Virtual Fencing Fundamentals

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Disclaimer

- I’m not a tech guru
  - Todays talk will be a bird’s eye view of the technology and application in SW
- Use of technology is driven by need and economics
  - A tool. The usefulness of the tool depends on the need
  - Neither of these are static
- Technology has been around for 20+ years. Technology refinement is allowing it to become scalable

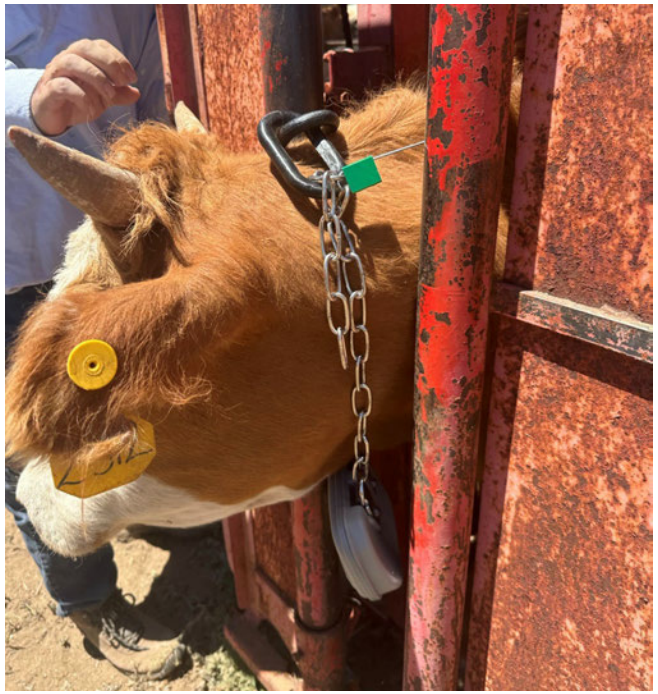
What is Virtual Fencing

- Setting Boundaries: Land managers use a mobile app or computer program to draw virtual boundary lines on a map.
- Audio Warning: When an animal approaches the invisible boundary, its collar emits a series of warning beeps.
- Correction: If the animal crosses the boundary, the collar delivers a mild, benign vibration or shock.
- Associative Learning: Animals quickly learn to associate the audio cue with the correction. Within days, they respond to the sound alone and turn around before the correction is needed.

How Does a Virtual Fence Work?











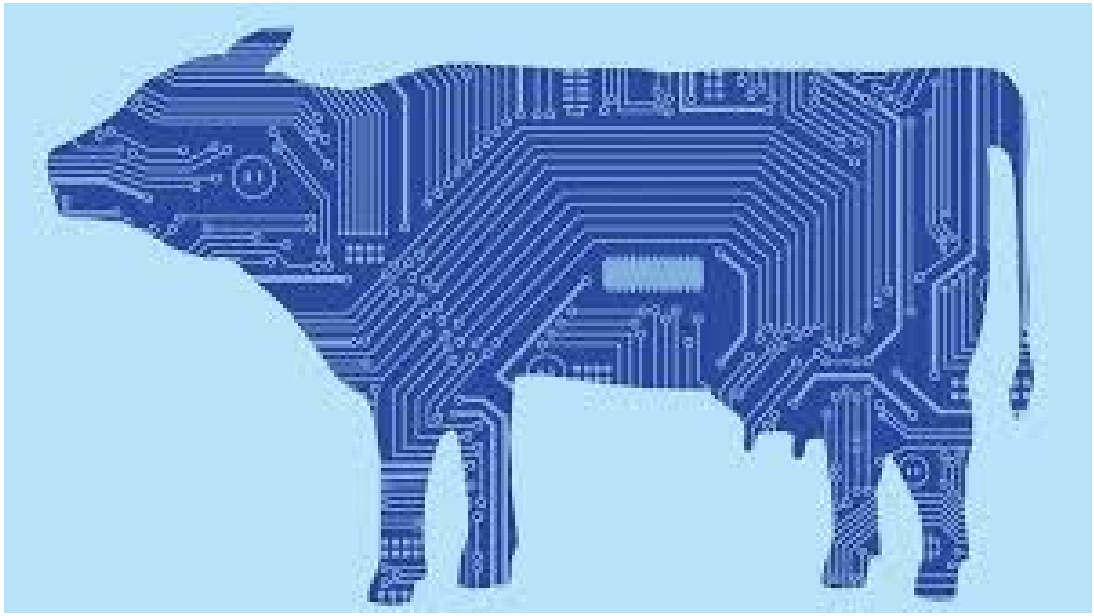
First Point: Communication Driving the Collar

- Regardless of company, the collar utilizes GPS technology to determine location of the cow and location of boundary.
- Programming the collar with boundaries, etc. utilizes a few different approaches depending on company.
  - Cellular reception on the individual collar.
  - Cellular reception to LoRaWan tower (or other gateway) which then broadcasts radio frequency to collars.
  - Satellite to “cow gateway”.



