

Forage Production Report

San Luis Obispo County

2001-2015



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Introduction

This year has seen the continuation of the unprecedented drought across the Western US, and especially here on the California Central Coast. Seven of the last nine years in San Luis Obispo County were below average rainfall and were classified at some level of drought. Figure 1 shows this progression of drought, with the last two years being the worst. San Luis Obispo County was classified in the category of exceptional drought for 2014 and 2015, the highest drought rating that the USDA National Drought Mitigation Center gives (Svoboda and Fuchs, 2015). Also, in a study of blue oak tree rings, Griffin and Anchukaitis (2014) suggest this current drought is the most severe in the last 1200 years, and is driven by record high temperatures and greatly reduced, though not unprecedented, levels of precipitation.

The purpose of this report is to discuss forage production in San Luis Obispo County. Forage production varies across the county based on annual rainfall, soil type, slope and aspect. Average annual precipitation is important in determining forage production. Weitkamp (1993) divided the county into three different zones based mostly on forage production resulting from different levels of annual precipitation (Fig. 2): Coastal Zone (greater than 20 inches; 8-15 ac/AUY), Central Zone (between 20 and 12 inches; 15-30 ac/AUY), and Eastern Zone (less than 12 inches; >30 ac/AUY).

Figure 3 shows the locations of the forage monitoring sites in San Luis Obispo County and the dates they were established. There were several new sites added to the annual monitoring locations for the 2014 and 2015 season. There was not a history of forage production for these new sites, so data from the USDA soil survey was used to estimate the expected normal production to evaluate the losses this year. The other sites do have a history of forage production data, which was used to evaluate this year's losses at those locations.

For this report, the results are shown as "usable forage" production. Usable forage is that portion of the forage that can be grazed without damage to the basic resources (SRM Glossary, 2015). In an annual rangeland, that means leaving enough residual forage so that sufficient residual dry matter (RDM) remains to cover the soil in the fall to ensure maximal forage production and soil protection with the onset of the rainy season. Maintaining adequate RDM not only influences how productive an annual rangeland will be in the following season, it also helps protect against soil erosion and nutrient loss. The recommended minimum levels of RDM are given in the publication "California Guidelines for Residual Dry Matter (RDM) Management on Coastal and Foothill Annual Rangelands" (Bartolome et al., 2002). Other investigations have found that dry vegetation can disappear at a rate of 7% per month from the end of growing season until the beginning of the rainy season due to physical and chemical breakdown. (Frost et al., 2008). For this report we estimate there will be 5 months for the dry period, May – September. This assumes that the dry season will end by early October. Since there is a natural loss of forage each month, an additional 35% (7% per month) was added to the minimum RDM values to account for forage lost through the dry period. The remaining forage is the usable forage value shown in this report. Plant species not palatable to livestock, such as fiddleneck (*Amsinckia* spp.), lupine (*Lupinus* spp.), turkey mullen (*Eremocarpus setigerus*), locoweed (*Astragalus* spp.) and tarweed (*Hemizonia* spp.) were excluded from the usable forage estimates.

Rainfall

Rainfall was measured at each site using recording rain gauges. In addition, records were obtained from the ranch headquarters at each site or the nearest weather station operated by the County of San Luis Obispo or Bureau of Land Management's remote automated weather stations (RAWS). San Luis

Obispo County received more rainfall this year (2015) than 2014, about 60% of average for the last 15 years (Figure 4). It was interesting that this year there was about equal rainfall in the coastal and central zones of the county (Figure 5), when usually the coastal zone is higher. This year the coastal zone from Cayucos south through Arroyo Grande was much drier than expected. Rainfall normally starts in October, and increases each month through January, then decreases until May (Figure 6). This year, precipitation started in October at approximately the average amount. November was about half of normal, but December was higher than average. However, January was almost entirely dry, February received half of average, and March was very dry. The rains that came during April were too late to help forage production (with the exception of a few locations along the coast), because the annual forage at most sites had already completed their growth cycle.

Usable Forage Production

Total forage production was measured each spring by clipping vegetation within the four exclosures at each site (Fig. 3) at the time of peak growth. Samples were oven dried and weighed. We estimate this year's usable forage production county-wide was 47% of the long-term average, or a 53% loss (Figure 7). The Estrella site showed an abnormally high production (Figure 8). The rainfall this year appeared to be spotty in nature. Apparently, the North West portion to the county received just enough rainfall, and at just the right time, to produce near average to above average production at sites in Cambria, Adelaida and Estrella. The Carrizo Plain site, which has a productive soil, also had near-average production this year. There appeared to be adequate forage along the mountains from Adelaida toward Atascadero onto Santa Margarita (e.g. the highest rainfall zones in the county; Fig. 2). Three sites at Cal Poly's Walters ranch, across Hwy 1 from Cuesta College, showed considerable variation among sites. The W6 site (a flat meadow near a creek) produced 20% more forage than average (Figure 8). In contrast to that, the Cal Poly EU8-S site (steep southern aspect, less than 1 mile from the W6 site) produced only 3% of the anticipated level of forage. Production at other sites ranged from -33% to -97% of long-term averages (Figure 8). After taking the unusually high production sites out (anomalies which included the Cambria, Adelaida, Carrizo, Cal Poly W6, and Estrella sites), production levels of the other 23 plots (the remainder of the county) were 65-70% below average.

