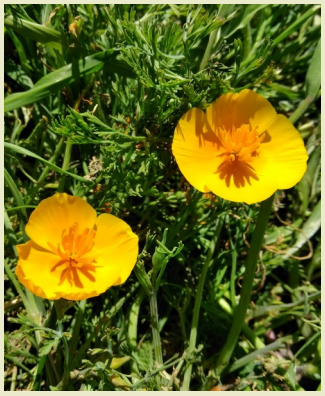
# RANGE BULLETIN



*Livestock & Natural Resources Newsletter*

**In this issue:**





*Editor*
Rebecca Ozeran
*Phone*
559-241-6564
*Email*
rkozeran@ucanr.edu

## Want more Livestock and Range information?

Find us on Facebook! Search for **@UCCEFresnoMaderaLivestock** or visit the page directly at **https://www.facebook.com/UCCEFresnoMaderaLivestock/** for weekly updates on upcoming events, recent news, and research information.

## News Briefs

### Western SARE offers grants for farmers and ranchers

These one- to three-year grants are conducted by agricultural producers with support and guidance from a technical advisor. Individual farmers or ranchers may apply for up to $20,000, and a group of three or more producers may apply for up to $25,000. Producers typically use their grants to conduct on-site experiments that can improve their operations and the environment and can be shared with other producers. Grant recipients may also focus on marketing and organic production. A technical review will be held in January 2019, and proposals will be selected for funding in March 2019.

**Read more and apply here: https://www.westernsare.org/Grants/Types-of-Grants#frg**

---

### In the works - Oak Research

UCCE livestock and range advisors in the San Joaquin Valley and Central Coast are developing a new research project to examine oak mortality and oak populations. We need your feedback to help us focus the project!

**Please fill out our 3-minute, anonymous survey here: http://ucanr.edu/oaksurvey**.

# Senate Bill 88

***What ranchers and landowners need to know about complying with Senate Bill 88 and the California State Water Board***

By: Julie Finzel, Theresa Becchetti and Scott Oneto

Common question: *I got a letter from the State Water Board about reporting the amount of water I divert for my stockpond. How do I comply?*

## Background

A number of water rights holders have received a letter recently from the California State Water Board stating that you must report the amount of water diverted for your stockpond in 2017, and threatening a $500 a day fine if you do not respond by April 1, 2018. The reporting of water diversion amounts for stockponds is a relatively new requirement that was passed as emergency legislation in 2015 during what is being called our 500-year drought. The legislation is known as Senate Bill 88 or SB 88.

If you received a letter from the water board it means that at some point you registered a stockpond with them and you are now required to report the amount of water diverted for each registered stockpond. If you are not sure which stockpond you registered, you can call the water board directly at: (916) 341-5300 for more information. Ask for technical staff. All water diversions and storage must be reported as water rights, according to the law; reporting requirements vary based on how much water is diverted and/or stored. The reasons for this reporting, as stated by the water board on their website, are:

- Understand and plan ahead for limited water supplies;
- Identify water losses in a diversion system and take corrective actions to conserve water and stretch limited water supplies;
- Assure compliance with the quantity and season limitations of existing water rights;
- Protect the senior rights of diverters in accordance with their relative priorities;
- Provide for efficient management and use of water during times of shortage; and
- Improve water planning and near-term forecasting of water demand

*This article continues* ►

*SB88 cont'd*

The regulations that enforce SB 88 state that the amount of water diverted must be monitored and recorded. The monitoring frequency ranges from hourly to monthly depending on the diversion amount and the total storage amount of the stockpond. Table 1 outlines the different diversion amounts and pond sizes. Most stockponds are likely to be in the last two categories: Storage greater than (>) 10 acre-feet (af) but less than (<) 50 af or storage < 10 af. In this case the required monitoring frequency is monthly, and the data is reported to the state on an annual basis.