Communication

- Communicate from computer/phone to GATEWAY
- From gateway to collar
- Collar to cow
- Then Reverse
  - Cow to collar
  - Collar to gateway
  - Gateway to phone/computer









Herd collar data

Collar

Cow

Key Point

- Once the collar is programmed, it does **NOT** need to be in communication with gateway for GPS boundaries to work.

- To reprogram the collar OR to collect data from cow movement/location, the cow must be in contact with gateway!

- This is critical and importance depends on goals for the use of the technology.

Training

Who learns faster: ranchers or cows?

Training and User Commitment is a MUST

- Cows must go through training period
  - Associate physical barrier with sound/shock
  - 20 cows is one thing. 200 cows is another. (feed, location, etc.)
  - Can take 3-5 days.
  - Companies (or NMSU Extension) can provide support for this.
  - Don’t forget about communication
- Ranchers must commit to the technology
  - Simply putting on collars and training cows = failure
  - Terrain, pastures, behavior, boundary experimentation, software familiarity, etc. are all critical

Introduction to Virtual Fencing/ Herding



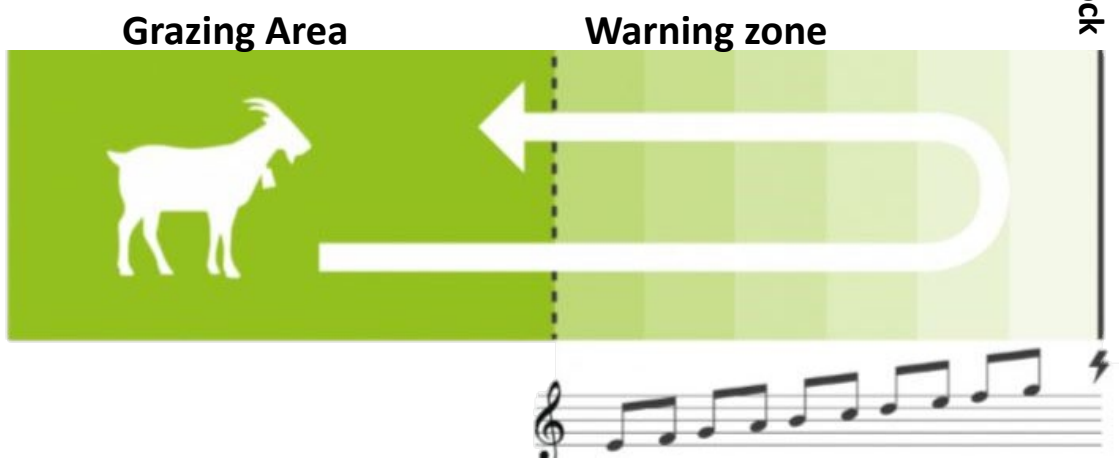
NoFence System

GPS and Activity Data

GPS to work needs 3.5m accuracy

Warn-Zap cueing

2G coverage / 4G CatM





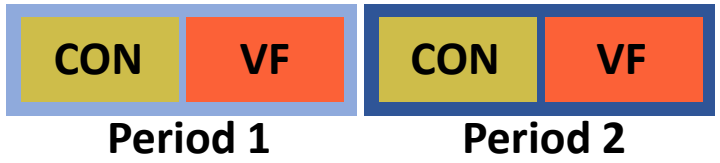


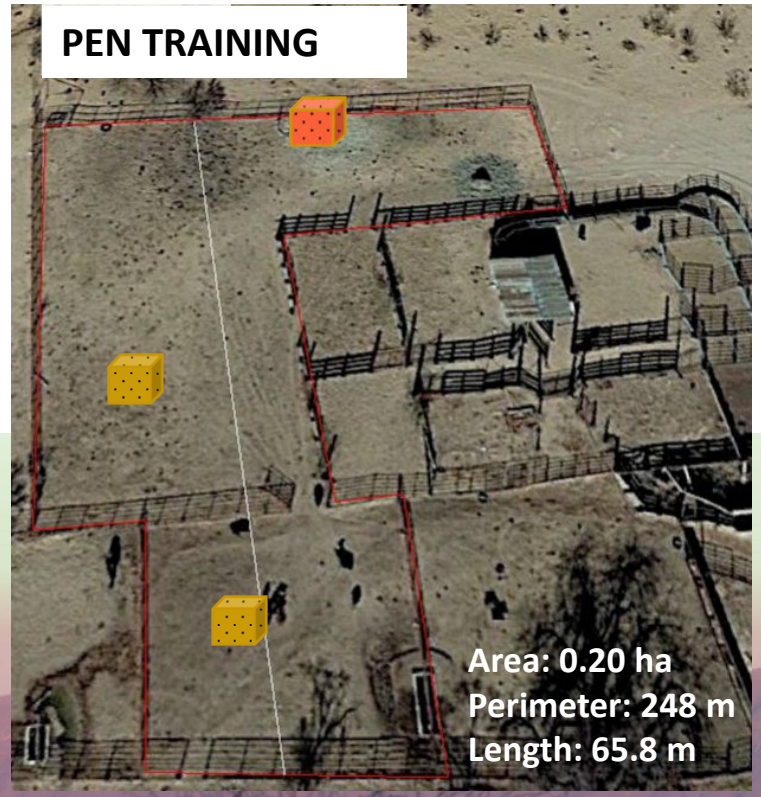
Training Cattle to Virtual Fencing

LEARNING PROCESS

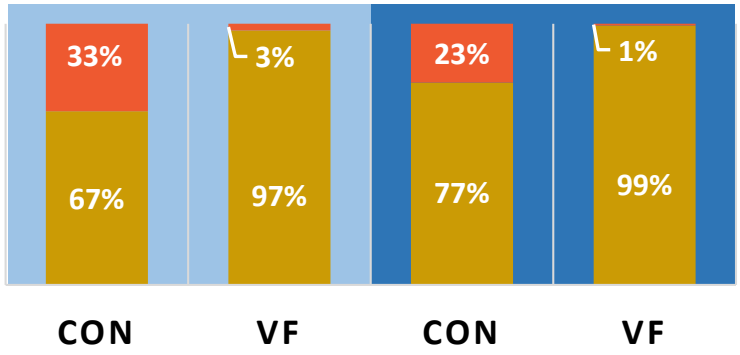