With 75% or more of all cattle being removed from the county last year, and continued low forage production this year, the productive capacity of beef cattle enterprises in the county remain very low. This is the fourth year in a row with below average forage production (Figure 7). In addition, years 2007 and 2009 were also drought years that created hardships for those in the county's livestock industry.

Forage Species Composition

Soft chess brome (*Bromus hordeaceus*) is a valuable annual grass because it retains most of its seed – a good source of nutrients for grazing animals - through the summer (Bently and Talbot, 1951). However, this year's production yielded less than 1% soft chess brome, with minimal or low grass production throughout the county (Figure 10). The most dominant grass in the eastern zone of the county this year was red brome (*Bromus madritensis* ssp. *rubens*), a much less palatable species. Wild oats (*Avena* spp.) were common in the coastal zone. San Luis Obispo County rangelands often have increases in forbs (mostly filaree, *Erodium* spp.) during the drier years, and a corresponding decrease in grass (Figure 9). This has been especially true for the last two years with forbs accounting for about 70% of all forage (Figure 9). Areas in the eastern portion of the county had as much as 90% forbs this year, with the

majority being filaree. County-wide, filaree accounted for almost 50% of all usable forage for 2015 (Figure 10). Some researchers have stated that most of the forbs are of little value, especially filaree, after they dry and crumble because that which remains is mostly fibrous stems that cattle will not graze unless forced to do so (Bently and Talbot, 1951). However, some local ranchers state that filaree is a good feed, even after it dries, until the rich golden color disappears by leaching from rain, or the wind simply blows it away after it dries and crumbles (Kuhnle, personal communication, 2015). Although usable forage this year was higher than last year, most of it being filaree, it was already beginning to dry by April. The value of forbs, especially filaree, as “usable forage” will continue to decrease significantly as the current dry period lengthens.

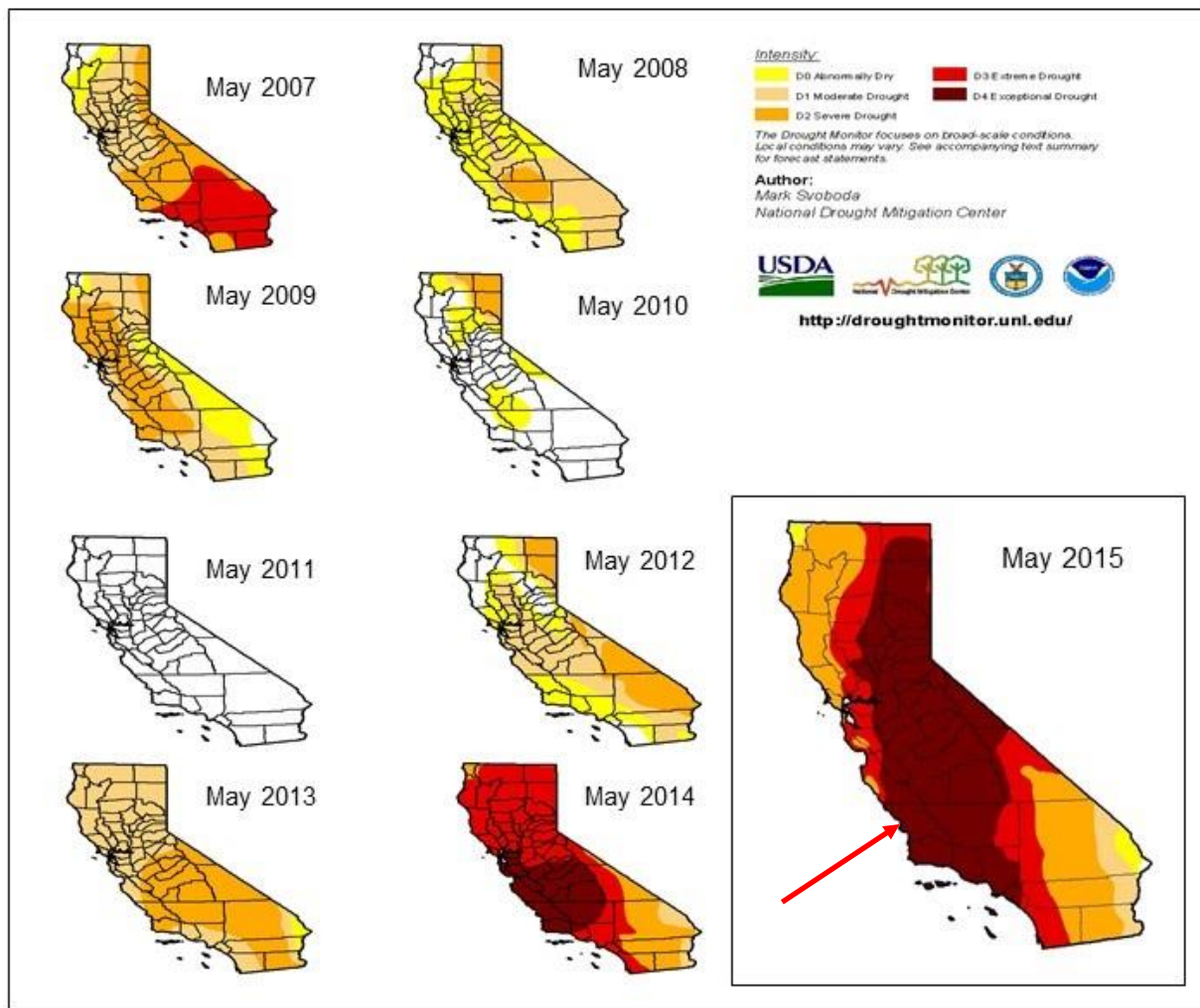


Figure 1. This figure shows how the drought progressed in California from 2007 through 2015, at time of peak forage production on rangeland. The ratings used are Normal (no color), D0 = Abnormally Dry, D1=Moderate Drought, D2=Severe Drought, D3=Extreme Drought and D4 = Exceptional Drought, the worst condition. San Luis Obispo County (red arrow) went from severe drought conditions in 2007 to normal in 2011 and progressed to Exceptional Drought in 2014 and 2015 (Svoboda and Fuchs, 2015).

