



Drought Impacts on Rangelands

California rangelands: definition and importance

Rangeland is defined by any number of factors, including ecosystem type, dominant vegetation, and utility for livestock grazing. While not all definitions include explicit mention of grazing, rangelands in California provide millions of acres of critical forage—edible grasses, forbs, and shrubs—to support the state’s cattle, sheep, and goat ranchers. Rangelands also provide a variety of valuable ecosystem services, such as habitat for endangered species like the San Joaquin kit fox and California tiger salamander, as well as numerous cultural benefits¹. However, rangelands are experiencing a wide variety of impacts due to drought, and as a result, ranchers are increasingly pushed to new lengths of adaptation.



Photo: Daniel Gies via Flickr
 Cattle grazing in Wildcat Canyon Regional Park.

How does drought affect rangelands?

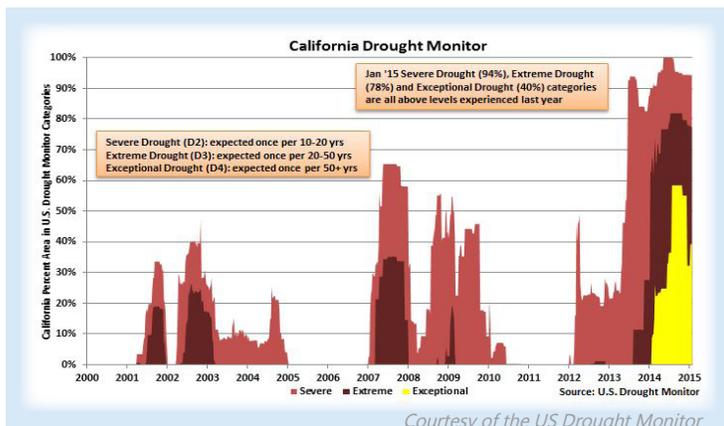
Forage production in California rangelands is strongly dependent on the magnitude and timing of precipitation. Summer forage in northern California hinges on rain and temperate weather during the fall and winter, while growth in central California can vary based on later spring weather and rains. In 2014, for instance, some areas in the central Sierra foothills experienced above-average forage production despite low annual average precipitation, because the rain that did fall happened to do so during the critical period of March². By the same token, however, 2015 forage production in the same central Sierra foothills fell by 32% because the area received only 21% of average spring rainfall^{3,4}.

The effects of drought on rangeland production can also be mediated by other factors which affect the spatial distribution of rain, such as latitude and topography. Northern California, especially at high elevations, has

more consistent rainfall and temperate weather. Meanwhile, more arid rangelands in the rain shadow of the Coastal Range or in Southern California are impacted more heavily by drought. As such, from 2013-2014, production at some of these coastal and southern sites could get as low as a 5% of the average, while northern sites usually stayed above 50% of the average².

Drought also threatens the ecology of rangeland vegetation. Low rainfall in rangelands can push livestock to concentrate their grazing around a smaller number of water sources. Clustering together can increase the risk of overgrazing and trampling of vegetation around these sources, which can cause ecosystem damage like soil erosion, reduced root length, and increased susceptibility to invasive species^{6,7}. While California rangelands are often dominated by invasive annual grasses from the Mediterranean, drought can also worsen the problem by favoring these non-natives over native perennials⁸. This has ramifications for the livestock industry as well. For instance, filaree (often associated with low rainfall) can reduce cattle nutrient intake because the plant is so low to the ground and difficult to eat⁹.

Drought can also impact forage and water quality. Increasing evapotranspiration concentrates salts in forage and water, which can make livestock thirstier and can sometimes even be toxic. Lower water levels and higher temperatures can also increase the risk of blue-green algae growth that contaminates water sources^{10,11}. Altogether, livestock water demand is increasingly unmet by California’s drying, warming rangelands as both the quantity and quality of forage and water fall.



The total area of California experiencing severe, extreme, or exceptional drought hit unusual highs after 2013⁵.

How has the drought affected California ranchers so far?

In addition to lower forage production, grazing is becoming a more challenging enterprise to manage as temperatures rise and precipitation falls. Ranchers bear a significant cost burden when adapting to drought stressors.