SKIN DEFENSE SYSTEM

ASSOCIATIVE LEARNING

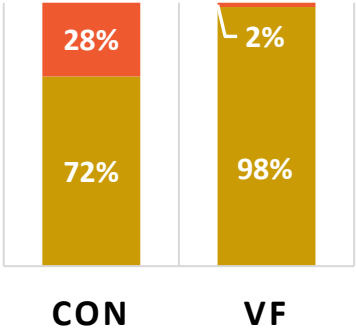




PERCENT TIME PER PERIOD



OVERALL

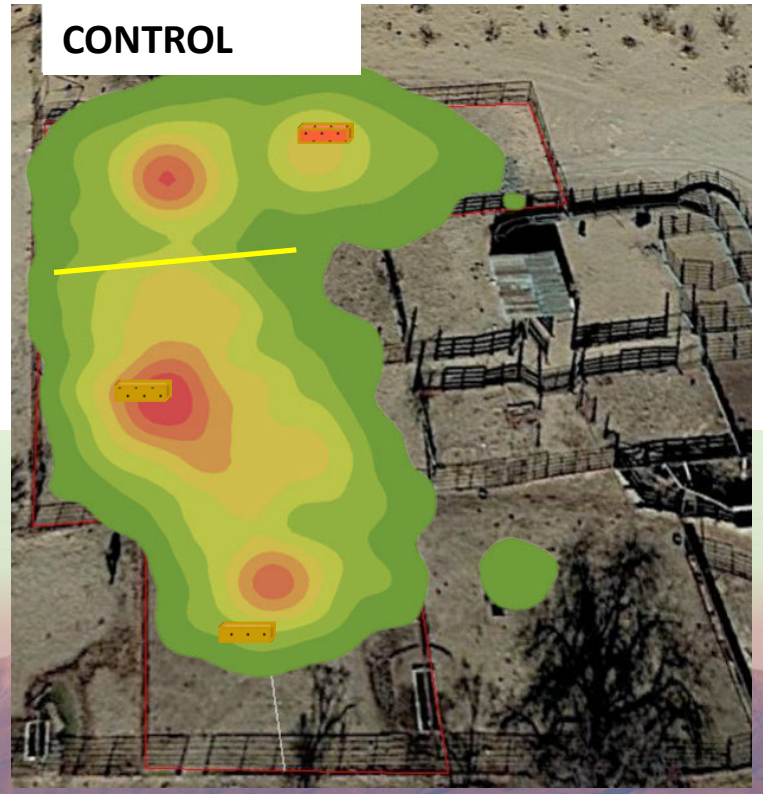


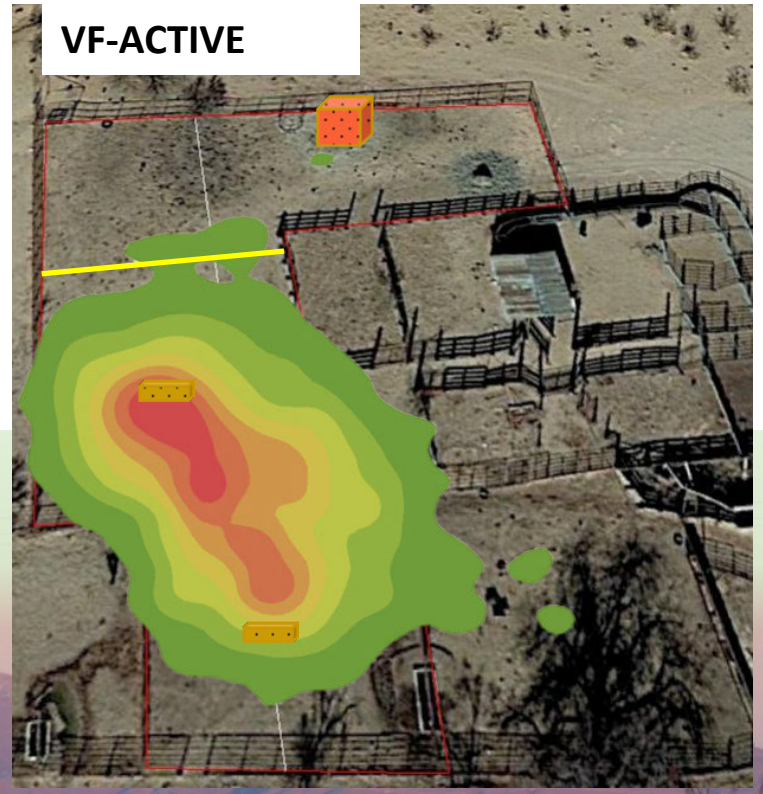
ALERTS/COW/DAY

PERIOD: 1 VS. **2**

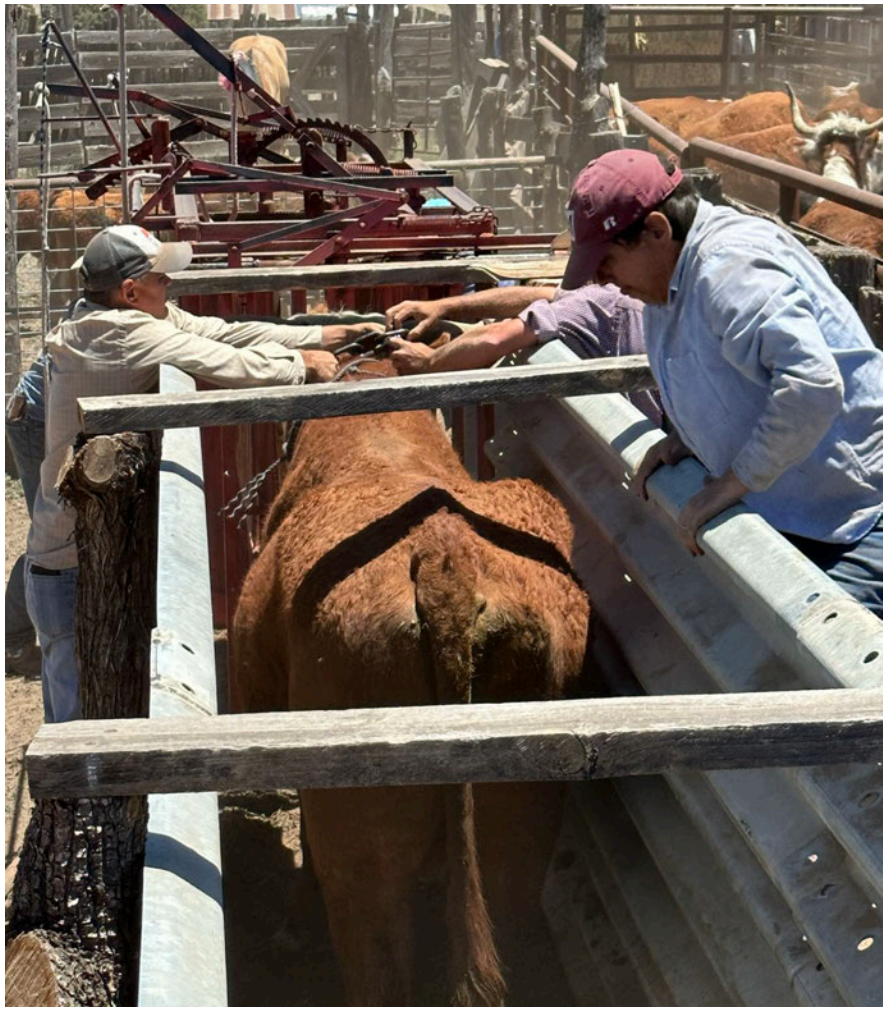
WARNS: 1.83 VS. **0.64**

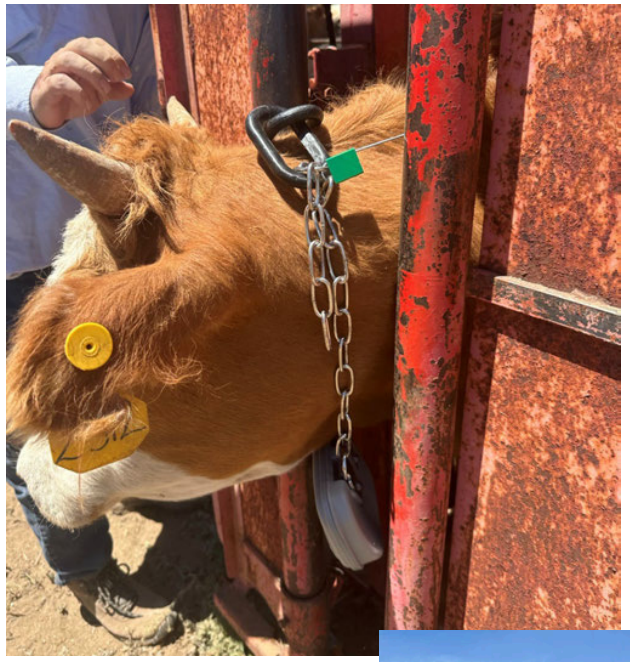
ZAPS: 0.43 VS. **0.31**





Black Fire: Deployed 200 collars

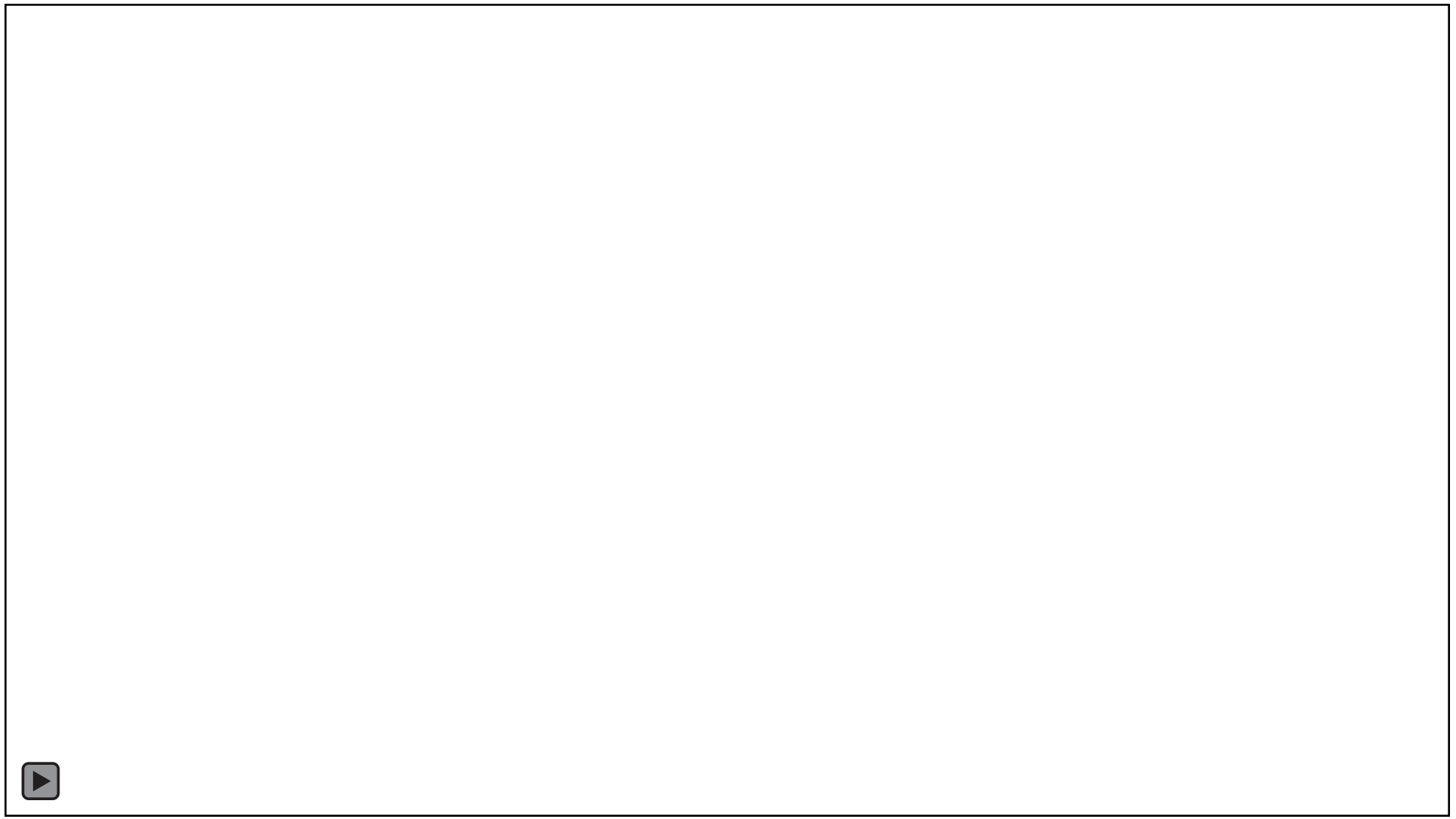








Training!



