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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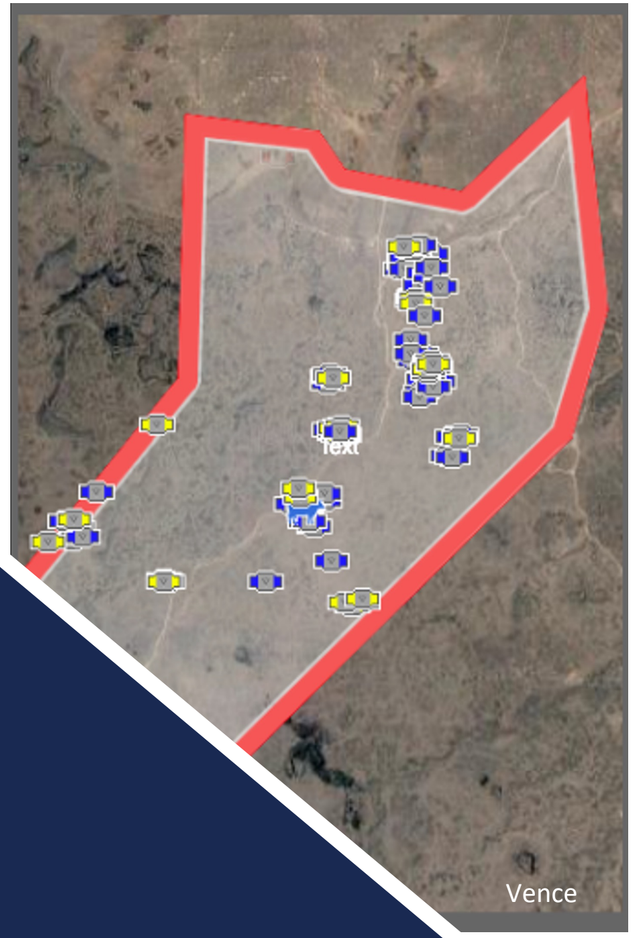
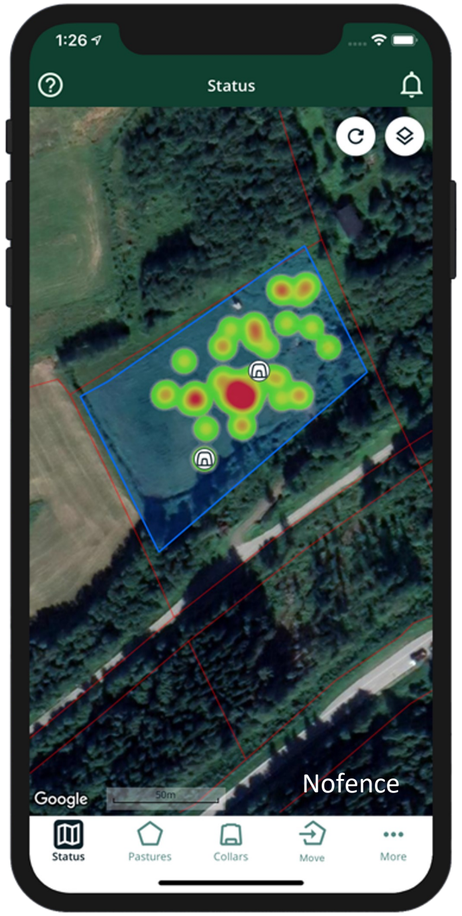
Information compiled by Green Lands Blue Waters and partners, 2024.

