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Virtual Fencing

> Virtual Fence technology uses **behavioral modification** based on cues (audio & electrical) from GPS collars

Virtual fencing (VF)

- ❑ Less logistically challenging
- ❑ Less labor intensive
- ❑ Greater management flexibility
- ❑ Cattle location tracking
- ❑ Cost effective – situation dependent




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EOARC Precision Agriculture Technology Workgroup

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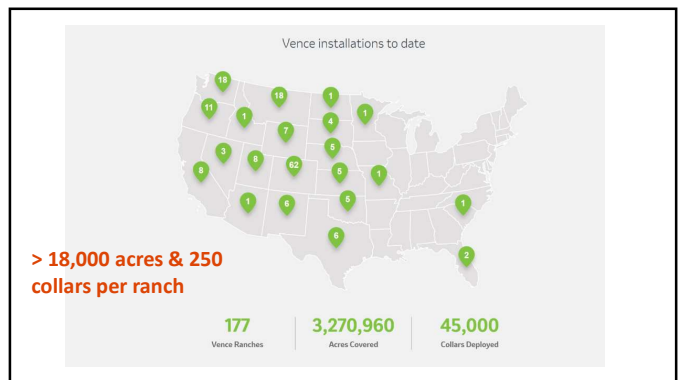
The Nature Conservancy
 Cameron Duquette



USDA **ARS**

Chad Boyd
 Rory O'Connor
 Kirk Davies
 Peter Olsoy
 Tony Runnels

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"Fenceless" Fencing: not a new concept but technological progress has improved feasibility



Proximity Sensing

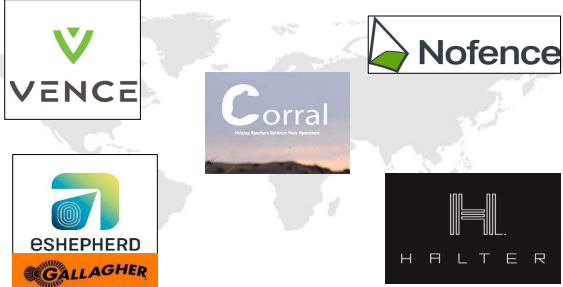
From Anderson (2007)



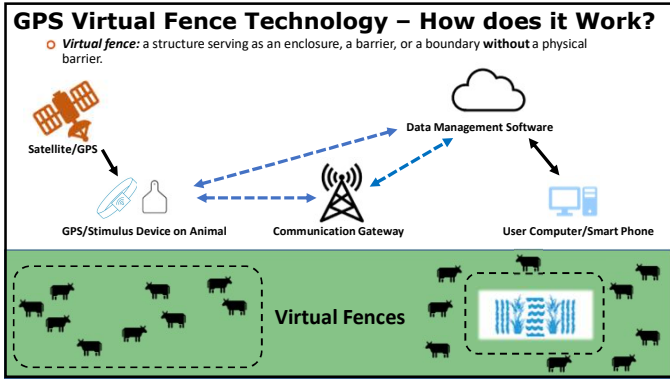
GPS Location

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Known Virtual Fencing Companies (?)



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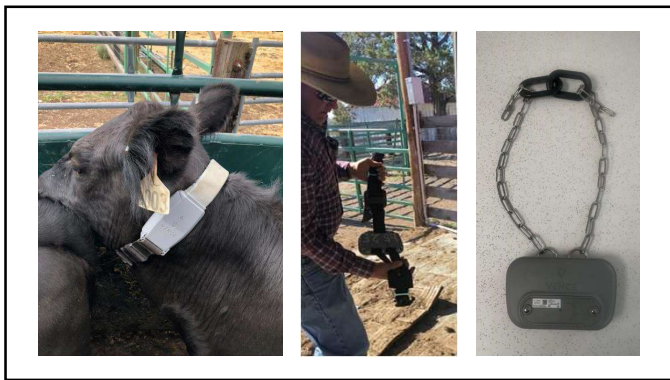
Virtual Fence Opportunities

- Pasture rotation and cattle “herding”
- Cattle location and monitoring
- Use of landscapes with grazing restriction areas (e.g. Post fire)
- Targeted grazing (e.g. fuels reduction, invasive control; toxic plant avoidance)
- Protect sensitive areas from over utilization (e.g. Riparian areas)
- Support wildlife migration/management

Maybe the only tool that can be effectively used at the landscape scale – tremendous potential!!

The image shows two side-by-side screenshots of a mobile application for virtual fence management. Both screens display a satellite map with a green boundary representing a virtual fence. Black dots on the map indicate the locations of animals. The app interface includes a 'Management' header and navigation icons at the bottom.