According to a survey of California cattle ranchers, approximately 70% of respondents have reduced their herd sizes or purchased feed to supplement lackluster rangeland forage production, and around 25% have rented additional pasture or moved their livestock to a new location in response to drought¹². Around 40% also applied for assistance programs, which have received increased funding from the 2014 federal Farm Bill^{12,13}.

However, many ranchers are still being put into risky financial waters and are unsure of their future in the enterprise due to the high cost of these adaptive strategies.

Drought Management Practices		% (n = 490)
Proactive	Employ conservative stocking rates	34
	Incorporate pasture rest into grazing system	23
	Incorporate both cow-calf and stockers for flexibility	21
	Grass bank/Stockpile forage	12
	Use 1-3 month weather predictions to adjust stocking	11
	Add other livestock types for flexibility	3
Reactive	Reduce herd size	70
	Purchase feed	69
	Apply for government assistance programs	39
	Wean early	39
	Rent additional pasture	26
	Move livestock to another location	24
	Earn off-ranch income	23
	Sell retained yearlings	22
	Place livestock in a feedlot	8
	Allow livestock condition to decline	7
	Add alternative on-ranch enterprise	4

Roche et al. In Prep

Reactive and proactive strategies being used by surveyed ranchers to deal with drought in California¹².

What are the long-term consequences if the drought continues?

Around 95% of surveyed ranchers believe that their past or current adaptation strategies will not suffice if the drought continues into the future. As the drought continues, forage quality and quantity will continue to decline. Ranching operations will face financial pressure to decrease stocking rates on these sparse rangelands, and will bear growing costs as feed supplies dwindle and hay prices rise from high demand¹⁴. Stockers will continue moving their cattle to different states for overwintering due to lack of forage in California, and an increasing proportion of cattle will be sent to other states earlier in their lives to be put on feedlots rather than grazing here¹⁵. Ranchers will also face pressure to convert their land to other, more profitable uses to the detriment of rangeland ecosystem services.

Reasons to Preserve Rangelands

Rangelands in California provide several key benefits to society, such as habitat, carbon sequestration, watershed management, recreation, and the preservation of ranching heritage and tradition¹. The conservation of rangelands can also save water, as the trend of converting rangeland to intensive agricultural and urban uses often increases water consumption¹⁶.

Where can ranchers get information and help?

- CDFA Resources: <https://www.cdfa.ca.gov/drought/>
- Conservation and livestock assistance: http://www.usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=usda_drought_programs.html
- "Managing Drought Risk" handbook & webinars: <http://drought.unl.edu/ranchplan/Overview.aspx>
- USDA Farm Service Agency loan programs: <https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/>

1. <http://ucanr.edu/sites/RangelandES/>
2. <http://anrcatalog.ucanr.edu/pdf/8018.pdf>
3. <http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=17340>
4. <http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=16949>
5. http://www.agweb.com/blog/know_your_market_281/drought_concerns_mounting_in_new_zealand_and_california/
6. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/home/?cid=NRCSEPRD365607>
7. <https://www.wvu.edu/~agexten/forglvst/overgraz.htm>
8. <http://www.jstor.org/stable/10.1086/648557>
9. <http://anrcatalog.ucanr.edu/pdf/8022.pdf>
10. [http://rangelandwatersheds.ucdavis.edu/DroughtInformation/Poppenga and Puschner 2014 Drought](http://rangelandwatersheds.ucdavis.edu/DroughtInformation/Poppenga%20and%20Puschner%202014%20Drought)

11. <http://drought.unl.edu/ranchplan/DuringDrought/WaterHeatStress.aspx>
12. https://www.researchgate.net/publication/266156181_Sustaining_working_rangelands_social_economic_and_ecological_insights_from_rancher_decision-making_and_drought_adaptation
13. <http://beef.unl.edu/2014-farm-bill-and-disaster-assistance-for-livestock-producers>
14. <http://accuweather.com/en/weather-news/drought-economy-california/24043326>
15. <http://www.reuters.com/article/2014/03/04/california-drought-cattle-idUSL1NoM11SA20140304>
16. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0103468>