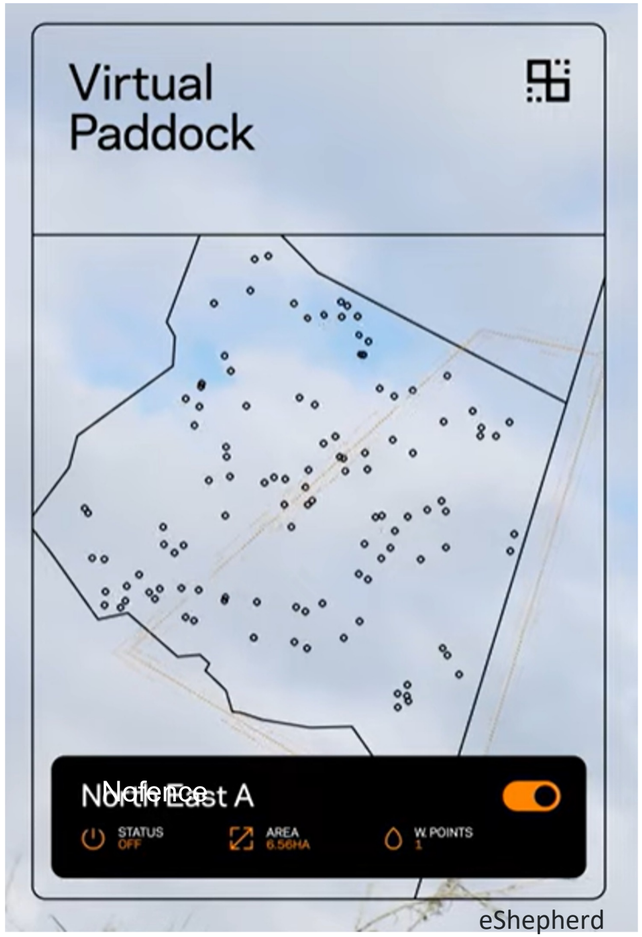
VF is a new technology that contains ruminant livestock with boundaries created on a farmer's phone

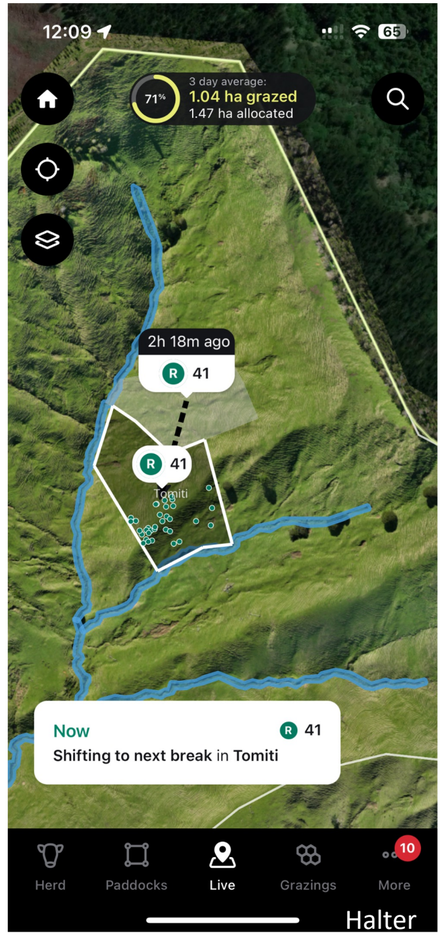
- Reduces the need for physical fence, specifically interior cross fencing
- Reduces fence maintenance and building labor
- Not intended to replace all physical fence; perimeter fence is still necessary in most cases