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The Wildfire Problem

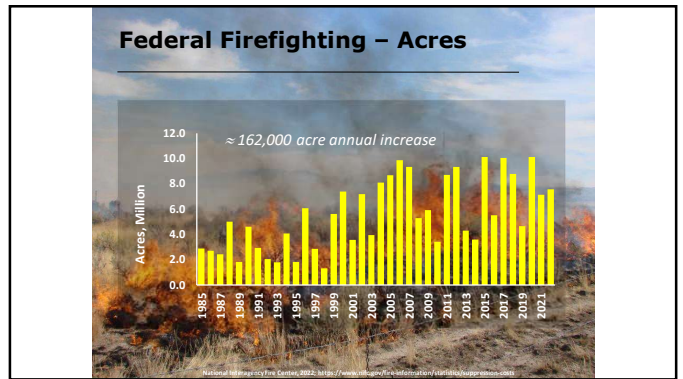
- Increase in prevalence of wildfire in the West

The image shows a group of people standing in a dry, open field, looking towards the horizon under a clear sky. The text above the image reads 'The Wildfire Problem' and 'Increase in prevalence of wildfire in the West'.

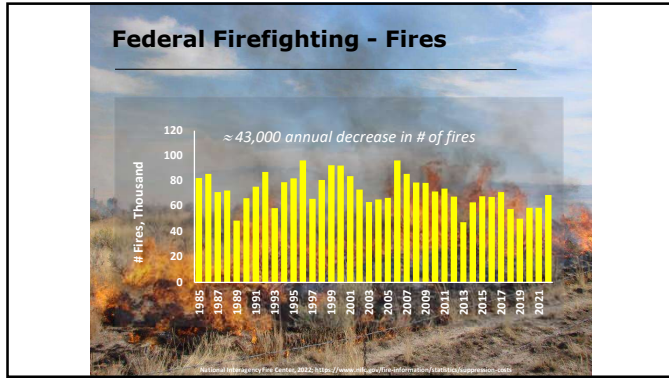
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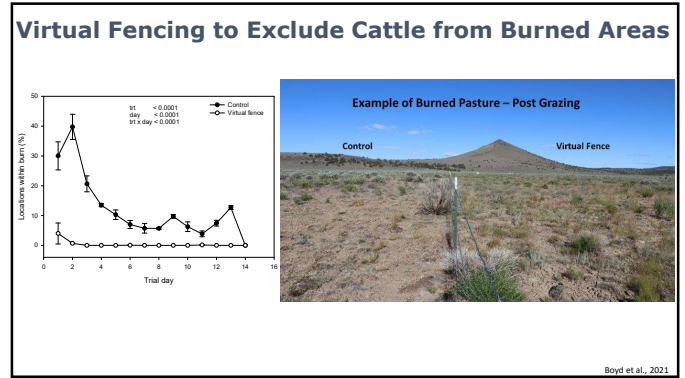
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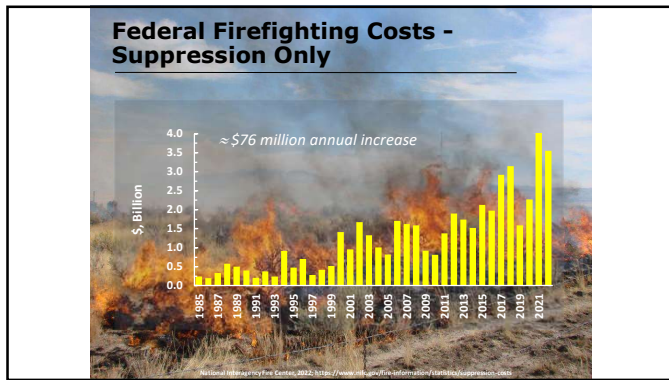
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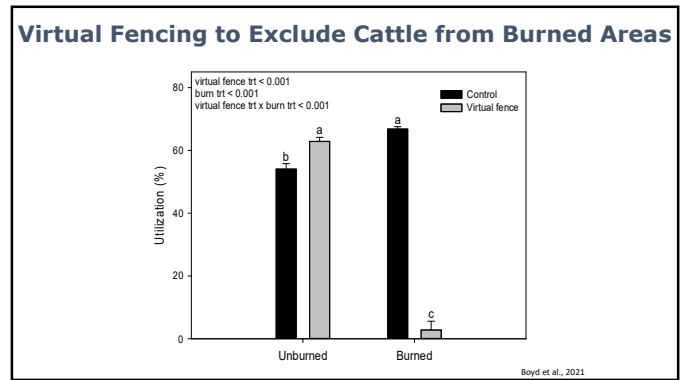
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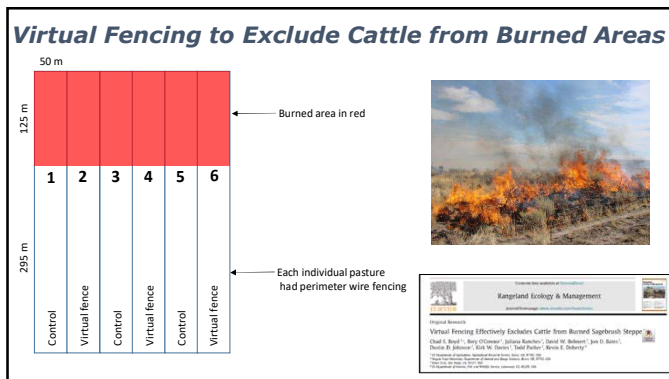
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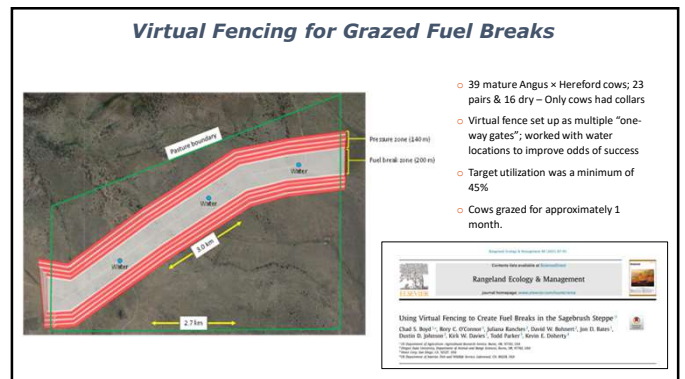
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Virtual Fencing for Grazed Fuel Breaks

