



Green Lands Blue Waters

Virtual Fence (VF)

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
- Opportunities and challenges
- Vendors in the US
- Costs
- Considerations for grazing plans
- NRCS financial support



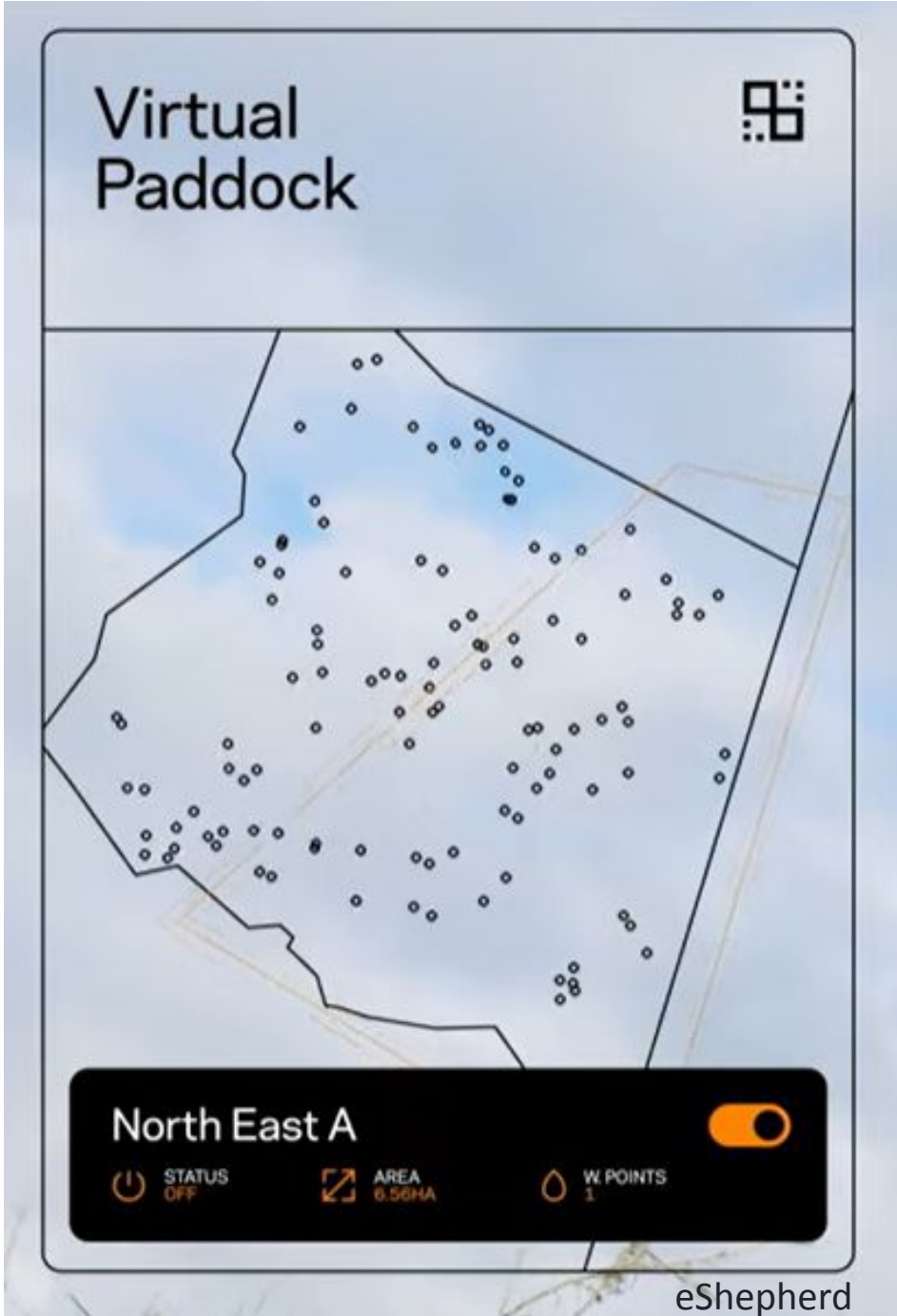
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VF is a new technology that contains ruminant livestock with boundaries created on a farmer's phone