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

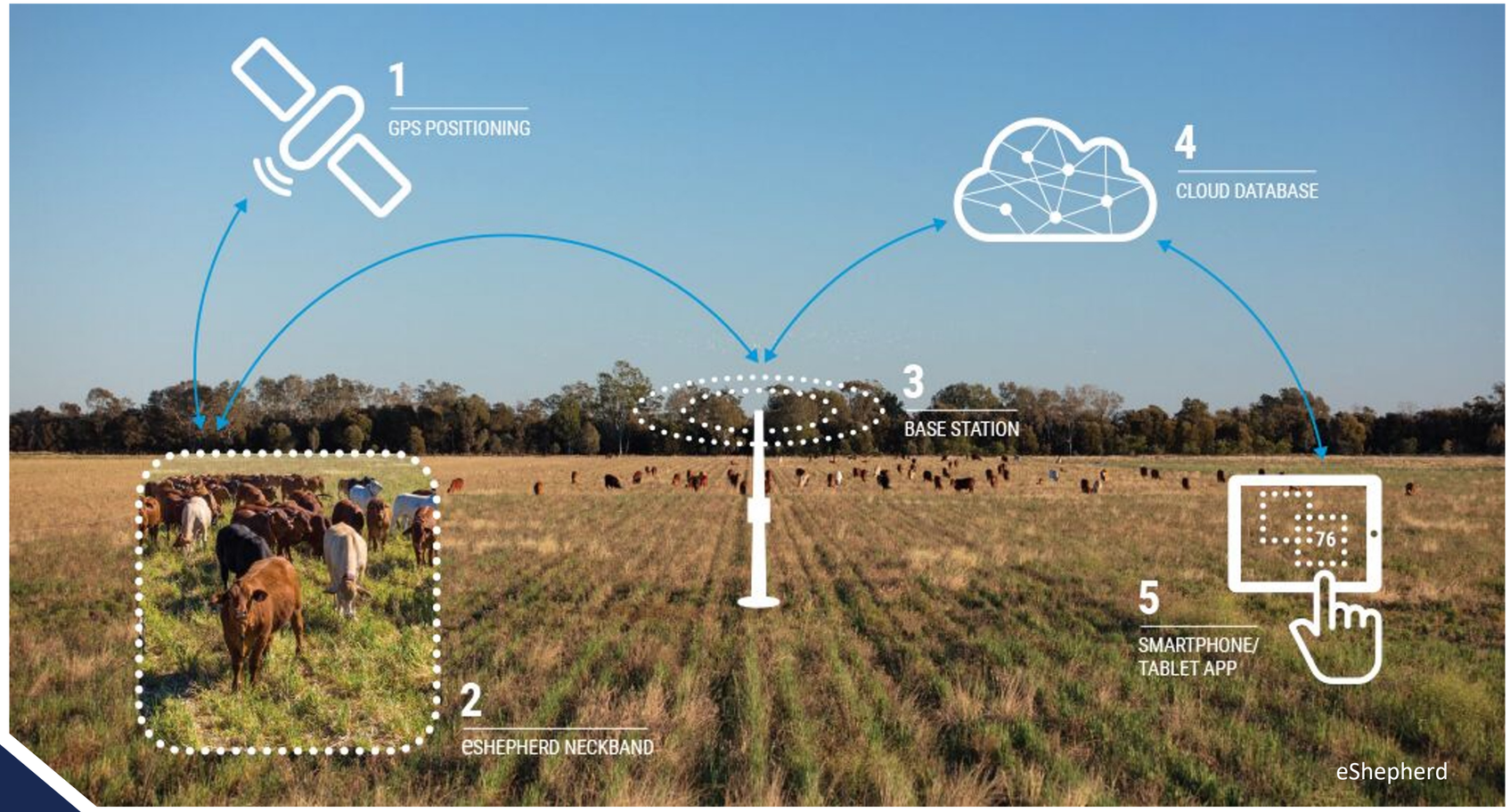




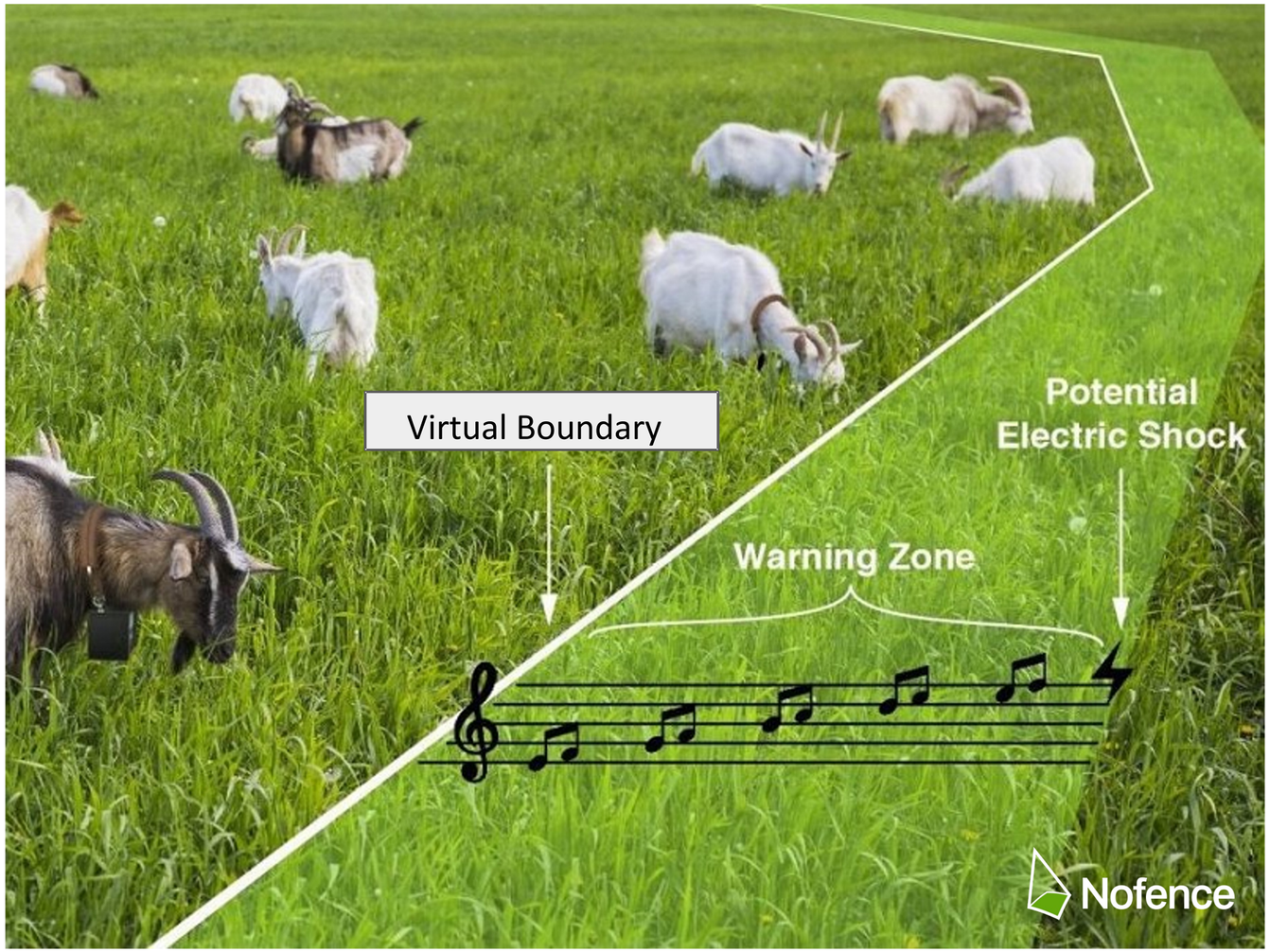




The collars communicate through the use of base stations and/or cellular networks



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



Nofence

Virtual Fence vendors in the US

VF collar examples by vendor

Nofence
Grazing technology

VENCE

GALLAGHER

Photo credit: Nofence

Photo credit: Vence

Photo credit: eShepherd Gallagher

Photo credit: Nofence

Photo credit: Nofence

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

Cattle

Sheep/goat

Example:

Nofence uses rechargeable batteries with chargers -

- Cattle battery holds a charge for 6-12 months
- Sheep/goat battery holds a charge for 1-4 months

Base stations operate off of solar power

- Some systems require a base station, others do not
- Base stations cost $2,500 - $10,000
- 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 fence[1]

[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

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

www.britannica.com/animal/coyote-mammal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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