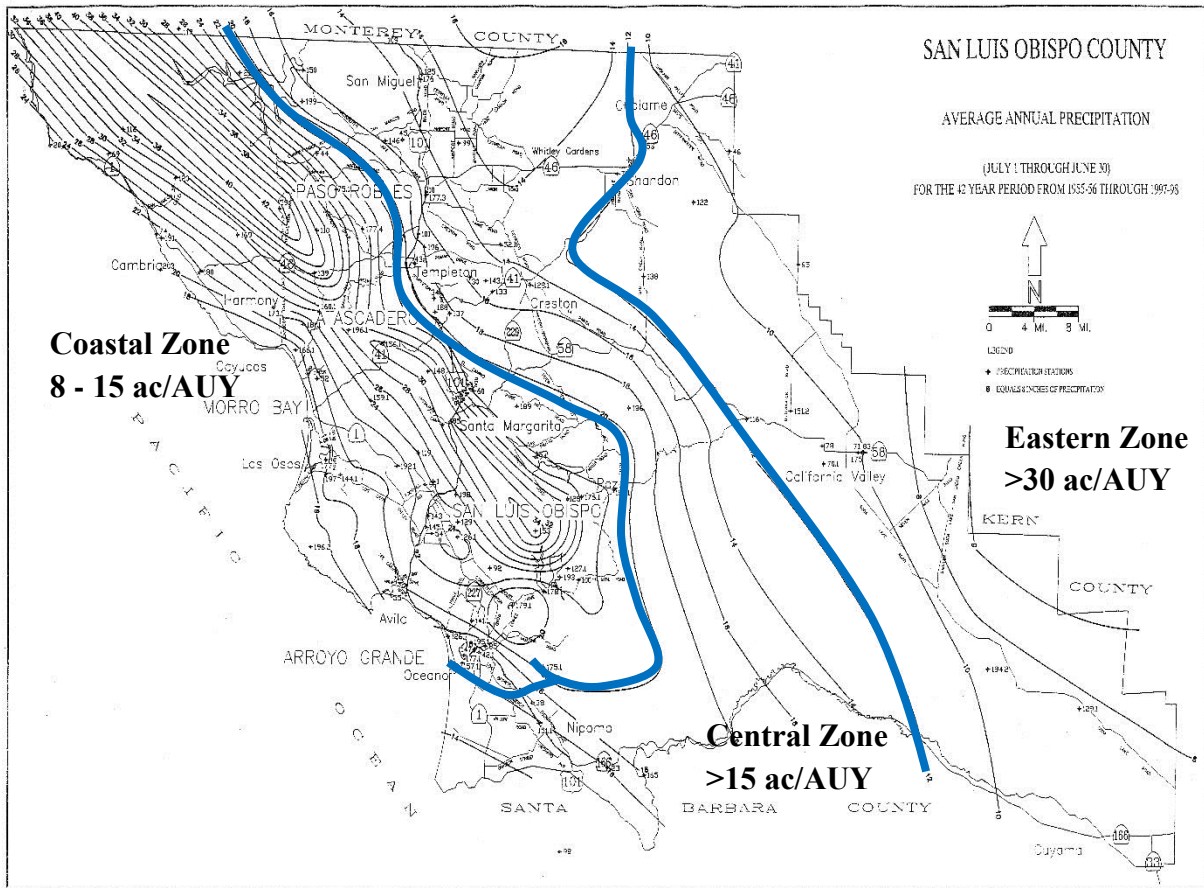


Figure 2. Stocking rates (grazing capacity) and related rainfall zones in San Luis Obispo County (Information adapted from Weitkamp 1993). Definitions: ac = acre, AUY = Animal Unit Year (the amount of forage needed to support a 1,000 lb cow for one year).