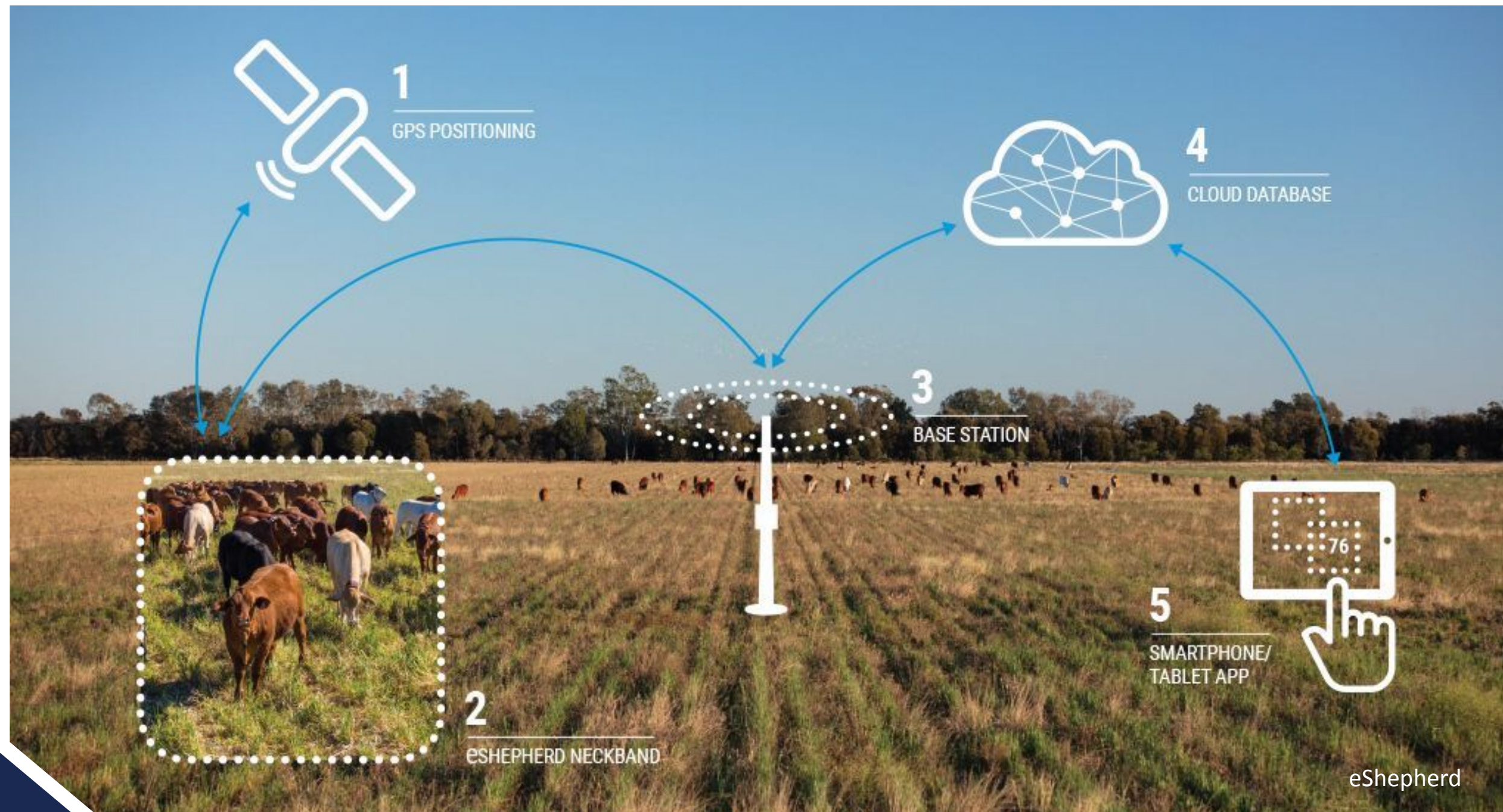


- Reduces the need for physical fence, specifically interior cross fencing
- Reduces fence maintenance and building labor
- Not intended to replace all physical fence; perimeter fence is still necessary in most cases

