Barbed Wire Fence Meets the Digital Age:

Utilizing Virtual Fencing to Control Weeds and Improve Rangeland

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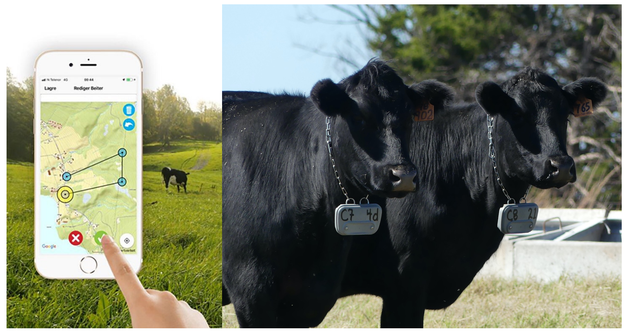
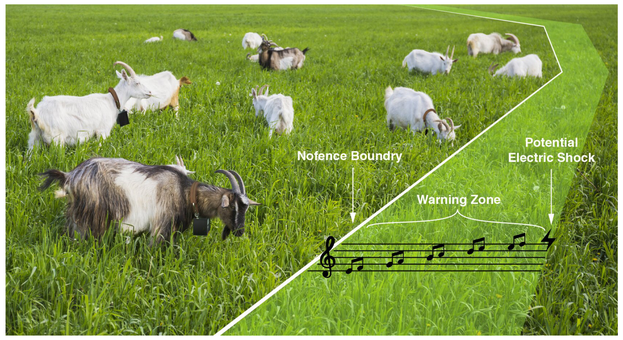
Introduction

Livestock fencing was the single greatest expense in 19th century production agriculture (Simmons 1935), and it remains a considerable expense in livestock grazing today (Meyer 2005).

Virtual fence (VF) is a new technology that contains livestock within user-defined boundaries without the need for physical fences. Ranchers create and adjust virtual boundaries with a digital map user-interface, like Google Maps.



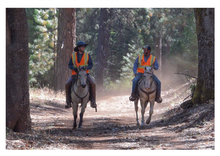
Livestock wear GPS collars that detect the VF boundaries and produce audio cues followed by mild electrical shocks to contain livestock in the designated area.



Funders & Collaborators

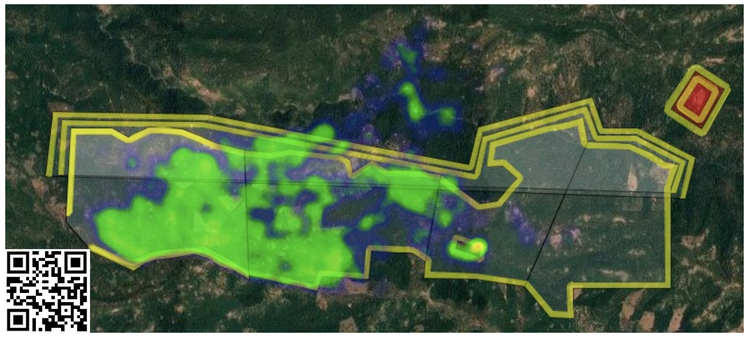
USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service
UC ANR
Sierra Pacific Industries

Mt. Echo Ranch
Lone Star Ranch



Trial 1: Summer Rangeland

A local rancher with a 5,000 acre grazing allotment on the El Dorado National Forest lost 7 miles of fence in the 2021 Caldor Fire. Reconstruction costs were estimated to be $350,000. Using VF collars on 95 cattle enabled grazing to continue the very next year for a one-time fee of $22,850 for the VF equipment.



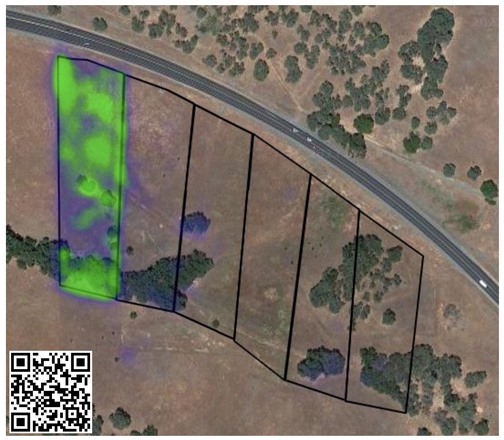
Heat map of the herd's GPS locations over the 2 month summer grazing season. The VF is marked with yellow lines. The QR code shows a time lapse of cattle locations on YouTube!

RESULTS

- ~85% of cattle obeyed the VF boundary. Non-compliant animals may need to be culled in VF systems.
- VF efficacy on forested rangeland was previously unknown. GPS towers communicated with nearly all collars once positioned with good visibility of the range. Livestock locations were reported with an accuracy ~120'.
- Knowing herd GPS locations enabled significantly faster round-up times across the vast forested range than years prior.

Trial 2: Winter Rangeland

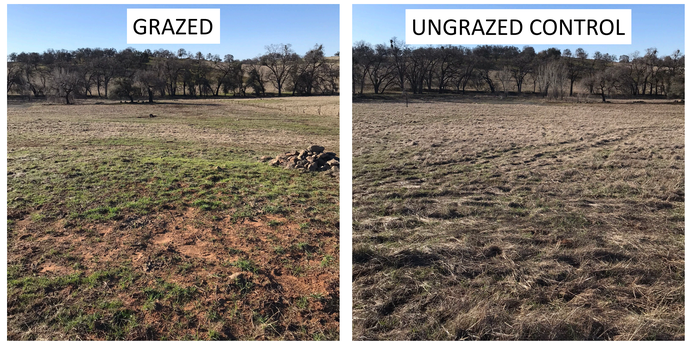
The study assessed VF's ability to contain 25 cattle in narrow 3-acre enclosures to create fuel breaks and reduce Medusahead thatch. The thatch covered up to 80% of the pasture, which had not been grazed in ~20 years.



Heat map of the heard's GPS locations during the 10 day grazing trial. Black lines represent the VF. The pasture did have a physical perimeter fence. The QR code shows a time lapse of cattle locations on YouTube!

RESULTS

- The herd grazed the Medusahead thatch from 5,090 to 524 lbs/acre in 10 days.
- Cattle exited the VF to calve then rejoined the herd. All other cattle respected the VF.



Current VF Options

	VENCE	Nofence Grazing technology
Cost to contain 50 animals	$11,500	$12,050
Collar cost	$30	$299 L, $199 S
Subscription fee	No	Yes
Requires $10,000 GPS tower	Yes	No
Requires cell reception	Yes	Yes
Collars	One size	Large and small
Battery life	5 month avg.	5 month avg.
Solar powered battery	No	Yes

The GREEN text indicates where one company provides better service than its competitor.

Future Research Areas

- Targeted grazing of palatable weeds to improve rangeland.
- Reduce wildfire risk by targeting areas with high fuel loads.
- Graze emerging brush on burned landscapes to prevent encroachment and promote reforestation.
- Breeding management: Control animal movement for desired breeding outcomes.
- Exclude livestock from environmentally and culturally sensitive sites and recreational areas.
- Decrease production costs by reduced need to build and maintain physical fences.
- Evaluate effectiveness on goats and sheep