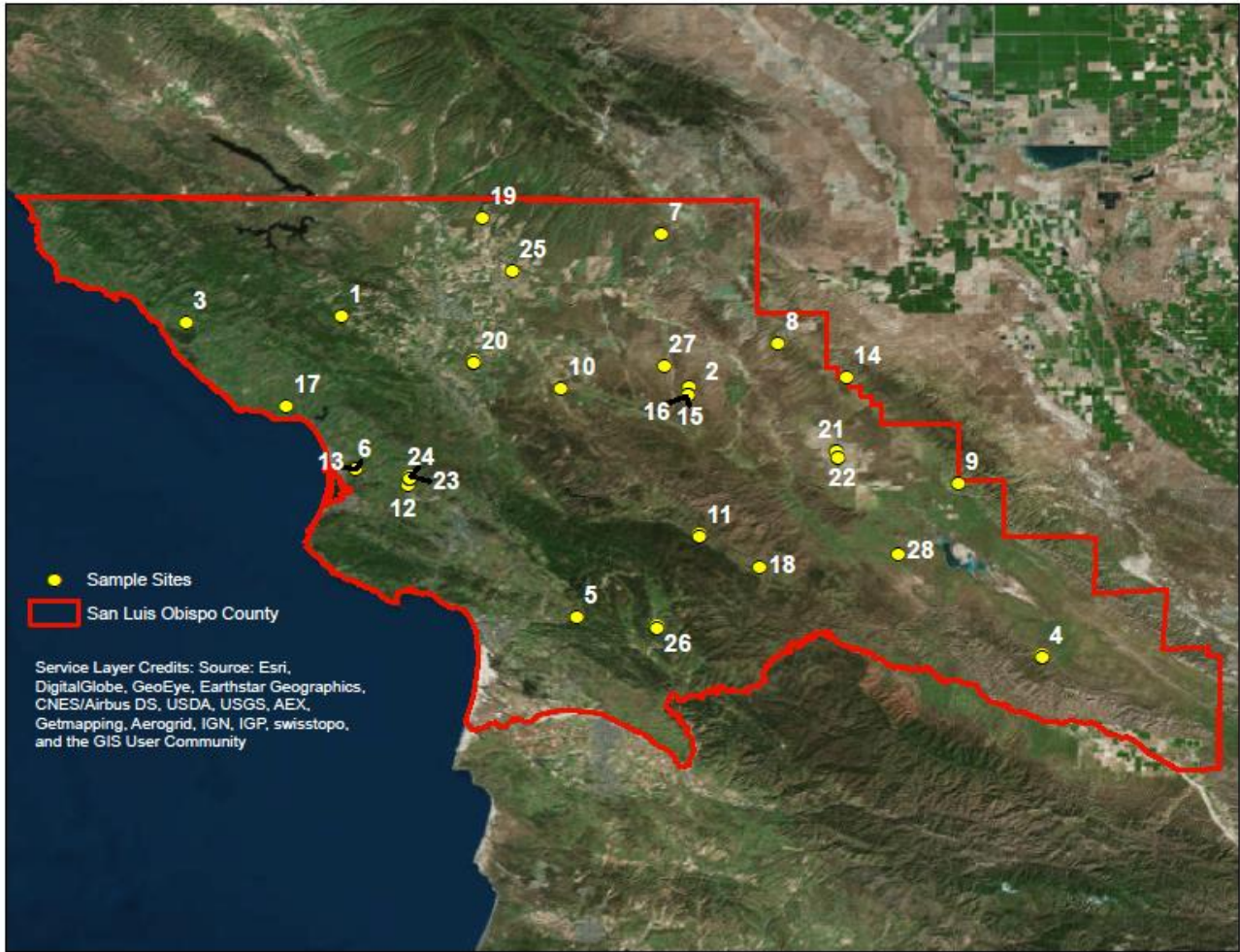


Figure 3. There are 22 locations for this monitoring. Three of the locations have both a north and south aspect, and there are two other locations that have more than one plot, i.e. a different elevation or soil, for 28 plots. Each plot consists of 4 – 10 foot diameter exclosures. These are spread out across the county, see map for all locations. These sites were established between 2001 – 2014, see table below for dates. (Figure prepared by John Burman, Althouse and Meade, Inc.)

Date Established	Site Name (with number as shown on map)
2001	Adelaida (1), Camatta (2), Cambria (3), Carrizo(4), Huasna (5), Morro Bay-S (6)
2003	Shandon (7)
2004	Bitterwater (8), Soda Lake (9)
2010	Creston (10), Pozo (11), Cal Poly-W6 (12)
2012	Morro Bay-N (13)
2013	Bitterwater-2 (14), Camatta-N (15) Camatta-S (16), Cayucos (17), Rock Pile Rd (18), San Miguel (19), Templeton (20), Topaz B3 (21), Topaz ST (22)
2014	Cal Poly-EU8-N (23), Cal Poly-EU8-S (24), Estrella (25), Huasna-2 (26), Shell Creek (27), Branch Mountain (28)

