UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Livestock Lines

Stanislaus & San Joaquin Counties
May 2026 Volume 31 No. 2

Biodiversity and Ecosystem Services - May theme for the international Year of Rangelands and Pastoralist (IYRP)

May's theme is perfect for California. Our rangelands range from coastal prairies, foothills, oak woodlands, mountain meadows and Great Basin types. California is generally considered a biodiversity hotspot, with over 300 plant and animal species federally listed in 2026. Livestock can find green grass year-round between the valley and foothill forage production in the winter months (annual systems), with mountain meadows and irrigated pastures in the summer (perennials).I want to summarize two papers that have been published that touch on this theme. The first is by my colleagues, who analyzed US Fish and Wildlife Services databases regarding threatened and endangered species with regard to grazing (biodiversity), and demonstrating the need for livestock to manage habitat.The second paper is also by colleagues, looking at the value of conservation easements in relation to ecosystem services and how every Californian benefits from them.

Biodiversity. As I mentioned, California is considered a global biodiversity hotspot, and with rangelands comprising roughly half of the land in the state, many of the flora and fauna that comprise the biodiversity are found on rangelands. Many papers have been published over the years categorizing "grazing" with no definition about what type of grazing (stocking rate, season, rotational or continuous, etc.) and pointing to "grazing" as a detriment to various species. However, that has changed over the years. Barry and Huntsinger searched documents for federally listed species, searching for mentions of grazing, and if so, what was the relationship? What they found is, over half the species were found in habitats with grazing and 65 species listed grazing as a threat and a benefit – so how grazing is managed can determine how the species thrive or not.Grazing type matters.

When they broke the data down further, it was clear that all animal groups except birds and fish benefited from grazing – with the exceptions of the California Condor and the desert pupfish. Besides Alpine habitats, terrestrial habitats benefited from grazing. Vernal pools, riparian areas and wetlands benefited from grazing. When they looked at trends around threats, no habitat was significantly tied to grazing.

I'm assuming any of you reading this can think of at least one way grazing can benefit threatened and endangered species – the easy one is managing invasive weeds. Invasive grasses quickly move into vernal pools when grazing is removed and changes the habitat for both plant and animals. In the Bay Area, the Checkerspot Butterfly is being saved by cattle grazing. Located along one of the many freeways in the Bay Area, nitrogen deposition from cars increased forage production and greatly reduced habitat for the butterflies.Grazing removed the extra forage and provided the structure of vegetation for the butterfly. These are just

two examples of how grazing can benefit the habitat for species. And both examples I gave also demonstrate how "inappropriate grazing" can be labeled.If vernal pools are grazed only in the dry months, grazing would not be able to control the spread of invasive grasses into the pools, it would have been too late to prevent infestation and stop seed production in or near the pools. In drought years, we would also lose the benefit of cattle creating micro pockets in the pool that some species need to finish their life cycle. Same with the butterfly, grazing needs to occur to create the habitat the butterfly and caterpillar need for reproduction.

Barry and Huntsinger call for more recognition that grazing management can co-exist with threatened and endangered species and that the stewardship of ranchers should be recognized as an option to sustain species on working rangelands.

Ecosystem Services. There are four basic buckets for ecosystem services – Provisioning (food and fiber, drinking and irrigation water), Regulating (ground water recharge, clean water quality, carbon sequestration), Habitat and Biodiversity (habitat for threatened and endangered species, wildlife corridor connectivity), and Cultural (open space/viewshed, recreation, cultural identity). We benefit from all of them and most don't provide any financial revenue for the ranchers and landowners who provide them (many of you). We buy meat at the store and you might have practices where you are compensated for carbon sequestration, but are you paid for groundwater recharge, habitat for species, or keeping apartments off the hillsides?Some of you might be, but it would be under some sort of conservation easement. And that is how Johnsen and his co-authors decided to look at the return on investment for conservation easements.

Working with the California Rangeland Trust (CRT), Johnsen looked at over 300,000 acres of rangelands on 56 ranches conserved with CRT and categorized the different ecosystem services they found for each ranch per the four buckets mentioned above. Then he looked at how to value these benefits the public enjoys. Two options were used, one that relied on surveys and interviews with people about how hey value specific ecosystem services, and one that used a global database.

The difficulty of valuing nature led to a large range in value - $364 million and $1.44 billion in ecosystems services each year. But even at the lower end of the range, it is an impressive benefit annually. The authors then wanted to calculate a Return on Investment (ROI) to make the large numbers more tangible to each acre conserved.Two scenarios were used for the ROI.

Scenario 1 - assume development in each easement had maximum density allowed by current zoning. Under this scenario, easements returned annually $1.35 to $3.47 for every dollar invested (more than my savings account gives me).This assumption believes that some ecosystem services might still be occurring on the property, but not at the level without development.

Scenario 2 - assume complete loss of all ecosystem services if there is no easement. This time the results are more dramatic- $42 to $168 per dollar invested in an easement. I dare anyone to find an investment that is anywhere close to that.

