

**University of California**  
 Agriculture and Natural Resources  
*Making a Difference for California*



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# Livestock, Range, & Watershed

San Luis Obispo, Santa Barbara and Monterey Counties

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**Forage Quantity and Quality Changes Through the Summer**

## Forage Quantity and Quality Changes Over the Summer Dry Period

*Royce Larsen*

Have you ever planed on saving pastures (banking feed) until later in the summer or fall. Have you wondered how much of that feed is lost through the dry months as it sits in the sun? Most ranching operations need pastures to turn cattle into during the summer and fall months. Saving, or “banking”, feed till later in the summer can be much cheaper than buying hay. However, saving this forage until later does have its challenges. A recent study was conducted on the central coast where we looked at the changes in forage, both quantity and quality, during the weathering process through the dry season. This research was reported in the article: Larsen, Royce E., Matthew W.K. Shapero, Karl Striby, LynneDee Althouse, Daniel E. Meade, Katie Brown, Marc R. Horney, Devii R. Rao, Josh S. Davy, Craig W. Rigby, Kevin B. Jensen, Randy A. Dahlgren. 2021. Forage Quantity and Quality Dynamics Due to Weathering over the Dry Season on California Annual Rangelands. *Range Ecology and Management* 76 (2021):150-156.

There were changes in both the quantity and quality of forage as it turned from green to brown (dry) and sat in the sun over the summer months, figure 1.



Figure 1. Photos showing forage changes from green (peak growth in April) to a dry weathered condition (October).



In our study we looked at what those losses were. On annual rangelands, forage growth begins with germination in the fall, usually October or November, then dries up around late April or early May (figure 1). Annual forage production follows a pattern, with germination in the fall with sufficient rainfall, followed by a slow growth period through the winter, followed by a rapid growth phase in March or April. You can watch this full growth cycle in a short 1 ½ minute video on youtube: <https://youtu.be/-X8qcI1kXng>. We looked at 25 different locations during 2015-2017, which included sites from the coast to the eastern portions of San Luis Obispo county. During this study we documented the changes that occurred in both forage biomass and nutrient content over the summer months.

Each year was different, both in how much forage grew, and what species of plants grew. We found that the main forage type, that of grasses and forbs, depended mostly on the amount of rainfall received. During the driest year (2015) forbs dominated (especially filaree) while the wetter years favored grasses, figure 2. Rainfall was also the dominant driver of how

much grew each year. There was a lot less forage growth during 2015, a drought year, an average amount in 2016 and the highest production in 2017 (the wettest year), figure 2.

The forage that was lost depended on how much, total biomass, that you started with. The lower the biomass the higher the percentage of forage loss through the summer months. The forage percent losses were highest in 2015 at 61.5% for the season, or 9.7% per month, and the lowest during 2017, 46.5% or 7.3% per month, figure 3. Solar degradation was the dominant mechanism causing the breakdown and loss of biomass through the summer dry season. That is why there are differences each year. When starting with higher amounts of biomass, more of the forage is shaded from direct sunlight than when starting with less biomass.