*This article continues* ▶

**Table 1:** Summary of reporting requirements for SB 88. Table courtesy of California Farm Bureau.

| Diversion Type | | Deadlines | | | Requirements | | |
|---|---|---|---|---|---|---|---|
| Failing to file can result in a $1,000 fine plus $500 for each day of violation. | | | | | | | |
| Direct Diversion | Storage | Device Installation | Annual Water Use Reporting (of prior year's use) | File for One of the Special Provisions (see below) | Accuracy (must recertify every 5 years) | Measurement Frequency | Qualifications of Installer & Certifier |
| ≥1,000 af/year | ≥1,000 af/year | 1/1/17 | April 1 for:<br>- Permits<br>- Licenses<br>- Registrations<br>- Certificates<br><br>July 1 for:<br>- Statements | 4/1/17 (Permits & Licenses)<br>7/1/17 | 10%* | Hourly | Engineer/ Contractor/ Professional/ UCCE Course*<br>**A diverter can become qualified by completing a UC Cooperative Extension water measurement training class, available in 2018. http://bit.ly/2FkICmq |
| ≥100 af/year | ≥200 af/ year | 7/1/17 | | 7/1/17 | | Daily | |
| | ≥100 af/ year | | | | 15% | Weekly | |
| >10 af/year | ≥50 af/year | 1/1/18 | | 1/1/18 | | Weekly | Individual experienced with measurement & monitoring |
| | >10 af/year | | | | | Monthly | |
| ≤10 af/year | | Not required | | - | - | Monthly (estimated) | None |

*SB88 cont'd*

The reporting requirements began in 2017 and will be due each year on April 1. Water diversions and storage less than or equal to 10 af are not required to use a measuring device to determine the amount of water diverted; water volume may be estimated. Water diversions and storage greater than 10 af must either use a measuring device or a measurement method approved by the water board and both devices and methods must be accurate within 15% of actual diversion rates. A measurement method means that you are measuring the amount of water diverted without installing a measuring device. Typically, this involves the combination of a few tools and some math. If measurement is required, regulations state that an individual experienced in measurement and monitoring perform the monitoring. Who qualifies under that definition? The board considers ranchers and farmers to be qualified individuals. Ranch and farm employees may also be considered qualified individuals. All reporting is required to be completed online. If you received a letter from the water board, there should be instructions on how to complete your reporting requirement. In the letter you should find a water right ID number as well as an associated password for each individual water right. The website where you initiate your reporting is: **https://rms.waterboards.ca.gov**.

If you have multiple water rights and you'd like to combine them all under one account, there is an option that says: Connect multiple water rights here. Click that link to create an account using your email address that allows you to do all your reporting at once. Otherwise, the system requires that you login separately for each water right and do a separate report for each water right. Ten informational videos have been posted online to help you complete your report(s). They are available at: https://www.waterboards.ca.gov/videos/rms.

### Measuring the Volume of your Stockpond

What is the quickest and most economical way to accurately measure the amount of water diverted for a stockpond? The solution is most likely going to involve some sort of measurement of the amount of water as it enters the pond or simply the amount of water in the pond. There are several measurement devices that have been identified in SB88 that can be used. These include in-channel flow meters, staff gauges, and data loggers. These range in cost from a few hundred to several thousand dollars. For stockponds greater than 10 af you must be able to measure and report the rate of diversion, the rate of collection of water for storage, the rate of withdrawal or release from storage, and the total volume of water diverted or collected for storage with 15% accuracy. For stockponds that are 10 af or less the same measurements must be reported, however, no device is required; water volume can be estimated. The instructions below can be used for both categories of stockponds.

One of the major considerations is how to measure depth. In some instances, a measuring rod, also known as a staff gauge, could be placed in the deepest part of the pond for quick, visual, monthly assessment of depth. Alternatively, depth could be measured using a boat or flotation device of some sort and dropping a measuring device. Once the depth is known, a storage capacity curve can be used to calculate the amount of water in the pond. When your stockpond was registered with the water board, it may have been registered with a stage-storage table and curve (storage capacity curve). If you don't have the storage capacity curve associated with your stock pond in your files, you can call the water board and they will send it to you. If there isn't a storage capacity curve established for your stockpond and your pond is larger than 10 acre-feet, you will need to develop one.