Applications in SW Pastures

- Elk/public/environment makes fence maintenance difficult?
- Destruction of fences (wildfire)?
- Grazing Management?
- Cattle location for gathering?
- Management of riparian or environmentally sensitive areas?
- Future: Cattle behavior as indicators of physiological events (predation, estrus, calving, etc.)
- REAL-TIME Vs. INTERMITTENT COMMUNICATION WITH COW

All About Discovery!™
New Mexico State University
aces.nmsu.edu

Know technology limitations for your goals

Gateway limitations

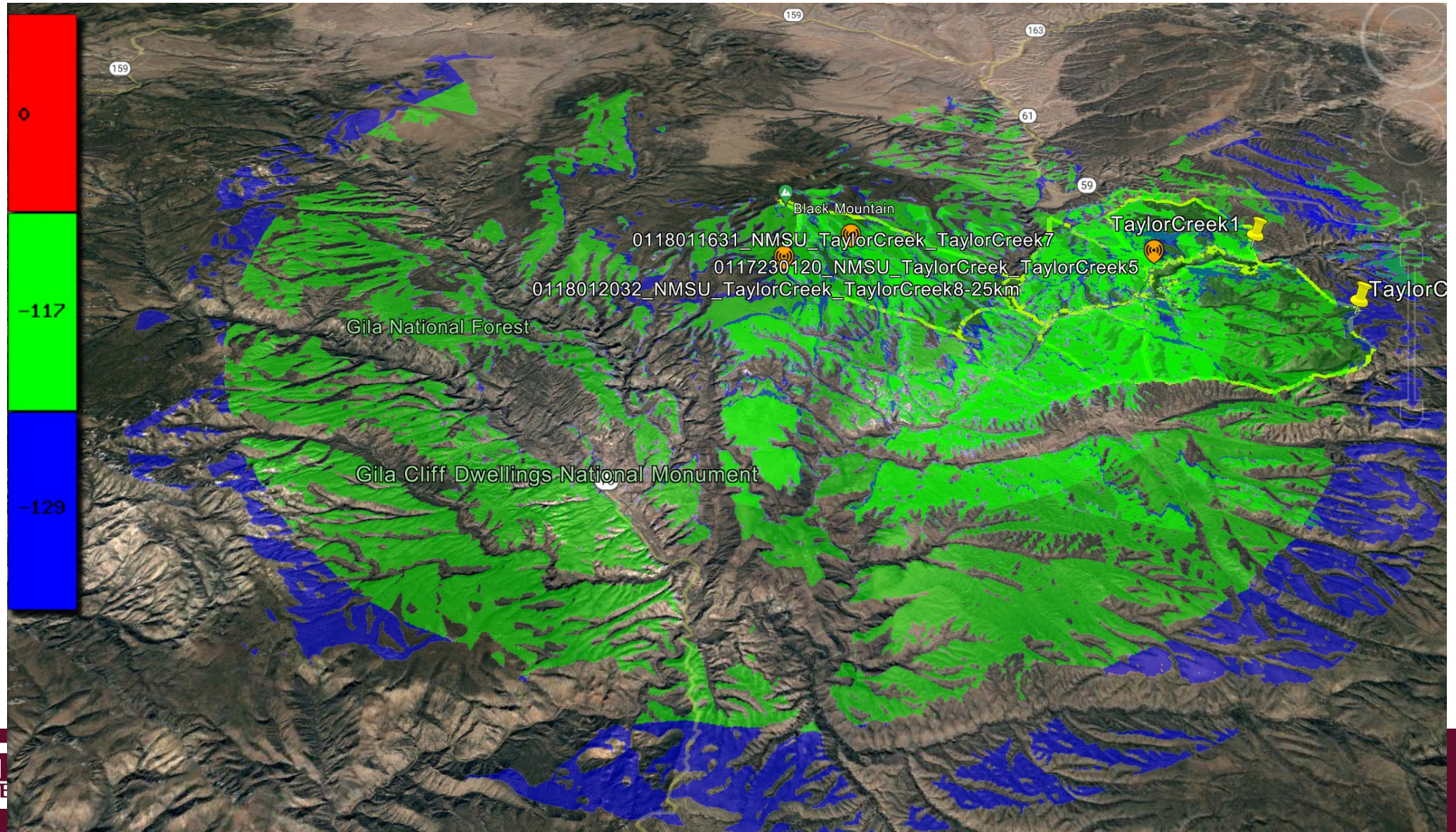
- Remote locations are a challenge with current station configurations







Gateway coverage of pasture



Do you need 100% pasture coverage?

- Do you need real-time monitoring or is fencing the primary concern?
- Are water holes covered?
- Cost vs coverage?