Even with the impressive ROI they found, the authors admitted that they could not capture everything in their assessments. The methods did not take into consideration site

specific factors such as specific endangered species or habitats. They believe the true ROI is likely higher than their reported values.

It would be hard to deny that public money invested in conservation easements on rangelands are a wise investment even with the more conservative numbers. Add to this the discussion about how much biodiversity is found on California rangelands, and it is easy to see why we should celebrate our rangelands this year. I challenge everyone share these papers with anyone who is not from the ranching world.Someone you see at your kid's school, in line at the coffee shop, at your doctor's office, anyone you can!This is your year to celebrate rangelands and how you and many others steward rangelands (half of California, and half of the world is a rangeland).

Barry, S. and Huntsinger, L. (2021). Rangeland Land-Sharing, Livestock Grazing's Role in the Conservation of Imperiled Species." Sustainability, 13(8), 4466.
Johnsen, R.L, V. Butsic, L. Huntsinger (2021). Evaluating Ecosystem Services: New Research Highlights the Value of California's Working Landscapes and the Return on Investment of Rangeland Trust Conservation Easements. California Rangeland Trust, Sacramento, CA. Available at: rangelandtrust.org

Warm Season Irrigated Grass Update

Last I mentioned, this research project would have been after the 2024 irrigation year. In 2025, we continued to follow the six species that showed the most promise from our first season. As a reminder, these plots were planted in June 2024 at the Plant Material Center (PMC) outside of Lockeford and were irrigated half an inch per week. During the 2025 irrigation season, each plot (there are four plots per species) had two marked clipping locations and were clipped in May, June, July, September and October. August was skipped due to the heat and low re-growth from all plots that month. Below is a summary of the production for each of the species.

Alamo Switchgrass. Alamo started off strong in the early season, with an average of 12,040 pounds per acre dry weight in May. Growth dropped dramatically in June, and it never quite hit that peak again, but July and September each had respectable forage production until it dropped in October. For the season, with the strong start, Alamo ended with 23,272 pounds per acre dry weight for the season. This would be a great addition for early growth in the season.

Haskell Sideoats Grama. Haskell started the season producing over 1,000 pounds per acre in both May and June, and with the summer heat increased production in July and September to 4,299 and 3,331 pounds per acre dry weight respectively. Production did drop in October to 1,616 pounds per acre dry weight. For the season, it produced less than half of what Alamo produced with 11,456 pounds per acre dry weight for the season.

Loetta Arizona Cottontop. Loetta showed promise in 2024, but came in slow and patchy this year. Three out of the four plots had no growth in May and June, with two plots still not producing in July. It did not perform as well as any of the other species, ending the season with only 3,843 pounds per acre dry weight on average from the four plots.

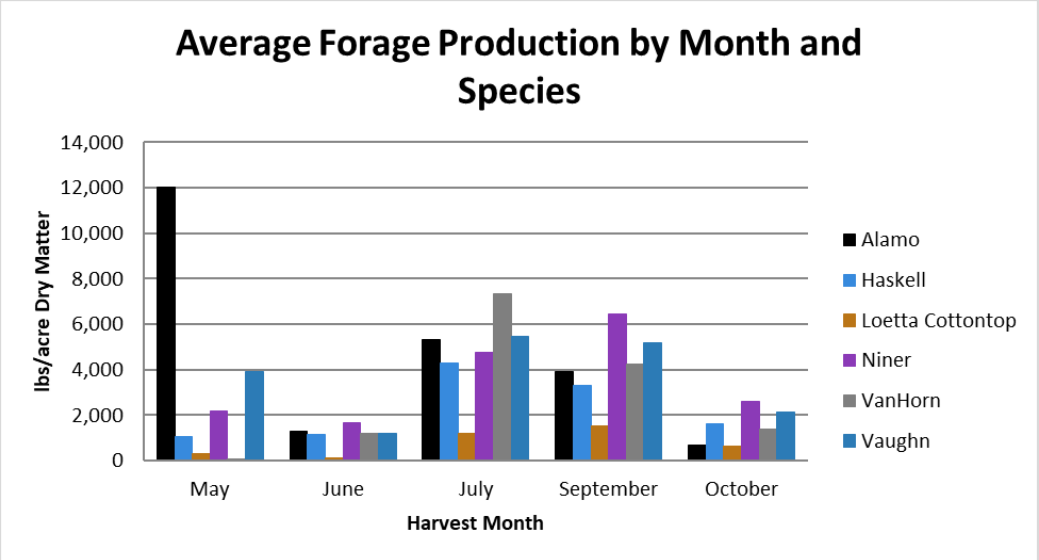
Niner Sideoats Grama. Niner was consistent with production starting off in May with 2,203 pounds per acre dry weight, increased during July and September, and then

dropped off in October as it cooled, but still produced a season total of 17,735 pounds per acre dry weight.

Van Horn Green Sprangletop. Van Horn was the one I was impressed with in 2024. It produced the most forage in the one clipping I did at the end of the season, and it had the highest crude protein of 18%. I was very disappointed to see the slow start. Like Loetta, three of the four plots had no growth in May, and the one that did was 295 pounds per acre dry weight. But by July all four plots were very productive with an average in July of 7,335 pounds per acre dry weight. Van Horn finished the season with 14,244 pounds per acre dry weight.