*This article continues* ▶

*SB88 cont'd*

Once you have the storage capacity curve and you have depth measurements you should be able to determine pond volume. Now, there may be some instances where a vertical staff gauge is not practical. In that instance, measurements along the bank of the pond can be substituted, but those bank measurements must be included in the storage capacity curve calculations.

A spreadsheet has been developed to automatically calculate pond volume and create a storage capacity curve. **Note:** These measurements and calculations assume that the pond being measured is a true circle, square, or rectangle. Since most ponds do not meet these criteria, there is some built-in error in the calculations, however, these instructions will provide a good estimate of water volume. If you need help or do not have internet access contact your local UCCE livestock Advisor. The spreadsheet is available at **http://cekern.ucanr.edu/Livestock/**

**The following steps will determine the amount of water in your stockpond:**

**Step #1: Calculate the surface area of the pond**. This can be done by ***either*** measuring the circumference of the pond (total distance around the pond), or by measuring the length and width. For circular ponds it is recommended to measure the circumference, but the diameter can also be used. To determine circumference from diameter multiply diameter times pi (3.14). For square or rectangular ponds measure the length and width. All pond measurements should be in feet.

Surface area for circular pond
- Square the circumference. Divide answer by 547,391 to get surface area in acres.

Surface area for square/rectangular pond
- Multiply length times width. Divide answer by 43,560 to get surface area in acres.

**Step #2: Calculate average water depth**

- Measure deepest water depth
- Multiple deepest water depth by 0.7 to get average depth of pond

**Step #3: Calculate pond volume**

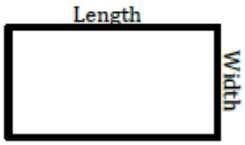
- Multiply surface area (Step 1) by average depth (Step 2)

The table on the following page will walk you through an example of a round pond measuring 1000 feet in circumference and a rectangular pond measuring 350 feet by 200 feet. The online calculator will do all the below mathematical calculations for you.

*This article continues* ►

*SB88 cont'd*

**Table 2:** How to calculate the volume of a stockpond, step-by-step.

| Round Pond | Square / Rectangular Pond |
|---|---|
| Step #1 Calculate Surface Area | |
| Measure circumference<br>  <br>1000 feet | Measure Length and Width<br>  <br>Length 350 feet<br>Width 200 feet |
| Multiply circumference by itself<br>1000 feet X 1000 feet = 1,000,000<br>1,000,000 / 547,391* = 1.827 acres | Multiply Length X Width<br>350 feet X 200 feet = 70,000<br>70,000 / 43,560* = 1.607 acres |
| Step #2 Calculate Average Water Depth | |
| Measure deepest water depth: 10 feet<br>Calculate average water depth: 10 feet X 0.7* = 7 feet | |
| Step #3 Calculate Pond Volume | |
| Multiply Step #1 by Step #2<br>1.827 acres X 7 feet = 12.789 acre feet<br>**conversion factors* | Multiply Step #1 by Step #2<br>1.607 acres X 7 feet = 11.249 acre feet |

The tools you will need include some combination of the following:

1) Flexible measuring tape (typically fiberglass)
2) Survey measuring wheel
3) Rangefinder (or laser distance meter; less expensive versions are available for $60-$100)
4) Screwdriver or some sort of anchoring rod (to allow one person to measure across the pond)

The water board requires that measurements be taken monthly, at water level. Your monthly measurements can be used to determine a baseline for your pond and create your own stage storage table and curve. Alternatively, if your pond goes dry each summer, these measurements can be made when the pond is dry. Water does not need to be present in the pond in order to estimate water holding capacity at varying depths.

