



# Green Lands Blue Waters

## Virtual Fence (VF)

2023-2024







**Virtual Fence (VF)**



# Virtual Fencing 101

This presentation was developed as an educational resource for NRCS staff and other technical service providers.

## You will learn about:

- Virtual fence technical basics (how it works)
- Virtual fence effectiveness
- The future of the grazing industry
- Opportunities and challenges
- Vendors in the US
- Costs
- Considerations for grazing plans
- NRCS financial support



Information compiled by Green Lands Blue Waters and partners, 2023.

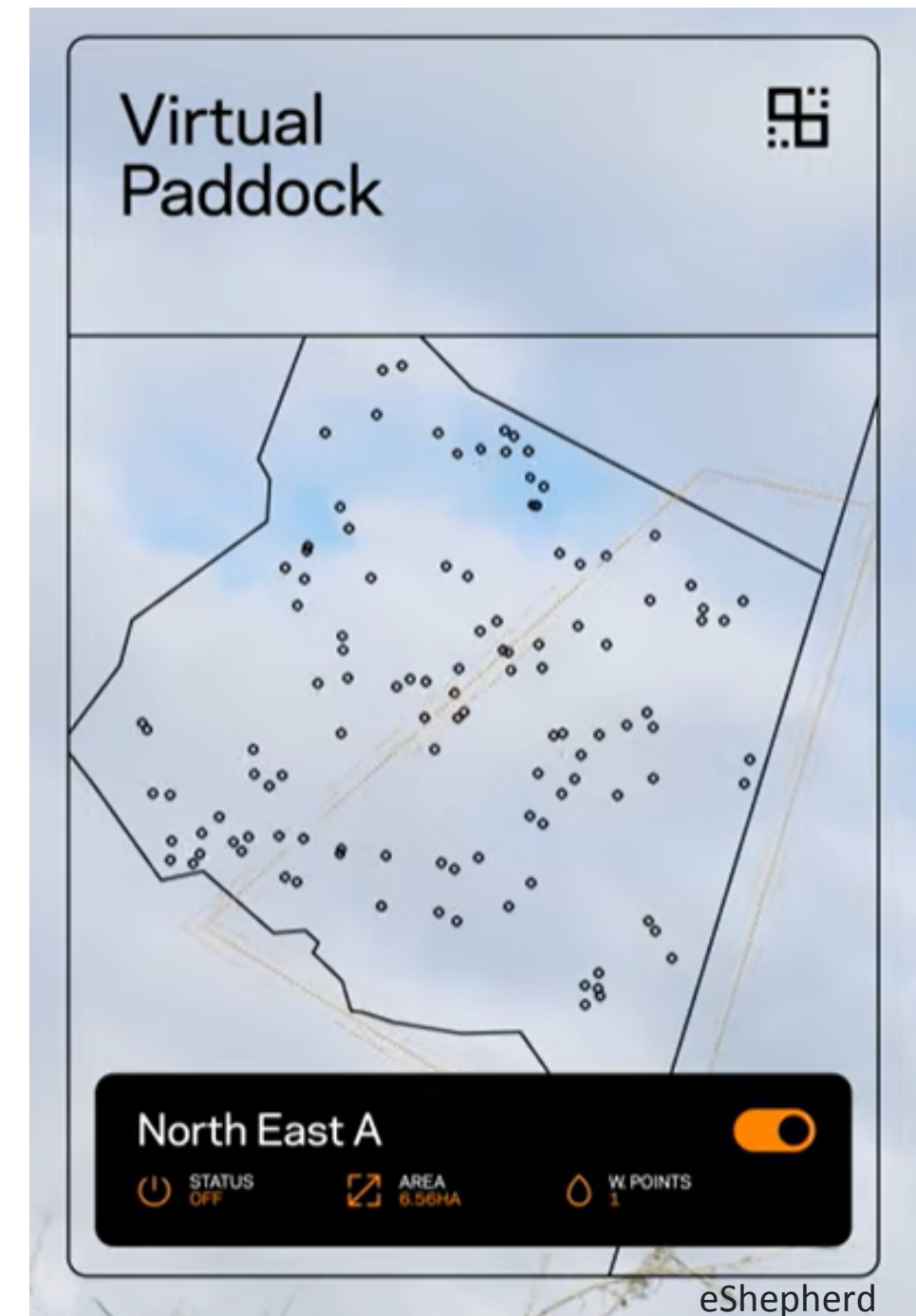
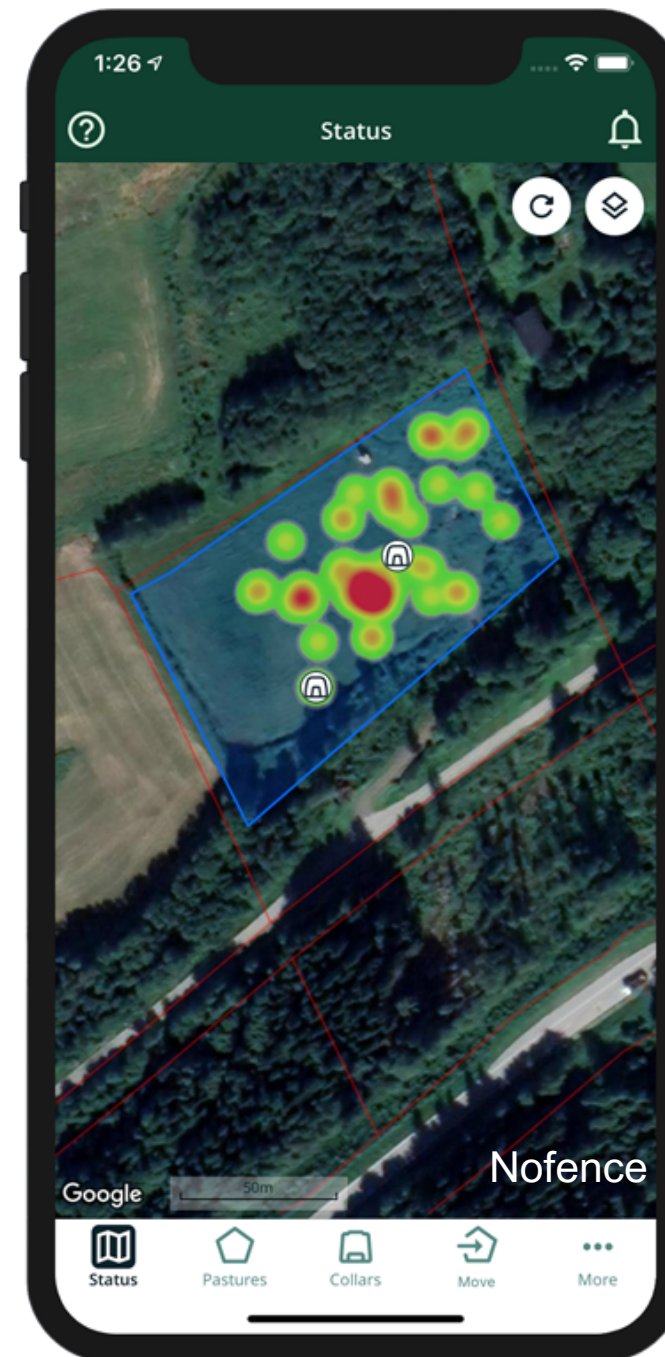
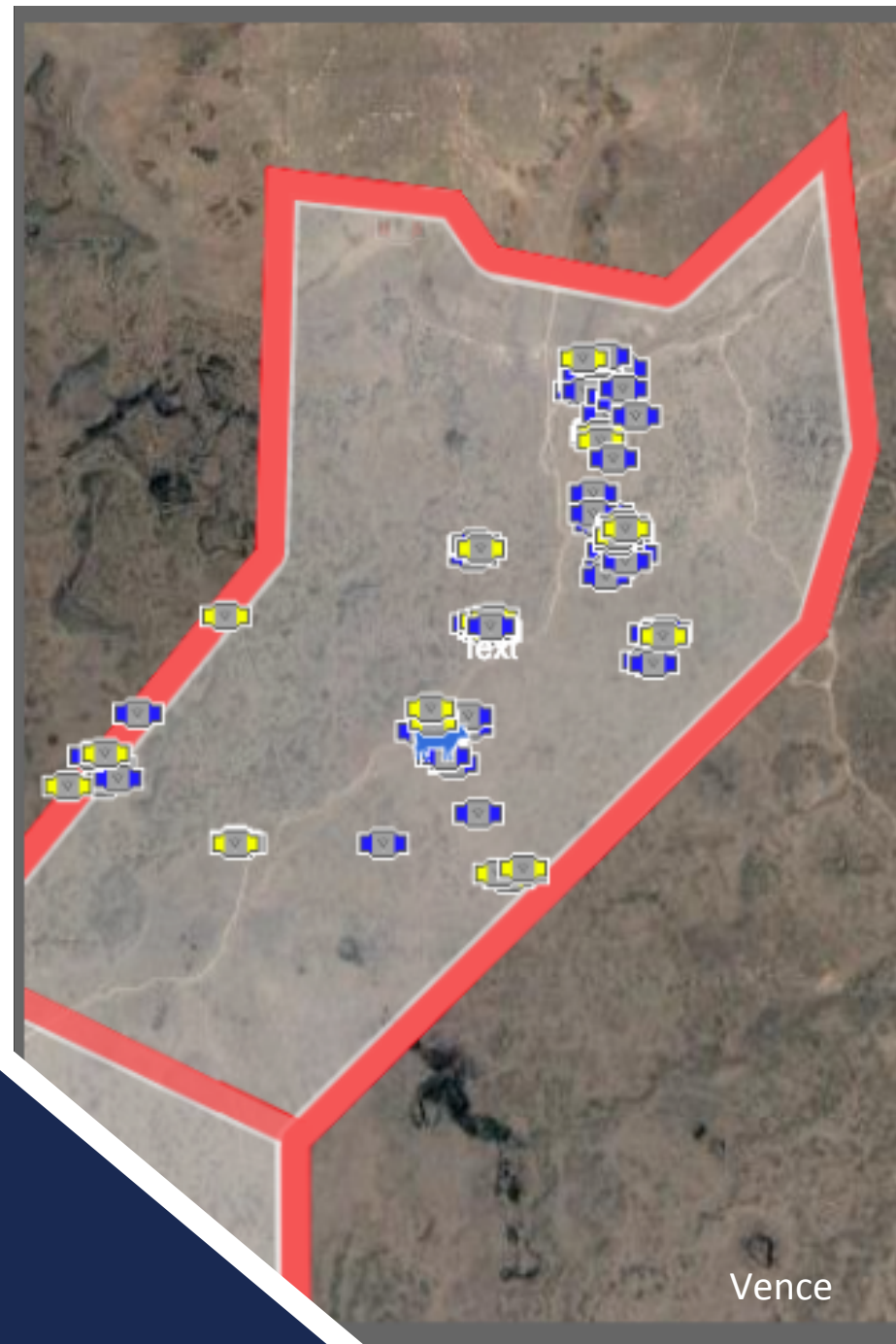
# **VF is a new technology that contains ruminant livestock with boundaries created on a farmer's phone**