Vaughn Sideoat Grama. Vaughn was consistent throughout the season, and that showed with a total seasonal production of 17,958 pounds per acre dry weight. Consistent production might help with stocking rates, not needing to increase or decrease livestock with fluctuating production.

Of course, nobody will have a single species pasture – you're working with a mix of grasses and legumes. It should be noted that we've had some issues with commercial seed for these species, mainly that some of them do not move through a drill very easily and broadcasting is not as successful as we'd like so far. We're still working out the establishment side of things at pasture scale- but I think some of them are worth considering if you want to improve your irrigated pasture. In the Sacramento Valley, cool season irrigated pasture mix has been documented to produce a season total of 10,000-10,500 pounds per acre dry weight. Each of these except Loetta easily out produces the cool season mix and can increase your summer production. We'll find a solution for the seeding challenges. In the meantime, these numbers make a strong case for adding a warm season grass to your irrigated pasture mix – more production means more carrying capacity.



Graph showing the average monthly production across four plots for each species.

Forage Production — Irrigated Pasture (lbs/acre Dry Matter)

Clipping dates: May, June, July, September, October | n = 4 plots per species

Alamo	Plot 1	4,405	1,326	5,217	2,876	798	**14,621**
	Plot 2	18,595	1,035	7,734	4,085	408	**31,858**
	Plot 3	8,073	355	4,060	4,381	983	**17,853**
	Plot 4	17,088	2,378	4,333	4,410	545	**28,754**
Haskel	Plot 1	0	0	0	0	999	**999**
	Plot 2	3,492	1,734	9,033	3,827	1,072	**19,159**
	Plot 3	0	2,826	4,591	2,496	1,698	**11,611**
	Plot 4	679	113	3,571	7,000	2,694	**14,055**
Loetta Cottontop	Plot 1	0	0	0	957	879	**1,836**
	Plot 2	0	0	0	696	243	**939**
	Plot 3	1,236	0	2,388	2,866	1,216	**7,706**
	Plot 4	0	582	2,394	1,655	261	**4,891**
Niner	Plot 1	3,166	2,545	5,548	4,477	1,471	**17,206**
	Plot 2	4,472	1,953	7,507	9,932	4,842	**28,707**
	Plot 3	227	1,180	3,455	5,485	1,529	**11,876**
	Plot 4	948	1,049	2,558	5,933	2,666	**13,153**
Van Horn	Plot 1	295	0	10,337	4,744	1,280	**16,656**
	Plot 2	0	1,553	6,554	5,269	827	**14,203**
	Plot 3	0	0	7,658	3,159	1,892	**12,709**
	Plot 4	0	3,305	4,791	3,778	1,534	**13,407**
Vaughn	Plot 1	2,282	590	5,879	5,282	3,014	**16,656**
	Plot 2	5,576	587	8,145	6,506	1,123	**14,203**
	Plot 3	1,759	1,807	3,697	4,784	553	**12,709**
	Plot 4	6,100	1,844	4,206	4,198	3,899	**13,407**

Table with the actual data for each species, each plot. Seasonal totals are also provided for each plot.

AUM Calculator — Irrigated Pasture Carrying Capacity

Based on clipped plot dry matter yields (lbs/acre DM). Season total = sum of all harvest intervals.

Forage per AUM (lbs DM)	750	*Standard AUM = 1,000-lb cow × 2.5% body weight × 30 days (750 lbs DM)*
Conservative harvest efficiency	50%	*Standard rotational grazing — take half, leave half (Holechek et al.; SDSU Extension)*
Intensive harvest efficiency	65%	*Management-intensive rotational grazing on irrigated pasture (CSU Extension; Colorado State)*

Species	Season Total (lbs/acre DM)	Usable Forage 50% HE (lbs/acre)	AUMs/acre 50% HE	Acres/AUM 50% HE	Usable Forage 65% HE (lbs/acre)	AUMs/acre 65% HE	Acres/AUM 65% HE
Alamo	**23,272**	11,636	**15.51**	0.06	15,127	**20.17**	0.05
Haskell	**11,456**	5,728	**7.64**	0.13	7,446	**9.93**	0.10
Loetta Cottontop	**3,843**	1,922	**2.56**	0.39	2,498	**3.33**	0.30
Niner	**17,735**	8,868	**11.82**	0.08	11,528	**15.37**	0.07
Van Horn	**14,244**	7,122	**9.50**	0.11	9,258	**12.34**	0.08
Vaughn	**17,958**	8,979	**11.97**	0.08	11,673	**15.56**	0.06
Average across species		**7,376**	**9.83**	**0.14**	**9,588**	**12.78**	**0.11**

Interpretation: AUMs/acre = (Season Total DM × Harvest Efficiency) ÷ 750 lbs/AUM.

Table 2. Calculating Animal Unit Month based on the seasonal averages of each species. Two "harvest efficiencies" are considered, a standard 50% as well as a more intensive 65%.