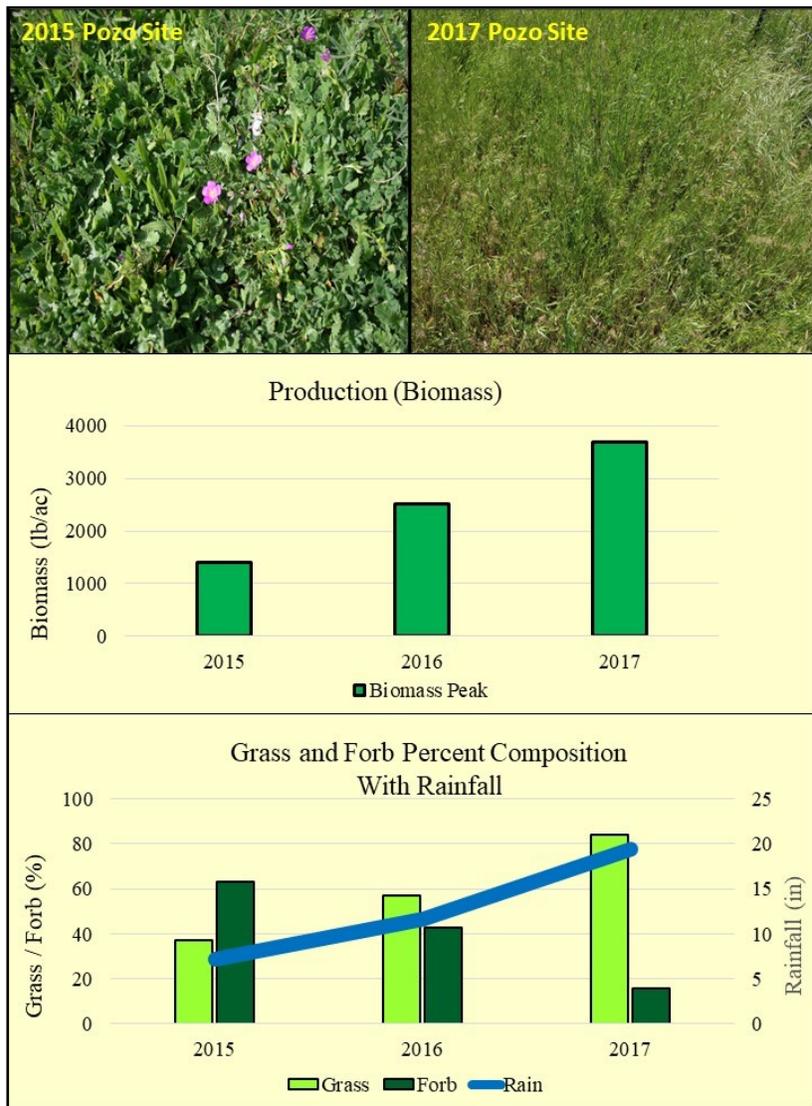


Figure 2. Grass and forb composition was different each year (top). Total production was lowest in 2015, and highest in 2017 (middle). Overall, lower rainfall favored forbs, mostly filaree, while higher rainfall favored grass (bottom).

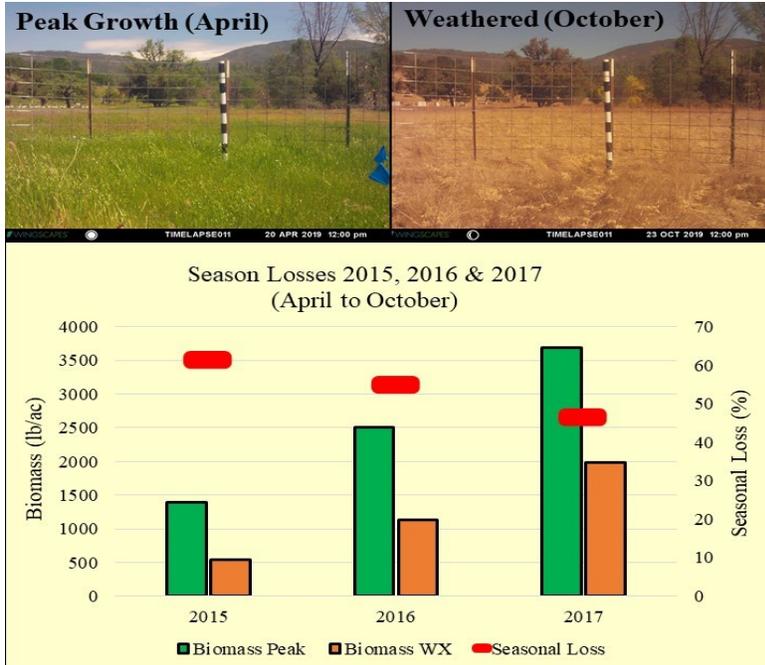


Figure 3. Peak growth stage (mature) and weathered forage conditions (top). Biomass losses that occurred from peak growth (mature plant stage) to the weathered condition for each year (bottom).