Boyd et al., 2023

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- 2 year study completed summer 2023
- 40 cow/calf pairs each year
- Preliminary results indicate significant reduction of fine fuels in target area (about 50%)
- Data driven, strategic, and defensible

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Virtual Fencing for Grazed Fuel Breaks

- The proportion of daily locations within the fuel break differed ($p < 0.003$) between dry cows and cows with calves.
- Dry cows showed no discernable pattern in daily locations within the fuel break over time, whereas values for cows with calves decreased over the duration of the trial and had nearly equal odds of being located within or not within the fuel break by the last day of the trial.

Boyd et al., 2023

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Cattle use of riparian areas

- Abundant forage and water
- Many riparian allotments support listed fish
- Regulatory agency standards for grazing, e.g.,
 - Stubble height
 - Bank alteration
 - Shrub utilization

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VF for Targeted Large Scale Fuel Reduction

Large Scale Fuels Management

- Predicting wildfire occurrence
 - Hypothesis generation from plot data
 - Collaborative work with U of M to model wildfire probability at Great Basin Scale

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Hall Ranch Riparian Study

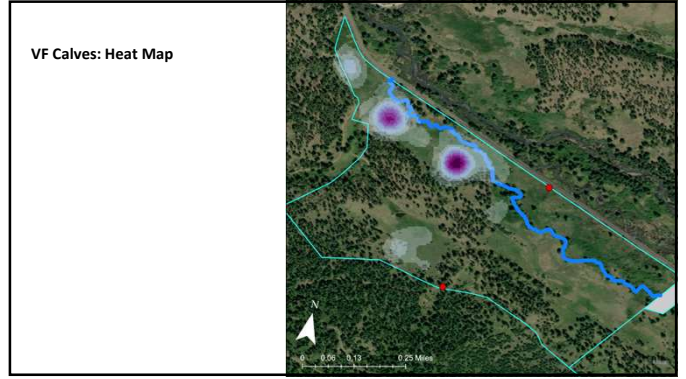
<https://bit.ly/3Z3G0iG>

- 2-yr study
- 135-acre riparian pasture
- 40 cow/calf pairs; all animals collared; calves only for location data
- Solar pumps with troughs used to water away from riparian area (100 yds)
- 2 months late season grazing (mid-August to mid-October)
- 50-yd riparian buffer
- 100-yd VF buffer for pasture split (increased from 50 yd initially)
- Assessing cow and calf behavior
- Assessing vegetation utilization & MIM