- Reduces the need for physical fence, specifically interior cross fencing
- Reduces fencing labor
- Not intended to replace all physical fence; perimeter fence is still necessary depending on the site

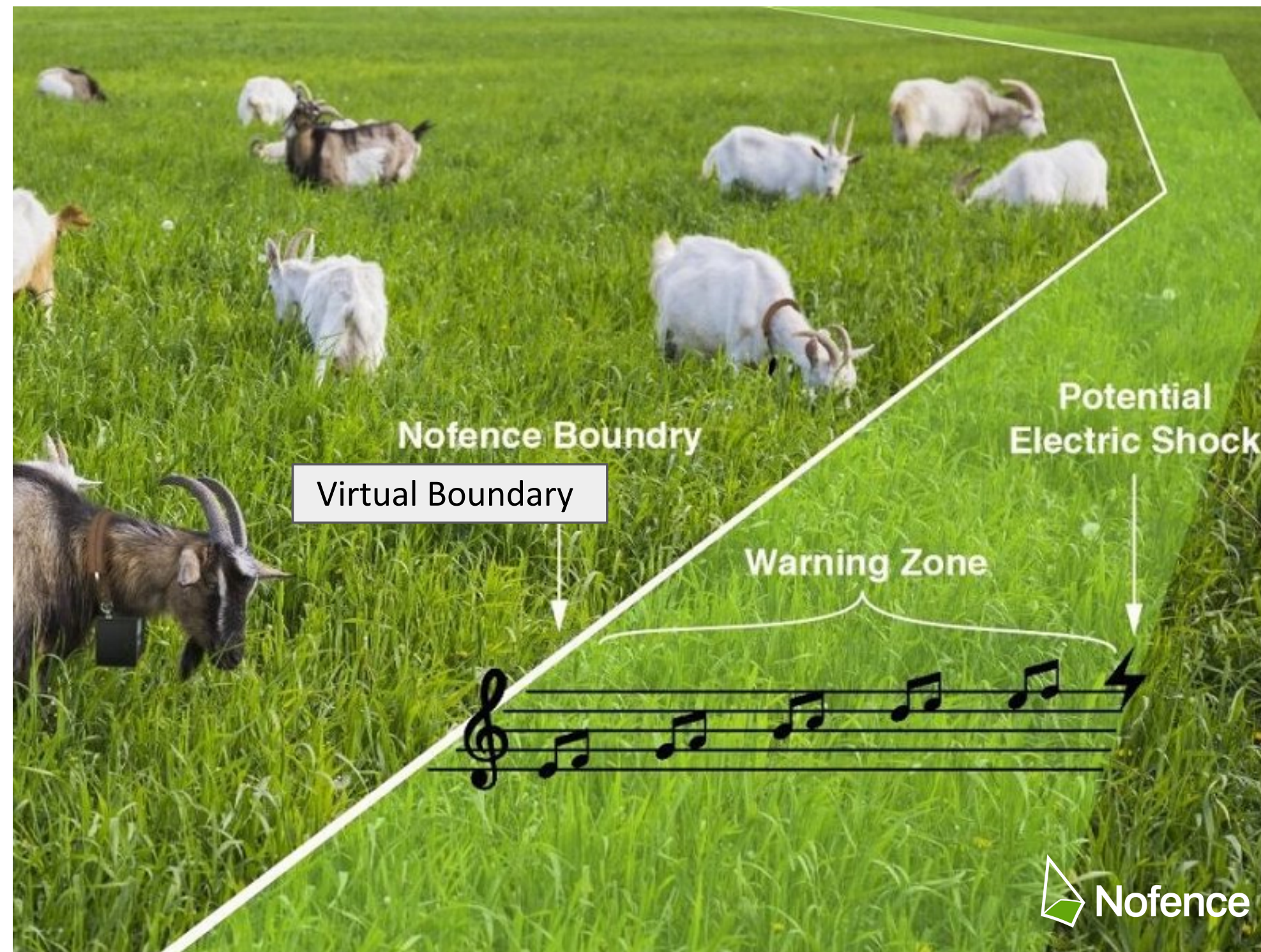


**Ranchers create and adjust virtual boundaries with a digital map user-interface, like Google Maps, that are communicated to GPS collars worn by the livestock**