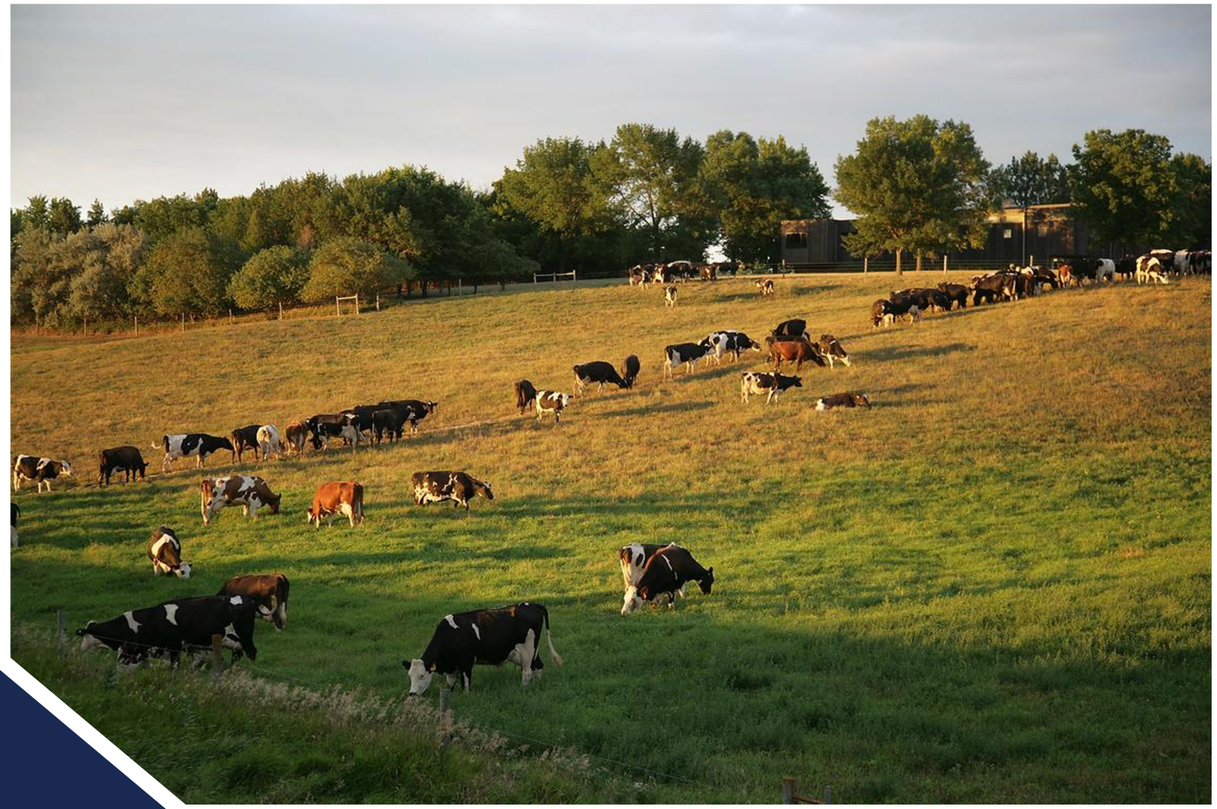
Credit: Wendy Johnson

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

Cost comparison

	Vence	Nofence	eShepherd	Halter
Collar cost	$40/year cattle	$359 cattle $259 sheep/goat	$250 cattle	$60/year cattle
Leased or purchased	leased	purchased	purchased	leased
Base Station required	yes	no	optional	yes
Base Station cost	$9,999	N/A	$6,000	$2,500
Requires cell reception	at base station location	everywhere	at base station location	at base station location
Solar chargers on collars	no	yes	yes	yes
Subscription cost	N/A	$3.00-$4.50/collar/month	$1.50-$2.00/collar/month	N/A

*Warranties and customer support vary by company. Pricing current as of September 2024. Contact company for current pricing.

NRCS Practice Scenarios for VF

Fence (382) Scenarios

- Describes purchase and installation of physical items
  - Collars when purchased
  - Communication towers (base stations) when needed

Grazing Management (528) Scenario

- Describes operation, learning, other annual activities
- Second through fifth year of virtual fence operation

Available in FY 2025; begins October 1, 2024

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Fence (382) Scenarios for VF

Two scenarios for smaller herds

- Typically smaller herds (around 50 head) on smaller acreages (less than 400 acres)
- One scenario for small ruminants (sheep, goats)
- One scenario for large ruminants (cattle)
- Both scenarios are on a per head of livestock basis

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Fence (382) Scenarios for VF

Two scenarios for medium to large herds

- Typically 50+ head on larger units (greater than 400 acres
- One scenario for medium size herds (50-150 head)
- One scenario for larger herds (typically more than 150 head)
- Both scenarios are on a per head of livestock basis

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Grazing Management (528) Scenario for VF

<u>One scenario</u>

- Virtual Fence Adaptive Management Years 2-5

Includes the following:

- Monitoring activities
- One workshop
- Annual subscription fees
- On a per head of livestock basis

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NRCS opportunities to support VF

NRCS accepts producer applications for its conservation programs year-round, but producers interested in funding during the current fiscal year should apply by their state's ranking dates.

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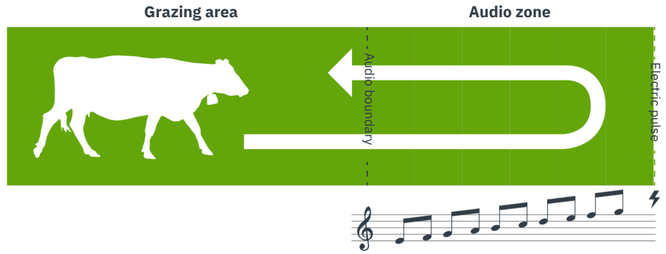
Resources

- 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
- Beef Cattle Producer Perspectives on Virtual Fencing

Virtual Fence 101

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

Vendors in the US include:

Vence™
Nofence™
eShepherd™
Halter™

Cost of VF varies by vendor:

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

NRCS support of VF:

NRCS accepts producer applications for its conservation programs year-round, but producers interested in funding during the current fiscal year should apply by their state's ranking dates.

- Goliński P, Sobolewska P, Stefańska B, Golińska B. Virtual Fencing Technology for Cattle Management in the Pasture Feeding System—A Review. Agriculture. 2023; 13(1):91. https://doi.org/10.3390/agriculture13010091

- Figures credit: Nofence. Content credit: GLBW & partners, 2023.

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Thank you to our cohort!

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