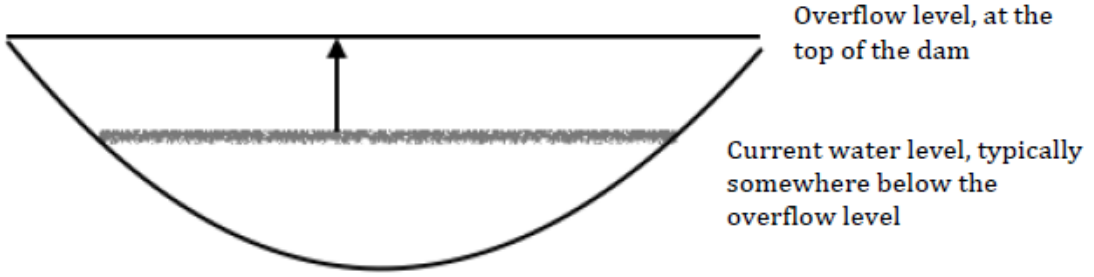
*This article continues* ▶

*SB88 cont'd*

Each time you take volume measurements of your pond, there is one more measurement you need to record. This is really the most important time saving element to this protocol. Pick a spot on the very edge of the pond, right around the high-water mark, mark it with something permanent and easy to find. Usually a survey stake or fence post is the most practical option, just be sure there won't be any major risk of injury from whatever object you pick. Measure from water level up to the high-water mark stake; make sure your tape measure is laying on the ground. This is your dry slope length. Record that measurement in the spreadsheet in the appropriate column in the excel spreadsheet. Run your measuring tape along the same trajectory each time, more or less towards the deepest part of your pond. If your pond goes dry each summer, determine the deepest point and measure the entire distance from the deepest point up to the survey stake you placed at the high-water mark to determine total dry slope length. This measurement isn't necessary, but will improve overall accuracy of storage capacity curve calculations.

The online excel file has two tabs along the bottom of the screen. One tab is labeled 'Pond Volume Calculator' and will calculate your pond volume and storage capacity curve for you. The second tab, 'Your Measurements' is a place where you can enter and record your monthly measurements. The excel file will automatically calculate the associated pond volume for you. Once you have established your own stage-storage table, monthly monitoring will consist of measuring the distance from overflow down to the water level (dry slope length) and recording that number. Note: when measuring the distance from overflow to the water level (dry slope length) you are measuring the water that is ***not*** in the pond, in other words the dry part of the pond. If paper is easier to reference, the completed storage capacity curve graph can be printed, full-size. Using your storage capacity curve graph, if your dry slope length measurement is 45 feet, find about where 45 is along the x axis (labeled "Dry Slope Length). Using a piece of paper or a ruler, find where 45 is on the curve plotted on the graph. The corresponding y axis measurement (Pond Volume) is your estimated pond volume. In the example Pond Volume Measurement spreadsheet it looks like pond volume is about 4 ac ft. Because 45 feet of dry slope corresponds to an actual measurement previously recorded, we can see that it is actually 3.6 ac ft. Record the difference in diversion or consumptive use in the appropriate place on the 'Your Measurements' tab or in your own record book. This method is designed to take no more than 5 minutes total, excluding the time necessary to drive to and from the stockpond.

Figure 1: Drawing of a cross-section of a stock pond and what you are measuring.




*This article continues* ▶

*SB88 cont'd*

The water board requires that you report water diversions during the licensed collection season, November to April, and that you report consumptive use from May to October. The calculations provided here allow for easy monitoring year round once the initial measurements are made. Consumptive use can be calculated by estimating the amount of water being consumed by livestock. This is as simple as determining number of gallons consumed per cow per day and then multiplying by the number of head that have access to the pond. If there is more than one pond in the pasture then assume the cattle are using each pond equally and divide by the number of ponds. Alternatively, dry slope length measurements can be used to measure consumptive use. If a pond is overflowing, diversions should be reported as zero because no additional water is being collected.

If you have a stockpond or spring that is not registered, the law states that any diversion or storage of water should be registered as a water right. There are fines associated with non-compliance, typically $500 a day. If you wish to register your pond you may do so online; there is also a link to the paper form in the references section at the end of this article. New registrations require paying a fee of $250 with a requirement that you renew every five years for a fee of $100, however, up to five stockponds can be registered on one certificate.

It would have been helpful to have received this information before you were required to monitor and report your water diversions. The water board has acknowledged that some landowners may need more time and they are willing to grant extensions. Visit this website https://public.waterboards.ca.gov/WRInfo, to request an extension on your reporting. Use the log-in credentials provided on the letter you received from the board. The water board has shared that red flags appear when no report is submitted, so it is important to submit a report if you received a letter. You can call the board directly at 916-341-5300 for more information and assistance. If you divert more than 100 acre-feet of water a year and you are interested in the UC measurement training class, courses are being offered in fall 2018. Contact your local UCCE livestock Advisor for more information. If you have questions or concerns about reporting your water diversion and use, contact the state water board or your lawyer. For questions about this article, contact Julie Finzel, 661-868-6219, or your local UCCE livestock Advisor.