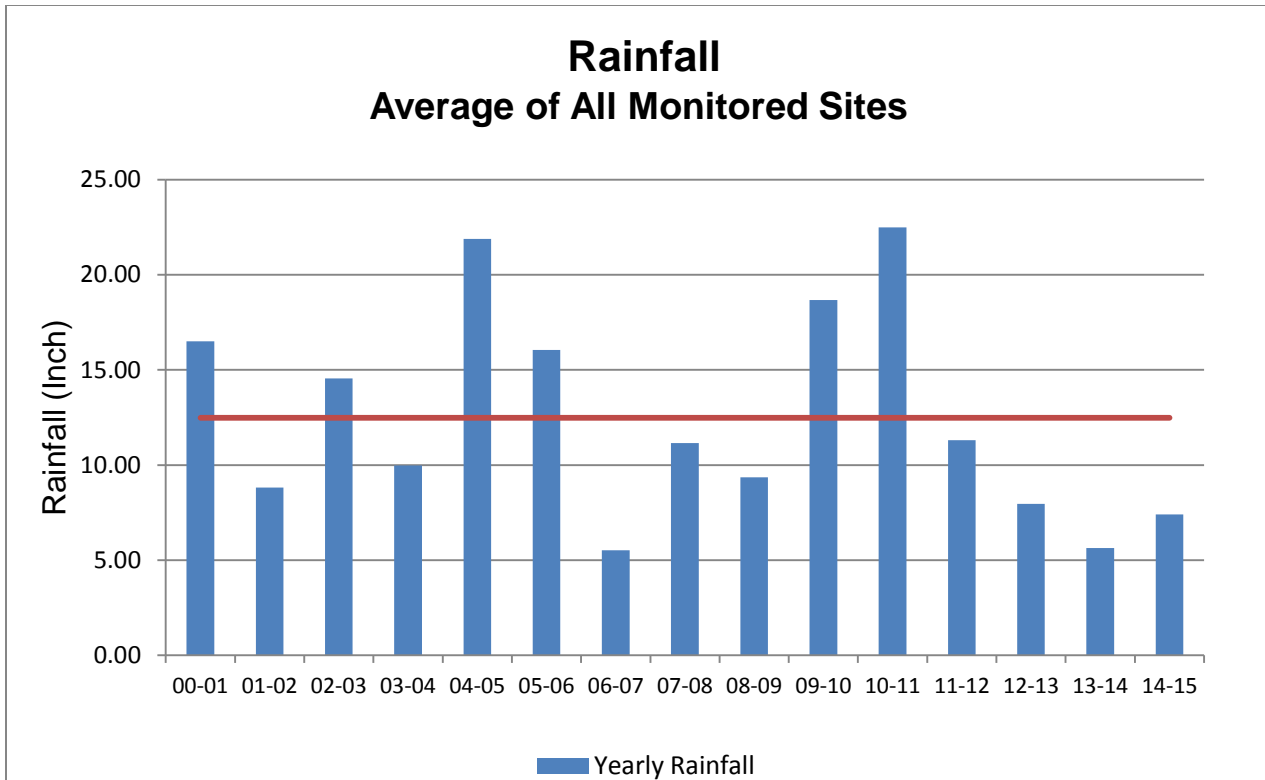


Figure 4. Rainfall by water year for all the sites monitored in San Luis Obispo County. A “water year” is the period from July 1 through June 30.

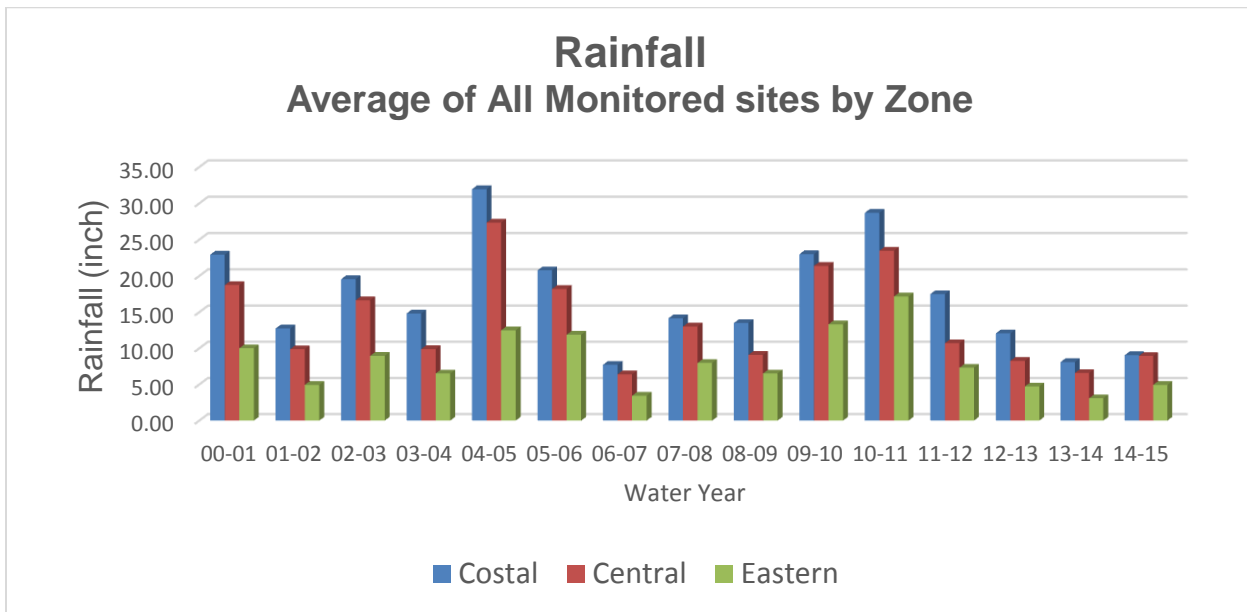


Figure 5. Rainfall by water year and within the three zones in San Luis Obispo County. A “water year” is the period from July 1 through June 30.