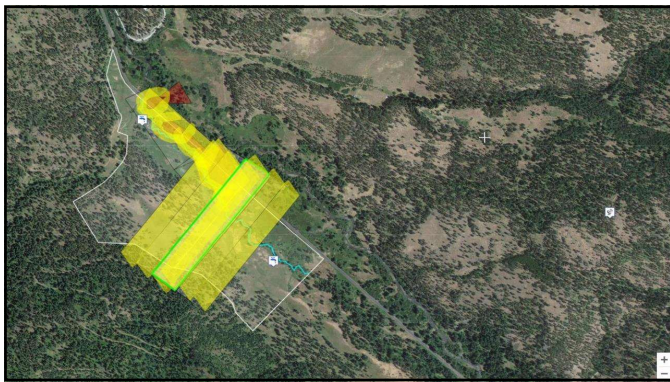
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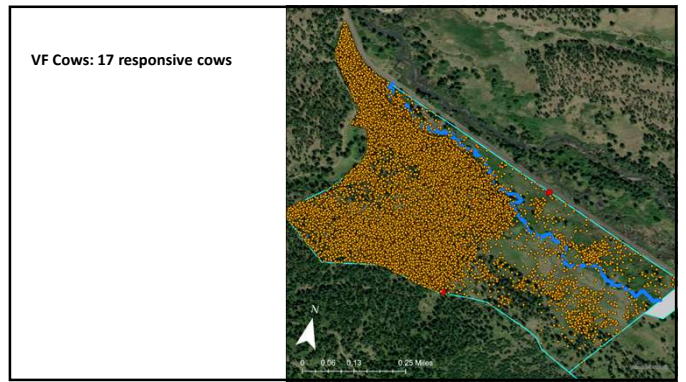
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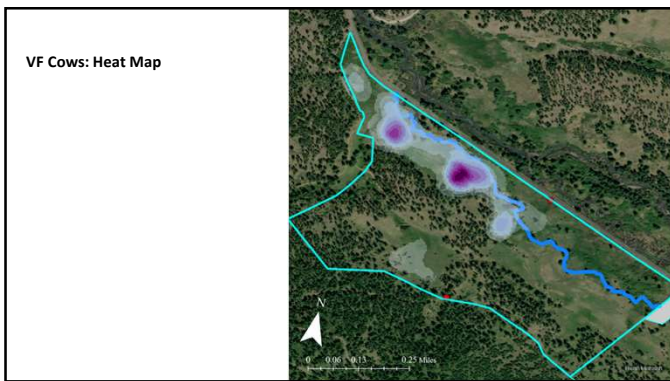
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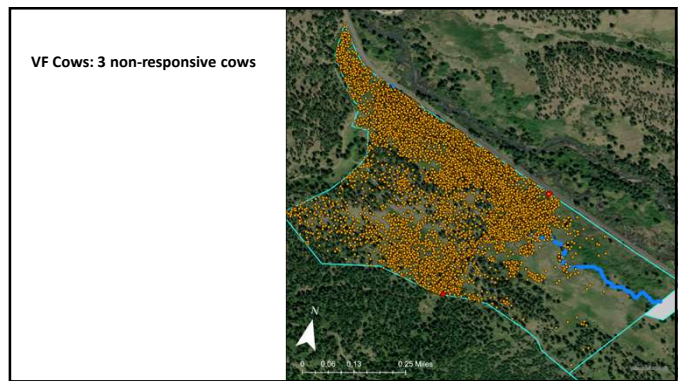
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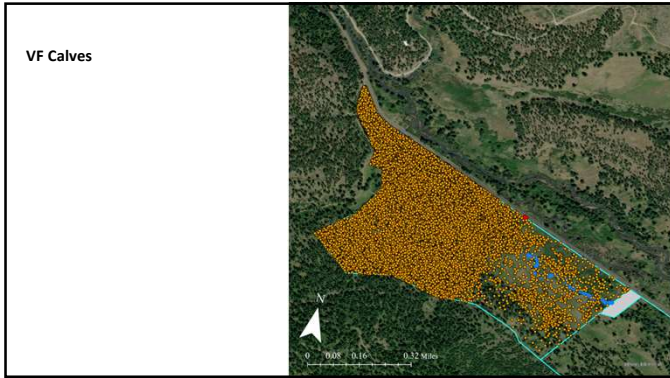
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What we know/think about VF at this time

- VF technology is showing promise as a tool for land and livestock management
- Virtual fencing is not an "iron gate" and will work best when used as a tool within a larger strategy
 - VF Buffer size is very important
 - minimize attraction and/or access to audio, visual, and other stimuli (riparian forage, other animals, etc.)
 - Pasture size seems to be a consideration for efficacy of VF
 - Smaller pastures limit buffer size and VF design
 - "Success" seems contingent on the specific management objective
 - Animal type (dry cows vs cow/calf pairs; yearlings, etc.) should be considered in management objective
 - Not all animals may be "trainable"
- Multiple VF are a critical consideration
- VF Technology Works!!
 - However, setting up a VF system requires careful consideration and knowledge of the technology, landscape, water location, and animal behavior to meet management objectives and expectations
 - Must be willing to learn as you go – adaptable management!

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Questions?

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**Virtual Fence Technology -
EOARC YouTube Videos**

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