show the same thing but differ in ease of interpretation.

NOTE: If you are keeping your own records, you may not have but a few years of data, but either PRISM or CoCoRahs can estimate a 30 year average for your location. Shorter periods may not reflect "average" conditions. For example, during the 1980s Arizona had some very wet years, especially wet winters, that would not have reflected the real average conditions. Likewise, Arizona has had a lot of very dry years in the last 20 years that may not reflect "average" conditions (we hope).

Drought Indices

The discussion above assumes that the District or their cooperators want to analyze and interpret wet and dry years or seasons as a basis for interpreting monitoring data and resource concerns. However, there are also available several different sources of maps or predictions of drought or wet years. For example, the Palmer Drought Severity Index is widely used to track drought conditions currently and over past years.

(https://www.drought.gov/current-conditions)
(https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/)

How Many Years of Data Do You Need?

To establish a long-term average precipitation for your location for purposes of comparison, it is desirable to have the longest record possible. PRISM and CoCoRahs use a 30-year average. To interpret the effects of recent precipitation compared to the long-term average, it is good to use data for the past 5-10 years. In some cases, interpretation of long-term trend monitoring data benefit by considering rainfall patterns for longer periods. For example, some of the Forest Service and BLM trend transects and photos date back to the 1950s and 1960s and may reflect some of the effects of precipitation during the 1950s drought or 1980s wet periods which persist today.