Acknowledgement to Kirk Wilbur with California Cattlemen's Association, Dan Raytis with McMurtrey, Hartsock, and Worth, and the technical staff at the state water board for their advice and insight during the preparation of this article.

**References and Helpful Links:**

**Water board website providing overview of SB 88 regulation and helpful links**
https://www.waterboards.ca.gov/waterrights/water_issues/programs/measurement_regulation/

**California Cattlemen's Association website offering reference material from water workshop in 2017**
http://www.calcattlemen.org/cca_events/drought-management-workshop.aspx

**Pennsylvania State Website on calculating pond volume**
https://extension.psu.edu/pond-measurements-area-volume-and-residence-time

*This article continues* ▶

*SB88 cont'd*

**Helpful presentation from the water board on measuring diversions and pond volume**
https://www.waterboards.ca.gov/waterrights/water_issues/programs/diversion_use/docs/measure_report_reservoirs_present.pdf
**Adopted text of emergency regulation associated with SB 88**
https://www.waterboards.ca.gov/waterrights/water_issues/programs/measurement_regulatio n/docs/measure_reg_oal_approve.pdf
**How to develop your own storage capacity curve (depth capacity curve)**
https://www.waterboards.ca.gov/waterrights/water_issues/programs/measurement_regulatio n/docs/water_measurement/res.pdf
**Form for registering a stock pond with the water board**
https://www.waterboards.ca.gov/waterrights/publications_forms/forms/docs/lsu_registration .pdf

*Editor's note: Julie Finzel, Theresa Becchetti, and Scott Oneto are UCCE advisors for Kern, Kings, Tulare; Stanislaus, San Joaquin; and El Dorado, Tuolumne, Calaveras, and Amador Counties. For their contact information, call Rebecca at* 559-241-6564.

## SB88/AB589 Regional Water Measurement and Reporting Certification Courses now available!

**All workshops will cost $25 in advance or $30 at the door. See location for additional registration information.**

**Available workshops:**

**October 22, 2018, 1:00-4:30 PM, Modesto, CA.** Link to Registration site and workshop location.

**October 23, 2018, 8:00-11:30 AM, Bakersfield, CA.** Link to Registration site and workshop location.

**October 23, 2018, 2:30-6:00 PM, Parlier, CA.** Link to Registration site and workshop location.

**October 24, 2018, 8:30 AM-12:00 PM, King City, CA.** link to Registration site and workshop location.

**December 3, 2018, 1:00-4:30 PM, Merced, CA.** Registration will open in October, please contact Scott Stoddard csstoddard@ucanr.edu for additional information.

If you do not have internet access and would like to register for one of these workshops, call Rebecca Ozeran at 559-241-6564 and she will send you a mail-in registration form.

# Small Flock Egg Producers Workshop - Bakersfield

**When: Thursday, October 4, 2018; 10:00 AM - 3:30 PM**
**Where: UCCE Kern County, 1031 S. Mt. Vernon Ave, Bakersfield, CA 93307**
**Topics: Intro to chickens; biosecurity; candling eggs; poultry disease; egg quality**

Offered by the Kern County Department of Ag and CDFA Egg Safety and Quality Management Program, this workshop includes printed materials and a certificate of course completion. The intended audience includes current egg producers and anyone interested in small-scale egg production in Fresno, Kern, Kings, Tulare, San Luis Obispo, Ventura, Los Angeles, and San Bernardino Counties.

**Call 916-900-5090 by October 1, 2018 to RSVP and guarantee course materials. This workshop is free of charge.**

# Wildfire, Rangelands, and UCCE

## Post-fire recovery for ranchers on coastal rangelands in California

**by Matthew Shapero, UCCE Livestock & Range advisor, serving Ventura and Santa Barbara Counties**

### Introduction:

While wildland fire is a regular feature of grassland and chaparral vegetation types in coastal California (Barbour et al. 2007; Sugihara 2006), it poses serious challenges to livestock operators when it occurs. Your response after fire will depend upon your management goals and objectives and the resources available to you. What follows is a brief summary of the ecological impacts of wildland fire to rangelands and available response options.