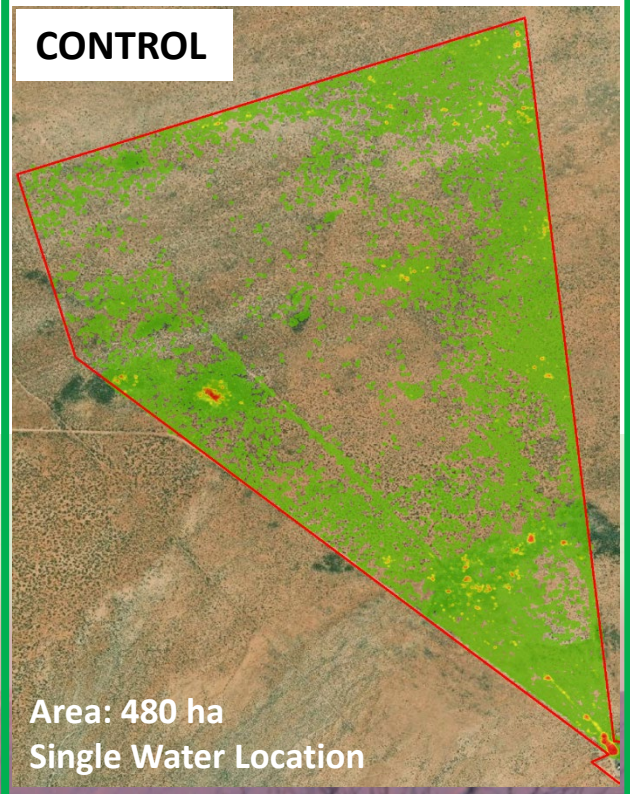
Does it work?