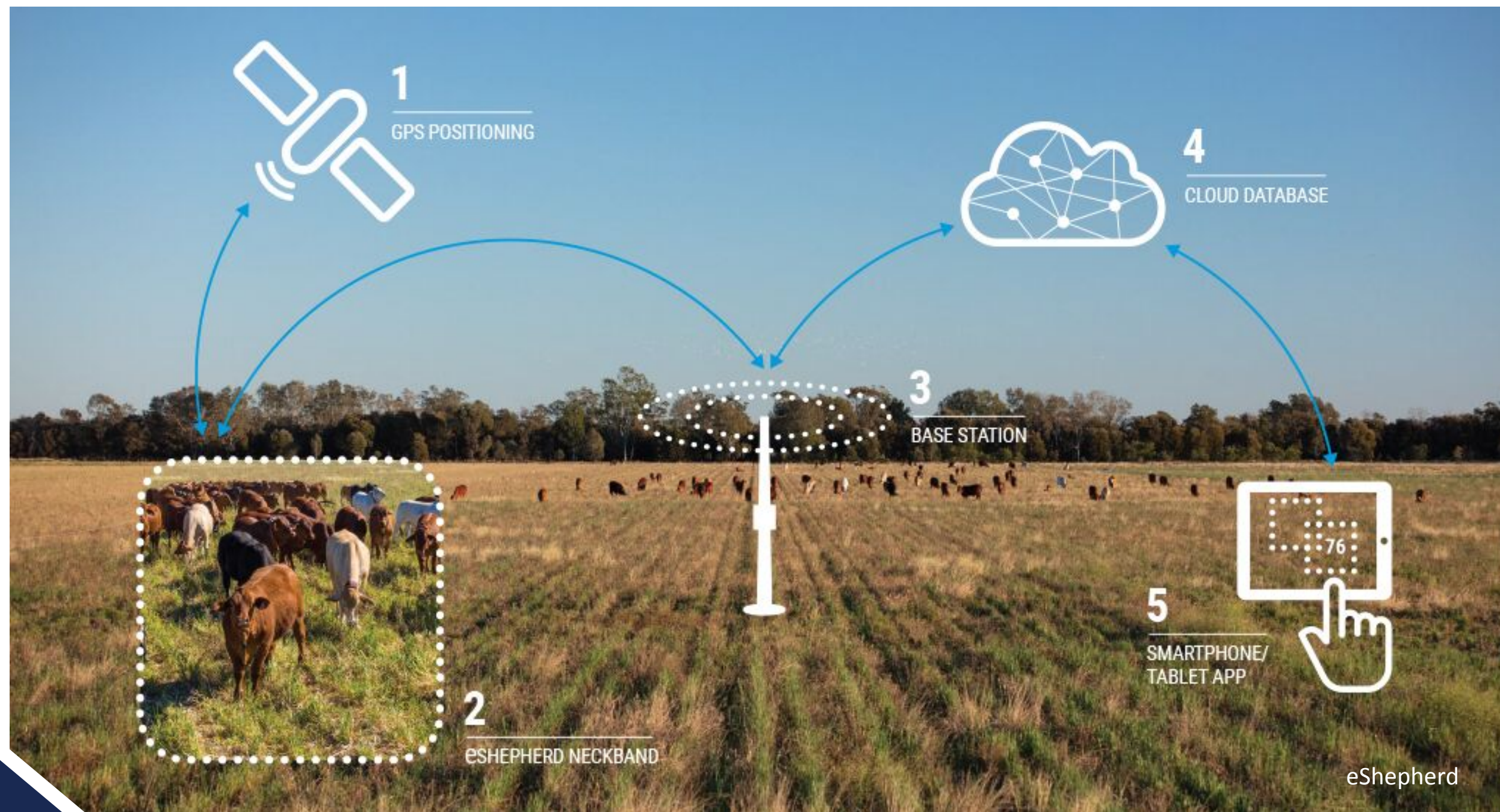


**As livestock approach VF boundary, collars produce audio cues followed by mild electrical stimulus to contain livestock in designated area**





# The collars communicate through the use of base stations and cellular networks





# Base stations operate off of solar power

- Some systems require a base station, others do not
- Base stations cost \$5,000 - \$12,000
- The station must be placed in an area with cell signal
- The station becomes mobile when installed on a trailer
- Collars connect via the base station
- Base stations have a radius of 10-12 miles
- Large ranches may require multiple base stations





# All systems require batteries

Some are rechargeable, some are not



## Example:

Nofence uses rechargeable batteries with chargers -

- Cattle battery holds a charge for 6 - 12 months
- Sheep/goat battery holds a charge for 3 weeks - 2 months



# Like dog fencing, but...

- Cheaper per unit
- Batteries hold longer charge
  - 10 hours for dog collars vs months for livestock collars
- Robust design and fit for livestock
- Electrical pulse delivered through chains



Halo



# Effectiveness

- Audio cues are automated, predictable and avoidable so animals quickly learn to respond to the audio cue alone
- If an animals escapes -
  - it will want to return to the herd based on herd mentality
  - VF acts as a one-way fence and allows animals to re-enter without consequence
- Researched extensively; no negative impact on animal welfare when compared to physical fence<sup>1</sup>

<sup>1</sup><https://doi.org/10.1016/j.animal.2022.100614>



# Ushering in a Grazing Revolution

## Benefits to the farmer:

- Create fences instantaneously, even with difficult terrain
- Decrease labor requirements
- Manage and move livestock from your mobile device
- No more searching for your animals in big pastures - use GPS to locate
- Track livestock in real-time & monitor well-being
  - Receive real time notifications of pulses & escapes
  - Identify sick animals quickly
  - Increase quality of life
  - Monitor animals anytime, from anywhere





# Ushering in a Grazing Revolution

## Benefits to the land:

- Provide grazing benefits in hard to reach/hard to fence areas
- No harm to wildlife
- Makes multiple moves per day feasible = soil health
- Aids in the adoption of regenerative grazing!