### Impact to soil and soil seedbank:

The pattern and severity of burning during fire is highly variable across landscapes and depends on slope, soil texture, humidity, wind direction, temperature, fuel type and moisture, and grazing history. Likely, your ranches burned unevenly, and you may have areas where there was hot and severe fire and other areas where combustion was incomplete and aboveground biomass is still largely present. Generally speaking, wildland fire poses two immediate threats to the rangeland resource:

1) physical changes to the soil and removal of vegetation make soils vulnerable to erosion and can lead to excess runoff; and 2) elevated temperature and smoke during fire can affect the soil seedbank and compromise the following season's regrowth. The extent of these impacts across your property, however, will be uneven due to the fire's patchy behavior.

*This article continues* ►

*Fire cont'd*

2) In addition to the dry forage that was consumed during the fire, you can expect reductions in forage production for the following two green seasons. Forage production will always be highly dependent upon the timing and amount of rainfall, but you can generally expect production to be 50-70% of normal and the species composition to shift primarily to forbs (i.e. clovers, filaree, etc.) for the growing season immediately following fire. The second growing season after fire you can expect production to be about 80% of normal. Production should return to normal by the third growing season (Becchetti et al. 2011).

Ranch in Ventura County the morning after it burned in the Thomas Fire, December 2017. Notice the uneven burn in the pasture; there are areas where there was hot and severe fire (on the hillslopes in the background) and other areas that did not burn at all.

## Management responses:

### Livestock management

Perhaps your most immediate concern is what to do with your livestock. The options available to you are to 1) ship out of the area to other feed resources, 2) sell livestock, or 3) provide supplementary feed and hold them until range forage returns. Ultimately, your decision will depend upon the individual circumstances of your operation. Option 1 allows you to rest burned pastures and maintain herd numbers but requires access to pasture elsewhere and will cost money to transport. Option 2 also allows you to rest burned pastures but selling animals means losing herd genetics and can also create undesirable tax implications. If you go this route, check with your accountant as you may qualify for certain deferrals on income tax from the sales of livestock during disaster. Option 3 allows you to keep your animals but may potentially slow range recovery.

The scientific literature is somewhat limited on the subject of grazing after wildfire. To be sure, the most conservative option would be to defer grazing on your pastures until the spring following fire (Options 1 and 2). If deferring grazing is not an option, consider reducing your stocking rate in pastures that burned and run lighter than you normally would to avoid excess use. Alternatively, you might select one "sacrifice" pasture on which to feed for the winter, which will allow you to rest other portions of your ranch until spring.

Two examples of different burn severities. On the left, a grassland pasture burned at "low" severity: combustion was incomplete and aboveground biomass is still largely present. On the right, a shrubland area burned at "high" severity. The severity of burning during fire depends on slope, soil texture, humidity, wind direction, temperature, fuel type and moisture, and grazing history.

*This article continues* ▶

*Fire cont'd*

## Re-seeding

Seeding rangelands after fire has long been thought to protect against soil erosion, however seeding is no longer a preferred practice used by agencies (e.g. US Forest Service, Natural Resource Conservation Service) as its effectiveness depends so much on the timing and amount of subsequent precipitation and introducing exotic, non-native seed can compromise the recovery of native plant species after fire. Additionally, disturbance to the soil surface while seeding and increased rodent populations after seeding due to the artificial feed resource has been shown to compromise slope stability more when compared to areas that did not receive a seeding treatment (E. Nicita, US Forest Service, personal communication, May 31, 2018).

Rangelands are also seeded post-fire to supplement the soil seedbank with desirable forage species. While this practice may have temporary benefits to forage production and composition, it is unclear how much re-seeding will increase forage production in the first and second growing seasons beyond what would otherwise be available, and it is uncertain whether shifts in species composition achieved by seeding will persist beyond the first couple of years. Accordingly, seeding forage species should be measured against its cost-effectiveness in your operation. Even without seeding, rangeland soil seedbanks should recover by the third growing season to their pre-fire species composition and production levels.

