Droughts Effect on Rangeland

By Joseph Barenberg

Losing a century or more of carefully bred genetics in the cattle herd that is your lifeblood, passion, and livelihood or destroying the native grasslands that your livelihood solely depends on is an incredibly difficult decision that many ranchers face when staring down a drought and the devastating effects that accompany it. Neither of those choices is one anyone wants to choose but there is a compromise. The key to drought management is finding where you can preserve the condition of the rangeland while maintaining profitability. Over 50% of the continental United States was in a moderate to extreme drought with a peak of 63% on October 25th of 2022(Assessing the U.S. Climate in 2022) with most of it being in the western half of the United States where cattle production is dominant. Many ranches spend a great deal of resources preparing and planning for droughts which most remaining rangelands are prone to.

What is a drought? As defined by Oxford Languages: A drought is a prolonged period of abnormally low precipitation leading to a moisture deficit. Droughts leave plants lacking the water they need to grow. This causes a decrease in plants' carbohydrate production. Carbohydrates are the energy a plant produces which is used to put on leaves, added to the plants' energy stores, and used to expand or replace the plants' root system since most perennial plants replace ⅓-½ of their roots annually. When a deficit in energy production occurs a plant stops growing and if that is not enough then it uses its energy reserves. This uses up the energy reserves a plant uses to come out of dormancy and increases plant mortality which opens the door to weedy and invasive species to take their place. Previous grazing practices also factor into plant mortality as the grasses in well-managed pastures will have more energy reserves and

better root systems which leads to a plant being able to survive longer and the opposite having the adverse effect.

The issues associated with droughts are dependent on soil moisture which is the most limiting factor to range plants. The precipitation effectiveness is the amount of rain that can be soaked into the ground and the precipitation that soaks into the ground is the water that is available to the plant. Increasing precipitation effectiveness also increases the amount of water available to the plant. Many factors make up precipitation effectiveness, often referred to as infiltration rate, which includes things such as rate of rainfall, slope, soil type, and ground cover.

Ground cover is the one variable that humans can control the easiest in increasing precipitation effectiveness. David Kincaid and Gerald Williams in their research article "Rainfall effects on soil surface characteristics" found a strong correlation between the crown cover and the percentage of surface runoff. Their data showed the line of regression to go from approximately 27 inches of runoff at 2% crown cover and descending to around 10 inches of runoff at 40% crown cover. This data does have some distinct variation when at similar amounts of crown cover however the points above the regression line follow a strong descending pattern more so than the points below.

Loss of ground cover worsens the symptoms a drought brings with it. The increase in surface runoff in relation to a decreased ground cover makes what little

precipitation that falls during a drought much less effective especially when falling quickly in large events. Overgrazing and increased range fires both greatly reduce standing vegetation which in turn increases surface runoff and soil erosion. The surface runoff is unable to be utilized by the plants where it fell making the rain event less effective in providing soil moisture for those plants to utilize.

A more long-term effect of a drought is the shift in plant communities from C_4 to C_3 grasses. C_4 grasses or warm season grasses use water more efficiently and are able to handle higher temperatures while C_3 grasses or cool season grasses are able to handle much cooler temperatures but use water less efficiently (Knapp et al., Resolving the Dust Bowl paradox of grassland responses to extreme drought). They also found that the proportion of precipitation during the dust bowl was greater in the cooler months than in the warmer months. This combined with C_3 grasses being able to utilize the moisture that falls when C_4 grasses are dormant gives C_3 more available moisture but leads to that moisture being used less efficiently which further compounds the negative effects of a drought.

Droughts not only affect the plant's growth on rangelands but also the ways in which rangelands are managed. Our main goal in managing for a drought is to preserve the condition of the rangeland. Before a drought, as always, we use good range management practices. We have a drought management plan which takes into account the resources we have available and the needed cash flow to sustain ranching. For example, my home ranch has an abundance of forage production so we stockpile feed

and rotate it out every few years and sell the feed as scratch to the neighbor's feedlot. When feed is abundant before a drought then we utilize some equally liquidable livestock like feeding out cull cows or keeping our calves for a longer period of time after weaning.

During a drought, our first step is determining if we are in a drought and the severity of the drought. Forage production is greatly impacted, and the rangeland's stocking rate will have to be greatly reduced to prevent overgrazing. Reducing the stocking rate is bad for the bottom line of any ranch but selling non producing and excess stock is a great way to reduce the grazing load on the rangeland while not hurting profitability. Another tool we use to help reduce the effective stocking rate is to increase the period of winter feeding. These are all things my family's ranch utilizes during a drought. Usually selling off cull cows, not keeping calves around longer than we can comfortably feed for, and increasing the period of winter feeding. The latter two solutions work well in our operation with plenty of baled forage stockpiled for droughts.

When the rain returns stocking rates should be slowly increased since native grasses are still recovering from the loss of vigor. It usually takes two years for a plant to fully recover from a drought. In the meantime annuals, weedy plants, and invasives may and will take root. We utilize flash grazing to reduce the forge and seeds produced by those weedy annuals. This is to encourage native plants to take over and lessen the risk of wildfires.

Rangelands have adapted to droughts over thousands of years. In summary grasses on rangeland lose vigor during a drought leading to greater plant mortality. Overgrazing worsens the symptoms of drought and increases runoff. We have a drought management plan made before a drought occurs and then enact it when appropriate and to the severity of the drought. Our plan is meant to protect both the bottom line and the rangelands which are crucial to the sustainability of ranching. When it rains again the effects are not over yet with at least two years being needed to return to pre-drought conditions.

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