Proof of Concept in Desert Pasture

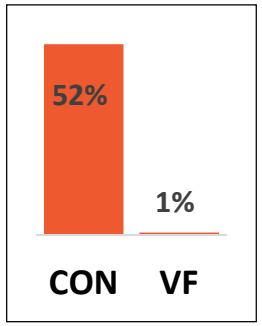
FORAGING BEHAVIOR

COMPARISION OF CONTROL TO VF-ACTIVE DEPLOYMENT PER COW/DAY

	CONTROL	VF-ACTIVE
AREA* (Ha)	134.20	86.91
DIST (Km)	6.56	5.80
ACTIVITY (#)	32587	30491



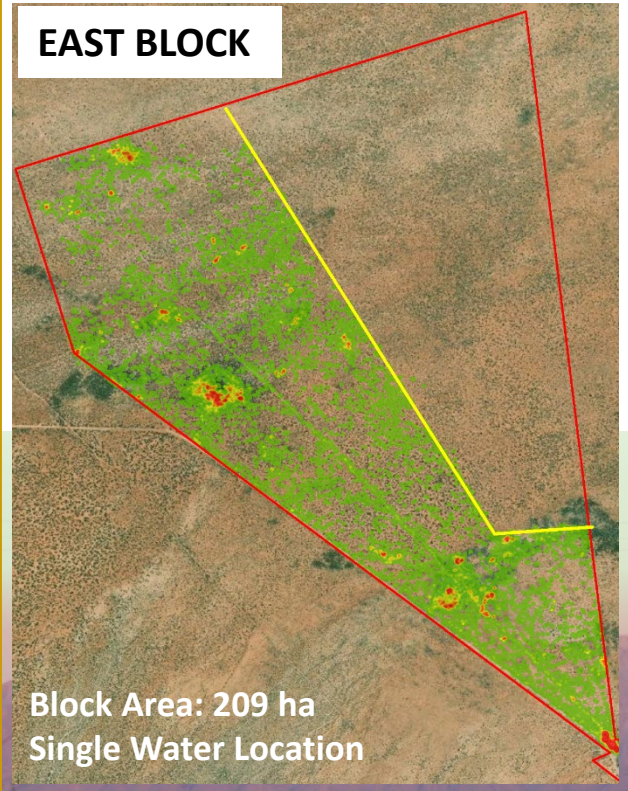
EXCLUDED EAST BLOCK



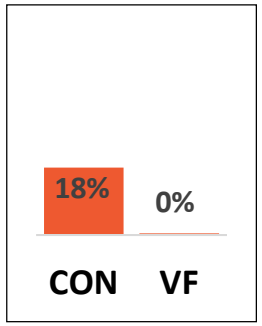
ALERTS/COW/DAY

WARNS: **1.12**

ZAPS: **0.17**



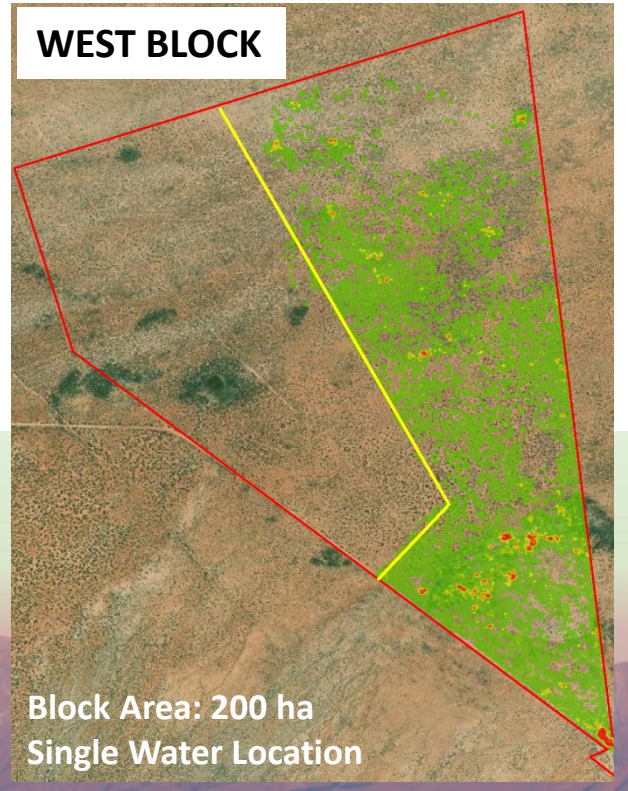
EXCLUDED WEST BLOCK



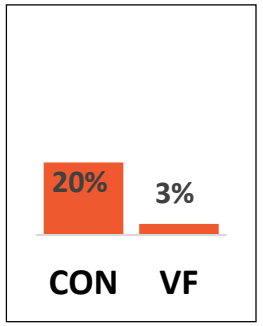
ALERTS/COW/DAY

WARNS: **1.12**

ZAPS: **0.14**



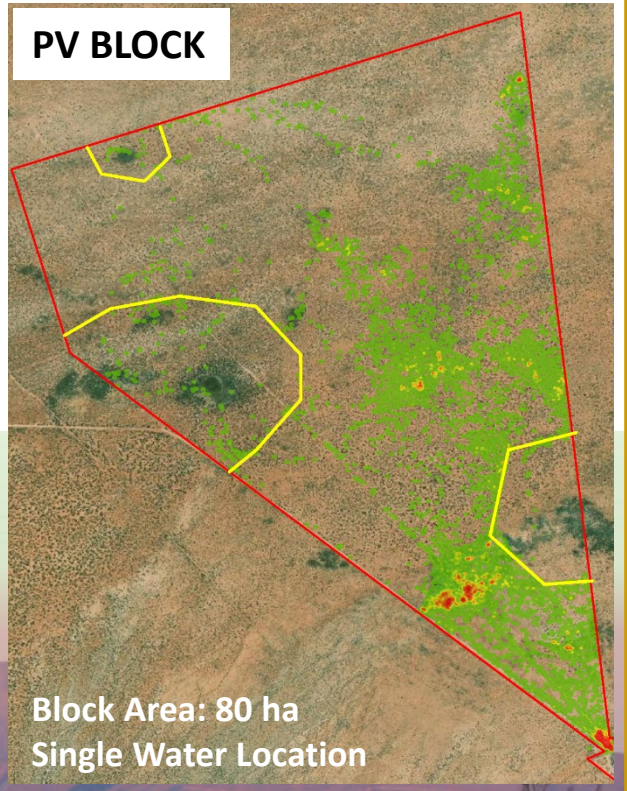
EXCLUDED PREFERRED VEGETATION BLOCK



ALERTS/COW/DAY

WARNS: **2.09***

ZAPS: **0.51***



Key outcomes from the field deployment

>200 collared cattle

Two ranches on federally managed allotments

4 d training period

Cattle conditioned using physical fence + VF cues

79–94% containment estimates

After more than 200 days across two sites

1–2 wk gathering reduction

Producer-reported time savings

10% gathering efficiency increase

Reported in progress report

Yes sensitive site protection

Riparian/burned areas protected with virtual exclosures

Key Consideration:

Physical fences were built on property or pasture boundaries.

Virtual fences in the SW require animal husbandry, knowledge of behavior, and understanding terrain considerations. Effective VF requires good stockmanship.

Considerations and Implementation

- Why do you need it, and is it cost effective?
- Pasture size and boundary considerations!
- What communication is available in your pasture?
  - What communication does collar/company utilize?
- Is gateway coverage conducive to your goals?
  - Do you require real-time monitoring?
- Learn terrain and fencing strategies.
- Learn fencing strategies for sensitive sites.
  - Make entire zone a shock zone for example
- Know your commitment to technology.

Considerations and Implementation

- Is solar important for the collar?
- Class/size of cattle and how often do you handle them?
- Commitment of everyone in grazing associations?
- Leased vs purchased collars?
  - Cost for lost collars.
- Data management and access.
- **NO, IT HAS NOT BEEN TESTED ON HUSBANDS!!!**

Questions?

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