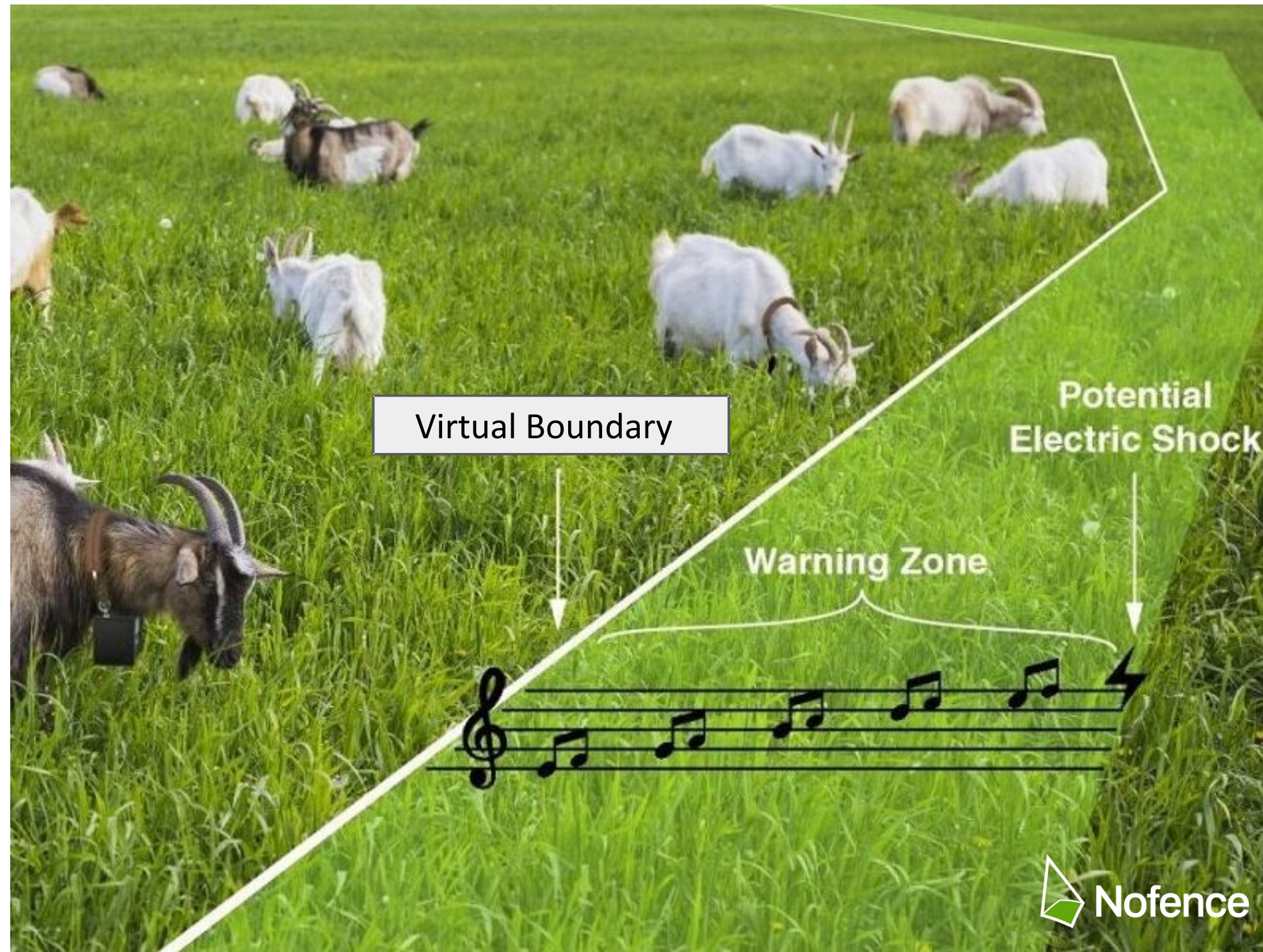
Livestock managers create and adjust virtual boundaries with a digital map user-interface, like Google Maps, that are communicated to GPS collars worn by the livestock



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

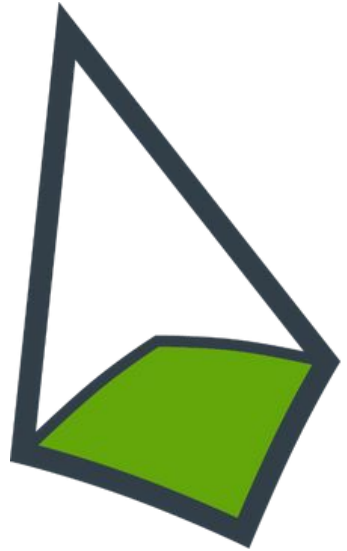


As livestock approach VF boundary, collars produce audio cues followed by mild electrical stimulus to contain livestock in designated area