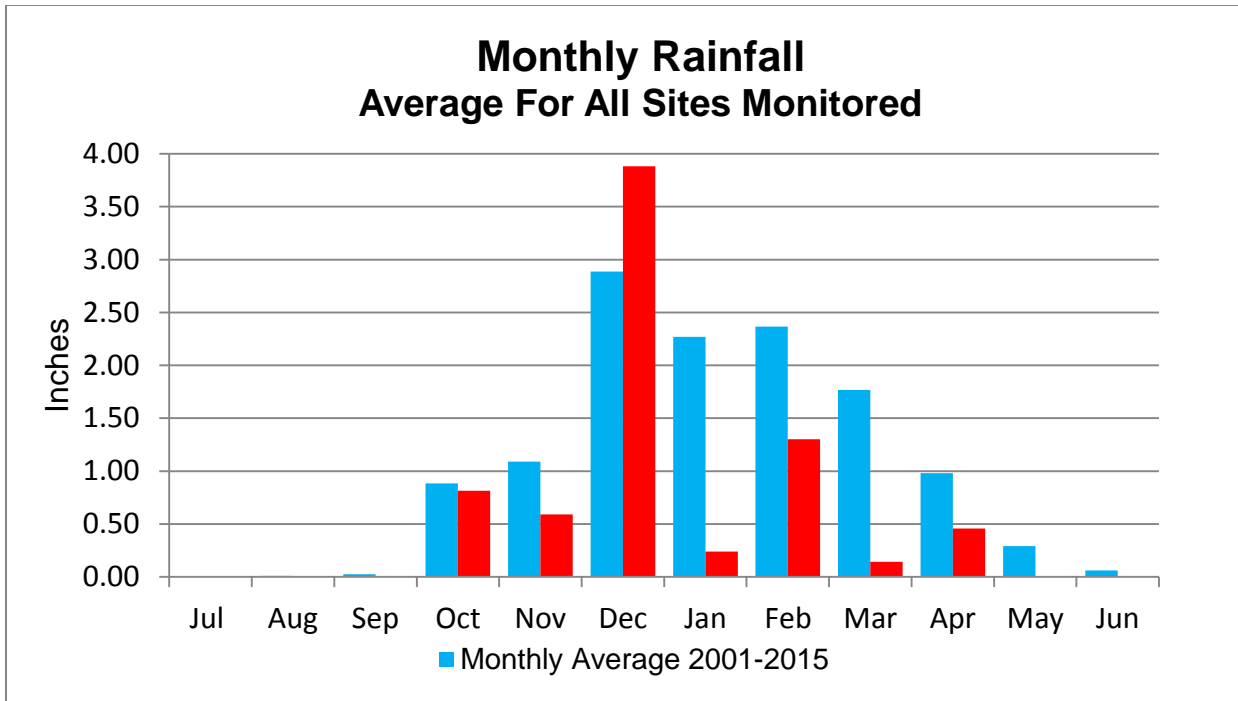


Figure 6. Monthly average for rainfall for all sites monitored compared to monthly average for 2014-2015 water year.

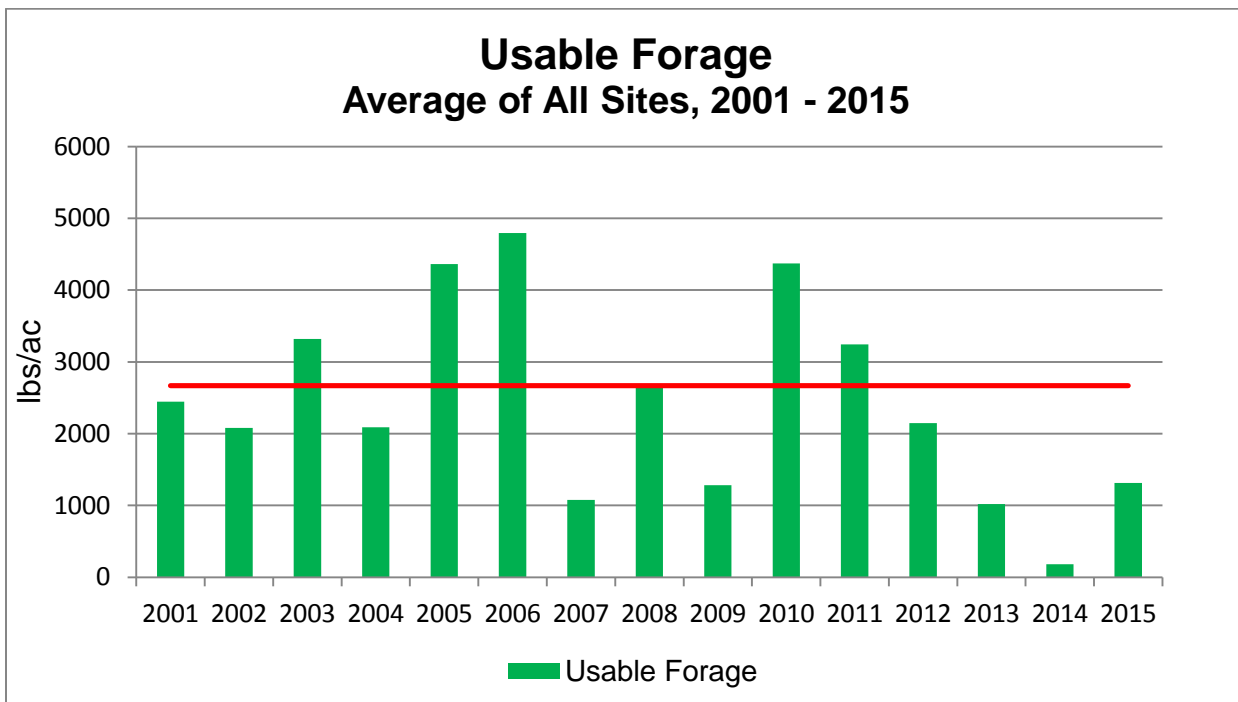


Figure 7. Usable forage production for all sites in San Luis Obispo County. The average loss was 54 percent.