Aerial seeding on a ranch in Ventura County after Thomas Fire, January 2018. Aerial seeding can be expensive but rapidly applies seed with minimal soil disturbance. In this instance, 1,000 acres were seeded with 10,000 pounds of cereal rye in a day.

Seeding *has* been shown to promote grass production post-fire in areas that were previously chaparral (Beyers 2004). If substantial shrubland areas of your pasture burned and you'd like to maintain them as grassland, you might consider seeding those areas; a good option is Italian ryegrass, as it's cheap, germinates quickly, and is a good competitor. With or without seeding, erosion on burned hillslopes will remain a concern post-fire, especially if early precipitation is concentrated and/or intense and should be something that you continue to monitor.

If you choose to seed but feel limited by available resources, target strategic sites on your ranch. Focus on grasslands that burned at high severity (as the soil seedbank will be more compromised in those areas), shrubland areas you would like to type convert to grassland, and/or seed in strips across the pasture, ideally perpendicular to hillslopes.

## Mulching

Mulching is another practice used to protect soils from erosion after fire. Although an extremely effective method of erosion control, the scale of fire on rangelands frequently makes mulching cost-prohibitive. If sensitive areas on your ranch suffered severe burns, however, you might consider spot mulch treatments. This may include mulching riparian areas, springs, or stock ponds where you are concerned about sedimentation. Consider applying weed-free rice straw to a depth of two to three inches (or, approximately 40 bales/acre).

*Editor's note: although this was written from a coastal perspective, the range management principles are very similar in other California rangelands. If you have any questions about applying these recommendations on your rangelands, contact Rebecca at* 559-241-6564 *or your local UCCE advisor.*

*This article continues* ▶

*Fire cont'd*

## Further Resources

**UC Cooperative Extension** is available to visit your ranch and/or discuss rangeland soil health, range seeding rates and species composition, grazing practices, and erosion control measures.

During wildfire, your local CE office may be able to connect you to emergency feed or to a list of locations accepting refugee livestock. These resources will depend on the county you are in. Please let your office know if you are willing to host refugee livestock on your property!

We also offer a variety of emergency preparedness and postfire resources online. Visit **http://cesutter.ucanr.edu/LivingWithFire/** for a variety of resources at all stages of fire response.

The **Natural Resource Conservation Service** (NRCS) offers cost-share programs to help you rebuild infrastructure you may have lost during the fire.

And finally, the **Farm Service Agency** (FSA) may have insurance programs available to you to compensate you for lost livestock or forage resources.

---

## For Further Reading

Restoration Manual for Annual Grassland Systems in California. UC ANR publication. (http://anrcatalog.ucanr.edu/pdf/8575.pdf).

Vegetation Management After Fire: The Use of Natives in Annual Dominated Systems in Central California. UC ANR publication. (http://gornish.ucdavis.edu/wp-content/uploads/2016/09/ca2016a0013-162303.pdf).

Practitioner perspectives on using nonnative plants for revegetation. California Agriculture article. (http://gornish.ucdavis.edu/wp-content/uploads/2016/09/ca2016a0013-162303.pdf).

Forage seeding in rangelands increases production and prevents weed invasion. California Agriculture article. (http://calag.ucanr.edu/Archive/?article=ca.2017a0025

---

## References

Barbour, M., Keeler-Wolf, T., & Schoenherr, A. (Eds.). (2007). *Terrestrial Vegetation of California, 3rd Edition.* University of California Press.

Becchetti, T. A., McDougald, N., Frost, W. E., & Sullins, J. L. (2011). Estimating the cost of replacing forage losses on annual rangeland. University of California Agriculture and Natural Resources, Publication 8446.

Beyers, J. L. (2004). Postfire seeding for erosion control: effectiveness and impacts on native plant communities. *Conservation Biology*, *18*(4), 947-956.

Sugihara, N. G. (Ed.). (2006). *Fire in California's ecosystems*. Univ of California Press.