In the future, new tech will be incorporated into collars to:

- Maximize forage utilization
- Sense soil moisture and soil carbon
- Measure animal health metrics (temperature, estrus, calving, etc)



# Examples of use

- Rotational grazing
- Weed control
- Cover crop grazing on row crop acres
- CRP grazing
- Grassed waterways and ditches
- Woodlands, silvopasture
- Public land grazing
- River corridors and floodplains
- Reduce fuel loads for wildfire mitigation
- Post-fire grazing
- Solar grazing
- Bale grazing





# Challenges

- Fitting collars on livestock
- Base station installation, when needed
- Relies on functional technology
- Areas with poor cellular signal
- Upfront cost of implementation, cost of base stations when needed
- More frequent animal handling for collar maintenance



<https://www.agproud.com/articles/57553-virtual-fencing-when-to-make-the-switch>



# Collar Maintenance

Maintenance requires running animals through a chute

- Swap out batteries several times per year
  - With some systems, this can be done without taking the collar off
  - Some systems require the collar to be removed and then refit
- Restart collars that may be having issues
- Tighten or loosen collars
- Clean off debris and manure
- Apply grease to electrical connection points



# Predator Control

- VF does not provide protection from predators
- Recommend pairing VF with physical fence when herds are most vulnerable (i.e., during calving, lambing and/or kidding)
- In the case of predation, producers have found that livestock are able to more freely run because they are not impeded by physical fence
- Farmer will receive escape alerts and track whereabouts via GPS



# Virtual Fence vendors in the US



VENCE





# VF collar examples by vendor



Credit: University of California Cooperative Extension



	Vence	eShepherd	Nofence
<b>Collar Cost</b>	\$40 Cattle	\$240 Cattle	\$299 Cattle \$199 Sheep & Goats
<b>Collars Leased or Purchased</b>	Leased annually	Purchased	Purchased
<b>GPS Tower Cost</b>	\$10,000	\$5,000	Not required
<b>Requires Cell Reception</b>	Yes	Yes	Yes
<b>Battery Life</b>	6 to 9 months	7 - 10 years	5-10 years
<b>Solar Chargers on Collars</b>	No	Yes	Yes
<b>Subscription Cost</b>	No	\$18 per collar for year 1, then \$1.50 per collar per month with the option to skip months.	1-49 Collars: \$56 per collar for year 1; then \$52 annually ≥50 Collars: \$42 per collar for year 1; then \$36 annually

\*warranty and customer support vary by company



# Cost comparison example



# Considerations for NRCS grazing plans

- Exclusion zones created in virtual paddocks to protect sensitive areas
- Allows for selective access to watering points; can frequently move access points
- Incorporate into agroforestry systems without the need for copious amounts of physical fence



Credit: Wendy Johnson



# Considerations for NRCS grazing plans



Credit: Dave Hanson

- GPS accuracy varies, but boundaries can be set as close as 15-20 feet from the area you need excluded
- VF doubles for internal fence, but does not replace perimeter fencing
- Lowers the barrier of integrating livestock into whole farm management plans
- Trees and slopes may interfere with GPS



# **NRCS opportunities to support VF**

**Programs: EQIP or CSP**

**Timeframe: 1-5 year contracts**

**NRCS plan:**

- Compensate for improvements in grazing management, not the VF system itself
- Prescribed Grazing Management Plan (Practice Standard 528)
- Producer purchases VF
- Payments per acre per year of contract
- One upfront payment in Year 1 to support implementation; other payments will support ongoing subscription

**Steps to make it happen:**

- Coach producers
- NRCS employee awareness and training



# National NRCS tech adoption committee





# Resources

- [Virtual Fencing: Emerging Companies, Functionality and Benefits](#)
- [Virtual Fencing: A Climate Adaptation Strategy](#)
- [Researchers Explore Virtual Fencing as a Conservation Tool](#)
- [Virtual Fencing Technology for Cattle Management in the Pasture Feeding System - A Review](#)



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