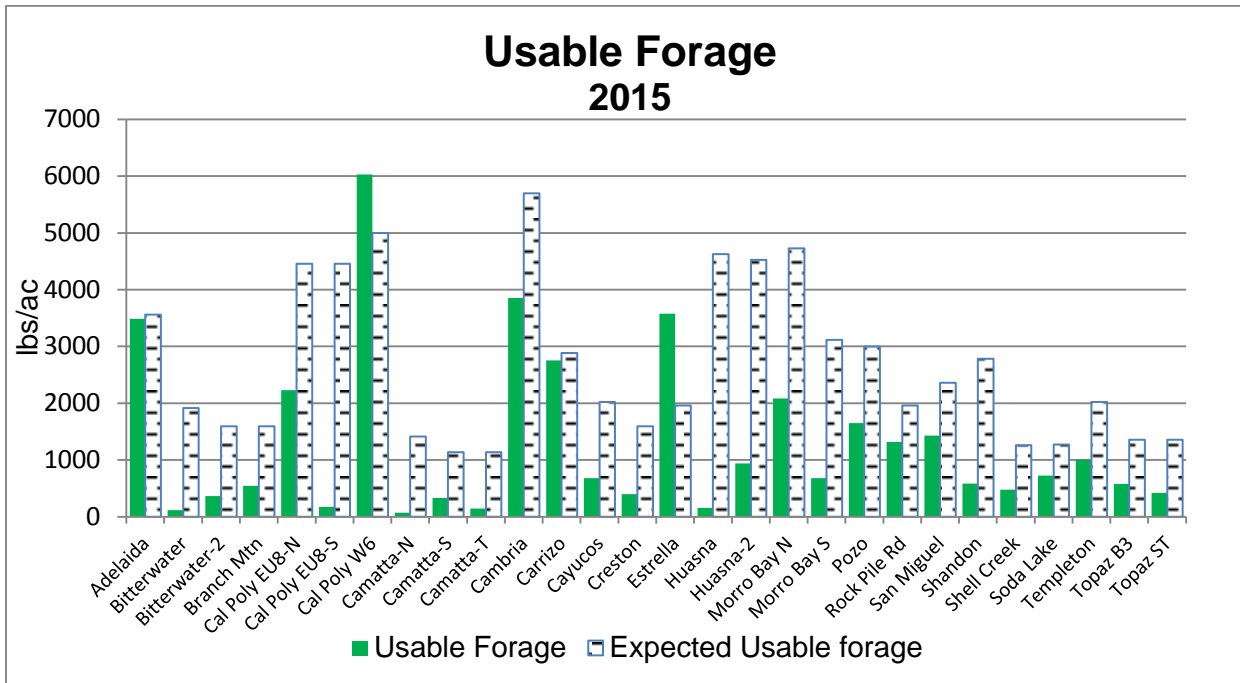


Figure 8. Usable forage at each site monitored in 2015. This graph also shows the expected normal value for each site. The 2015 values ranged from 97% below average to 88% above average. The Estrella and Cal Poly W6 sites were above average, and were an anomaly. The Adelaida, Cambria and Carrizo sites were near average, while all other sites were below the average expected usable forage values.