Virtual Fence vendors in the US



Nofence



VENCE



VF collar examples by vendor



Credit: University of California Cooperative Extension

Collar Maintenance

Maintenance requires running animals through a chute to:

- 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

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

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



www.farmprogress.com/technology/bring-precision-ag-to-the-ranch

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 fence¹

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

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



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)

Challenges

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



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

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

Considerations for Incorporating VF into NRCS grazing plans

Develop a Grazing Management Plan (528) and identify management strategies to address resource concerns:

- To protect or manage sensitive areas within grazing units,
- To improve livestock distribution to meet soil and place resource concerns,
- Wildlife and other conservation concerns,
- Remove constraints and increases management flexibility



Credit: Wendy Johnson

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

Other Considerations for Implementing VF



Credit: Dave Hanson

- GPS accuracy varies, but boundaries can be set as close as 15-20 feet from the area you need to manage
- VF may be used for internal fence, but does not replace perimeter fencing
- Provides opportunity to integrate livestock into whole farm management plans
- Trees and slopes may interfere with GPS
- Livestock location data can be used in conjunction with other field monitoring to ensure grazing plan objectives are met

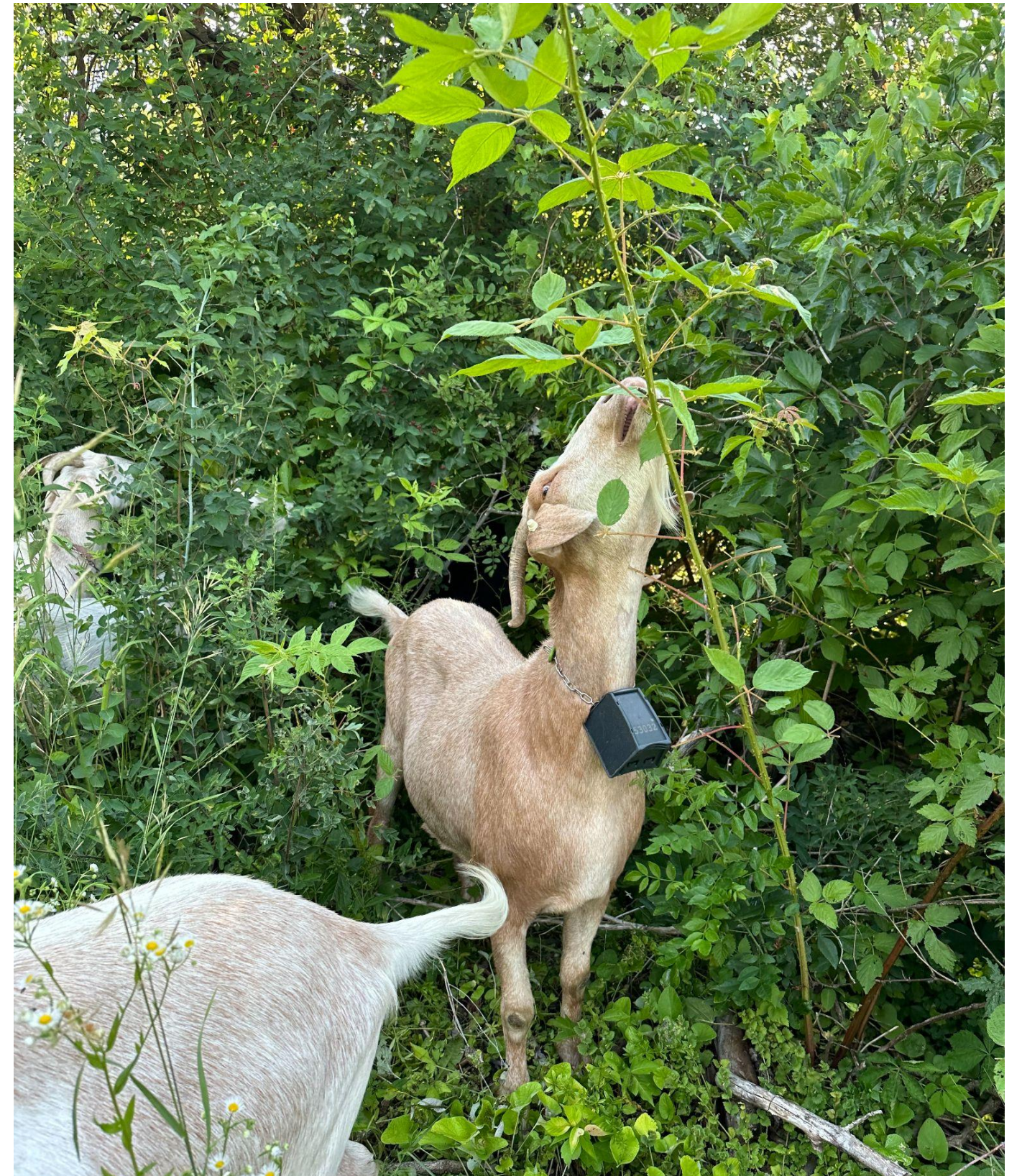
Field Applications

- 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



Where does it make the most sense?

- Targeted goat grazing
- Woods, hills, prairies, CRP, floodplains
- Cover crop grazing