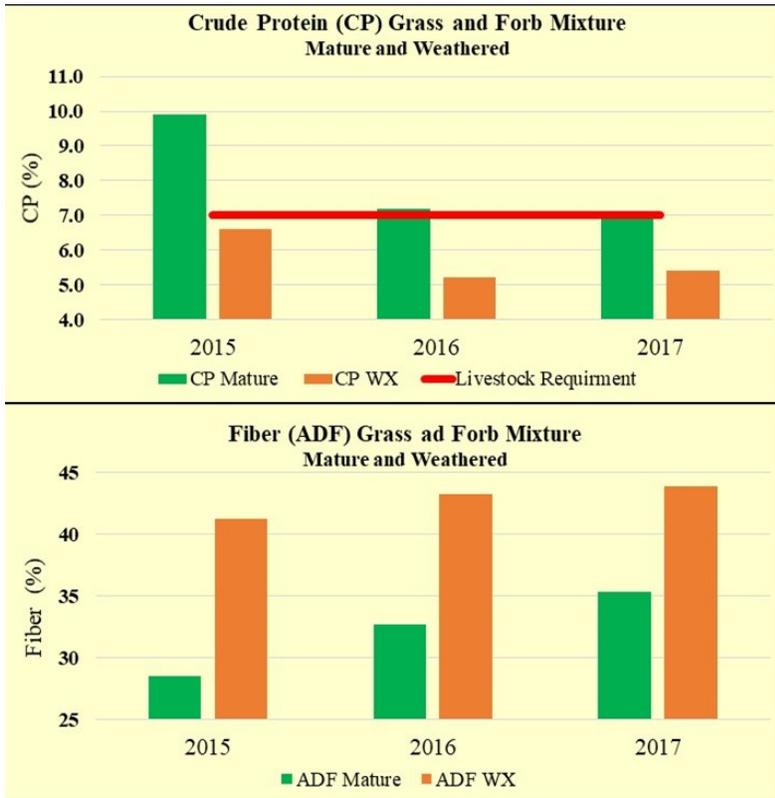


Figure 4. Top - crude protein (CP) at mature growth stage (peak) versus weathered condition for 2015-2017. Bottom - percent fiber for mature growth stage (peak) versus weathered condition during 2015-2017.

As a result a lower percentage of the forage is lost as compared to amount lost when starting with less forage biomass to begin with.

Not only is biomass lost, but the quality of the forage also declines significantly. Livestock need a minimum of 7% crude protein (CP) in their diet. The amount of CP livestock get depends on the composition of the forage they have. In general forbs are much higher in CP than grasses are. We found that CP in the spring (plants that were mature but still green) was much higher in 2015, than 2016 or 2017. Although forage production was low in 2015, there was a much higher percentage of forbs resulting in much higher CP levels than during 2016 and 2017, figure 4. Then, as expected, CP concentrations significantly decreased from spring time (still green forage) to the old weathered (dry) forage during all years, figure 4.

In contrast, relative concentrations of fiber were different each year. Fiber in forbs is much lower than in grasses. During 2015, while the percentage of forbs was high, fiber was low. As the percentage of grass increased, so did the fiber increase during 2016 and 2017, figure 4. Just as CP decreased through the summer months, fiber increased as the forage dried and weathered, figure 4. As expected, we found that forage quality decreased significantly from late spring (peak growth forage conditions) to fall (old dry weathered forage conditions).

The significant loss of aboveground biomass, along with decreased forage quality, can affect livestock grazing strategies. Forage biomass losses through the dry season should be considered when determining how much feed you need to “bank” for later use, and how much you may need to leave to achieve proper residual dry matter (RDM) levels for the new rainy season. Also, nutrient losses require supplementation regimes in order to meet the needs of livestock. The bottom line is that forage and nutrient losses each year depend on how much biomass (lb/ac) and forage type (grass vs forb) that you start with in the spring. These conditions change each year, and it is mostly driven by the amount of rainfall received.



Thistle Sage ([Salvia carduacea](#)) is a native annual herb in the Lamiaceae (Mint) family that grows in southern and central California, primarily in hot, dry inland areas. It comes closest to the coast in northern Santa Barbara County. It tends to grow in sandy or gravelly places, at elevations from 0-4500 feet. It has a distinctive thistle appearance but is not related to true thistles. It is more closely related to Chia (*S. columbariae*). It is almost always grown from seed and is sometimes included in desert seed mixes.

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#### Coronavirus Information

**We are facing a crisis like most of us have never seen before. The state of California has issued an order to shelter-in-place. All UCCE employees have been directed to work remotely. However, we are still available by phone and email. UCANR, and the San Luis Obispo office, lead by Dr. Katherine Soule, has put together a lot information about the coro-**