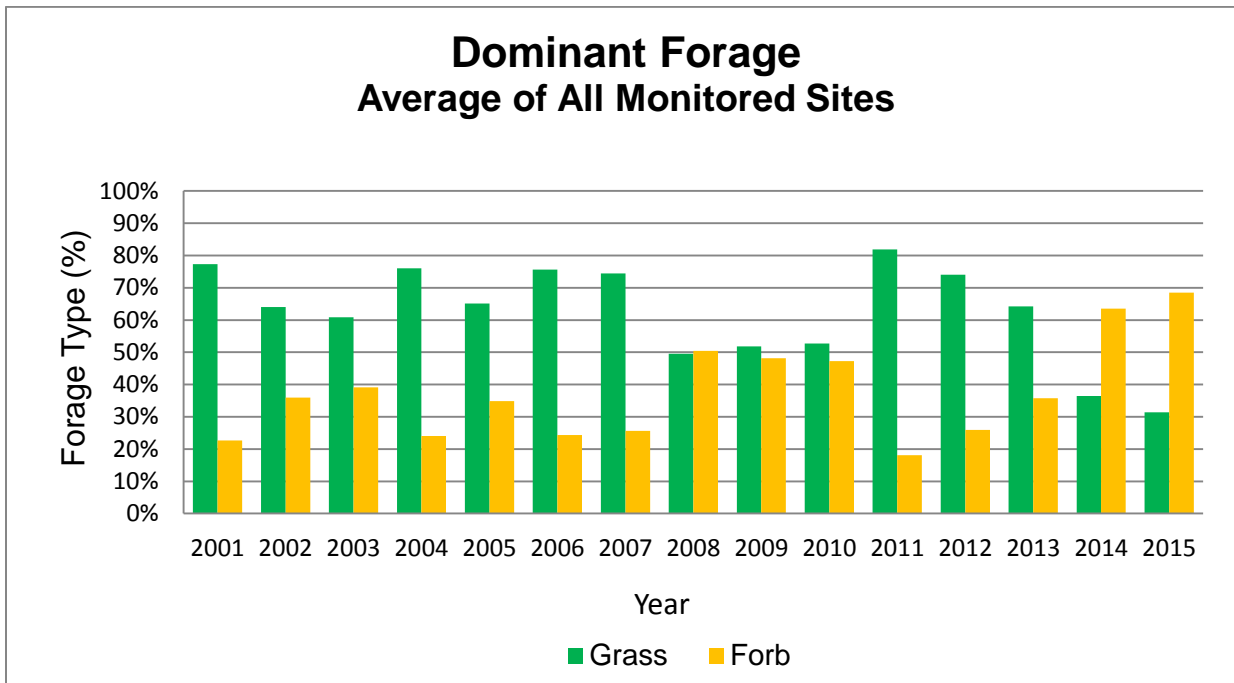


Figure 9. Dominant forage type for the county. The percentage of forbs increased during the dryer years and were dominant for 2014 and 2015.

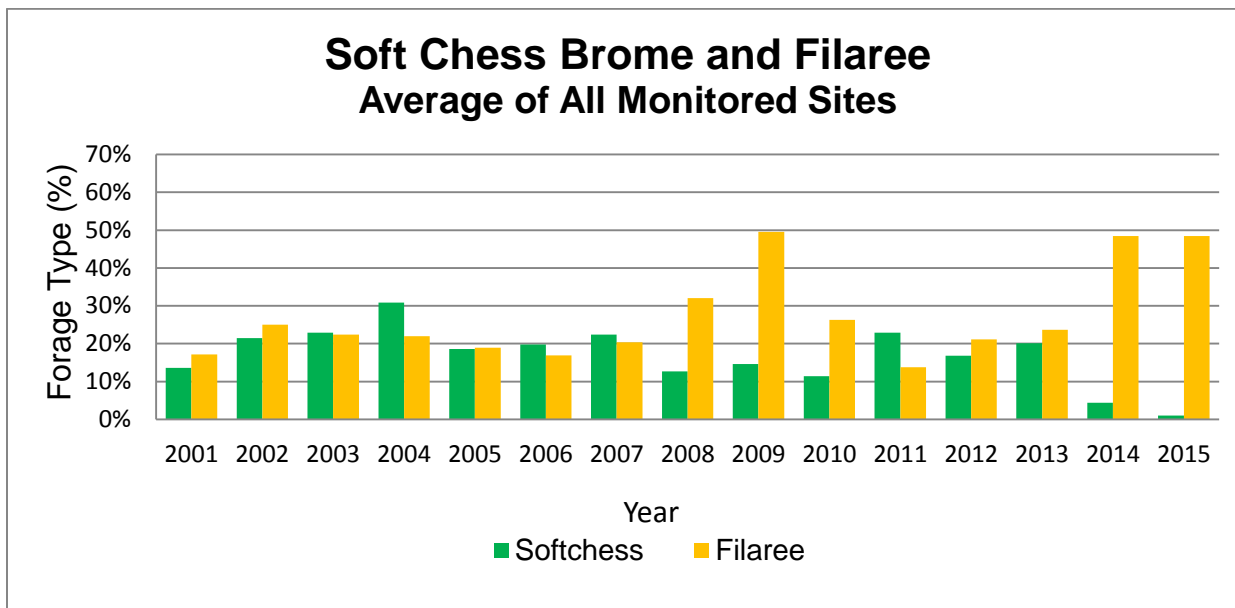


Figure 10. Soft chess brome and filaree portion of forage for the county. Soft chess brome has decreased to less than 1%, and filaree has increased to approximately 50% during this extended drought period.

References:

- Bartolome, J.W., W.F. Frost, N.K. McDougald and M. Connor. California Guidelines for Residual Dry Matter (RDM) Management on Coastal and Foothill Annual Rangelands. ANR Publication 8092. University of California Agriculture and Natural Resources Communication Services 6701 San Pablo Avenue, 2nd Floor Oakland, California 94608-1239. <http://anrcatalog.ucdavis.edu/Items.aspx?hierId=10450> accessed May 18, 2015.
- Bently, J.R. and M.W. Talbot. 1951. Efficient Use of Annual Plants on Cattle Ranges in the California Foothills. California Forest and Range Experiment Station, Forest Service. Circular No. 870. Washington D.C. United States Department of Agriculture.
- Frost, W.E., N.K.McDougald, R. Larsen, K. Churches and J. Bartolome. 2008. Disappearance of residual dry matter on the coastal and Sierran annual rangeland of California. Society for Range Management: Building Bridges Grasslands to Rangelands. Louisville, KY. Abstract No. 2435.
- Griffin, D., and K. J. Anchukaitis. 2014. How unusual is the 2012–2014 California drought? *Geophys. Res. Lett.*, 41, 9017–9023, doi:10.1002/2014GL062433.
- Kuhnle, D. 2015. Ranchers Viewpoint in the Carrizo Plains. Personal Communication.
- Society for Range Management Glossary. 2015. <https://globalrangelands.org/rangelandswest/glossary> accessed May 18, 2015.
- Svoboda, M. and B. Fuchs. 2015. California Drought Condition *In* United States Drought Monitor. National Drought Mitigation Center, Lincoln, NE. Website <http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?CA> accessed May 18, 2015.
- Weitkamp, B. 1993. The influence of climate on range forage production in San Luis Obispo County. Farm Advisor Facts #16. San Luis Obispo, CA: University of California Cooperative Extension, San Luis Obispo County.