- Multiple moves per day
- Large areas of unfenced grasslands



	Vence	eShepherd	Nofence
Collar Cost	\$40 Cattle	\$240 Cattle	\$299 Cattle \$199 Sheep & Goats
Collars Leased or Purchased	Leased annually	Purchased	Purchased
GPS Tower Cost	\$10,000	\$5,000	Not required
Requires Cell Reception	Yes	Yes	Yes
Battery Life	6 to 9 months	7 - 10 years	5-10 years
Solar Chargers on Collars	No	Yes	Yes
Subscription Cost	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



Size:	90 ac, 30 head		1500 ac, 100 head		
	Vendor:	Vence	NoFence	Vence	NoFence
\$/ac		\$29.00	\$40.00	\$4.28	\$6.86
\$/head		\$88.00	\$119.00	\$64.00	\$103.00

“Annual” cost is the total cost per year, including the annualized cost of the base stations and collars over their useful life. Based on 2023 prices.



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nrcs.usda.gov/



Current 528 payment schedules that support a virtual fence system

528 Prescribed Grazing	FY24
National Payment Schedules	\$/ac
Rangeland Standard	\$9.87
Range Long Term Monitoring	\$24.31
Habitat Management Standard	\$21.24
Habitat Mgmt Long Term Mon.	\$34.24
Pasture Standard	\$63.76
Pasture Intensive	\$167.32
Pasture Deferrment	\$6.13
Range Deferrment	\$3.33
Grazing mgmt on 5 acres or less	\$247.46

Virtual fence equipment annualized costs per acre for larger operations are \$2-\$10 and \$10-\$50 for smaller operations.

Currently existing payment scenarios for 528 are adequate to support the annual costs of VF



“Annual” cost is the total cost per year, including the annualized cost of the base stations and collars over their useful life.

NRCS opportunities to support VF

Programs: EQIP

Timeframe: 5 year contracts

NRCS 528 plan:

- Will subsidize collars OR base station(s) **upfront** to support implementation
- 50-60% subsidization; varies by state and/or program
 - 90% if underserved or a beginning farmer
- Payments in years 2-5 will support ongoing subscription costs
- Begins October 1, 2024

Steps to make it happen:

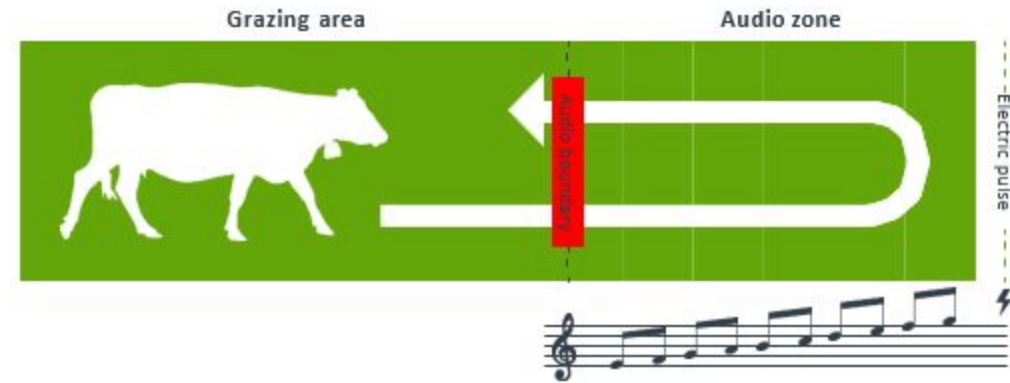
- Coach producers
- NRCS employee awareness and training



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](#)
- [2024 Virtual Fencing 101: South Dakota State](#)

Virtual fence (VF) is a precision livestock management tool that creates an enclosure, barrier, or boundary without a physical fence. VF allows real-time automation of grazing management from a smartphone or computer. Livestock are fit with a collar that generates audio warnings and electrical stimuli.



GPS in the collar continuously tracks animal position and checks this against the virtual boundaries set by the producer. As an animal approaches the boundary, a series of audio warnings are delivered. If the animal does not turn away, the collar delivers an electrical pulse.

VF aids in the adoption of regenerative grazing.
This technology can be applied in many different management scenarios:

- 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



Cost of VF varies by vendor:

Costs include collars and monthly subscription fees, and base stations, in some cases.

Vendors in the US include:

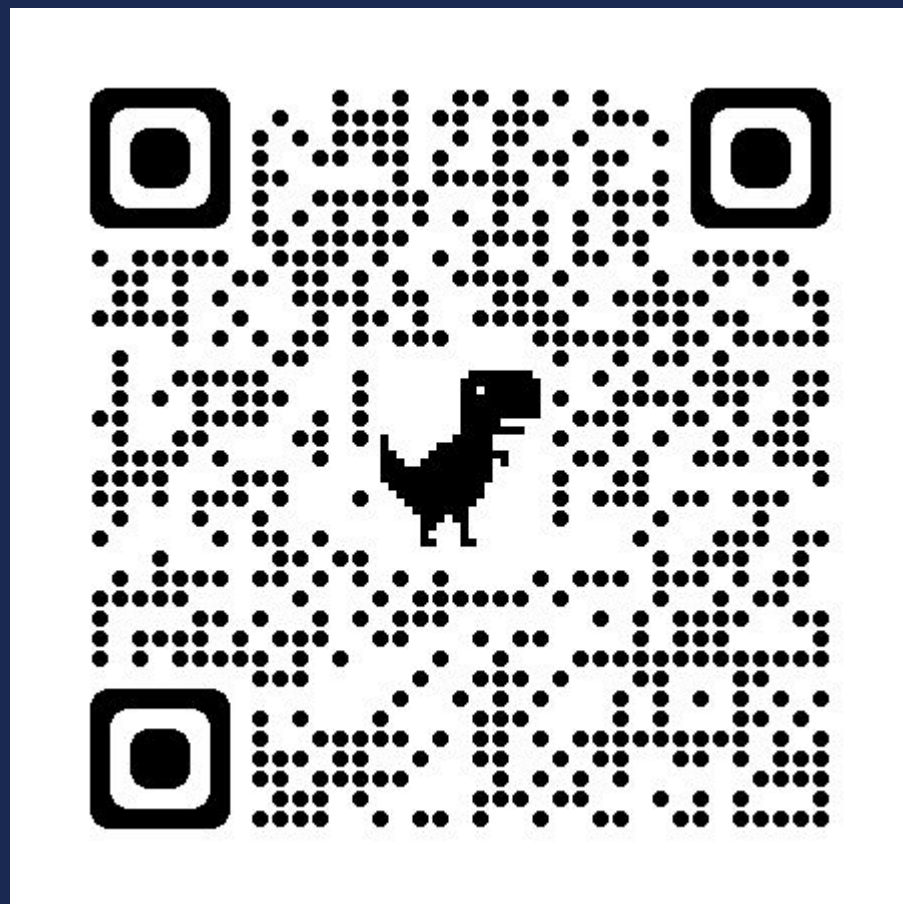
Vence™
Nofence™
eShepherd™
Corral Technologies™

NRCS support of VF:

Producers are encouraged to work with their NRCS representatives to incorporate VF into a Prescribed Grazing 528 plan. As part of this plan, producers may have the opportunity to receive a per acre grazing payment each year of their contract to help offset the cost of VF.



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