Center for Regenerative Agriculture
University of Missouri

Virtual Fence 101: An Introduction to Virtual Fencing Technology

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Introduction

Virtual fencing technology is a relatively new technology that has become of interest to many producers with grazing livestock due to potential for labor savings and other benefits. The technology became more widely available in the U.S. starting in 2025, creating questions among farmers, ranchers, and their advisors about how the technology works and situations it is best suited to. This guide is aimed at providing more information for producers and their advisors about this promising new technology.

Early adopters in the Midwest and other regions are starting to demonstrate the technology's impact on regenerative grazing strategies such as rotational and strip grazing in both perennial pasture and cover crop systems. Advantages include being able to see livestock's location 24/7, creating unique paddock designs to maximize grazing and protect conservation areas, and easy planning of the livestock's rotations between paddocks all from a smartphone, tablet or laptop.



Figure 1. Early adopters help test virtual fence in Missouri. From left to right: Kaitlyn Dozler-German, Erin Kiley, Daniel Bonacker, Chris Hudson, Tim Aulgur

Virtual fence offers a number of potential benefits to an operation, such as lowering the amount of time and labor typically associated with planning grazing rotations and inserting flexibility and adaptability into each individual operation, providing innovative management options for grazing cattle, sheep, and goats.

As producers start to consider adopting virtual fencing it is important they understand the basics of what the technology is, how it works and the range of products from virtual fencing companies active in the marketplace. It is also important to highlight that no two grazing operations are identical. While virtual fence may work extremely well for one operation it doesn't necessarily mean it is the right fit for another. It is recommended that each producer take time to get familiar with the technology and evaluate the fit with their current grazing strategies, to determine if it can help meet their goals and add value to their operation. For a producer giving serious consideration to adopting virtual fencing, it's worth creating a utilization plan for the technology's implementation prior to purchasing.

What Is Virtual Fence?

Virtual fencing is a new precision livestock technology that allows producers to track their herds in real time and contain them in specified areas of fields/pastures without the need for physical fencing. The system creates invisible barriers using GPS coordinates and keeps the livestock in or out of an area by administering sensory cues such as vibrations, sound and electrical stimuli.

History Of Virtual Fence

The concept of virtual fencing dates back to 1971, when Richard Peck filed a patent for a system designed to contain domestic animals, such as cats and dogs. His system used a receiver collar worn by the animal and a wire buried around a defined area. When the animal approached the boundary, the wire emitted a signal to the collar, triggering a response. Peck's system was later tested on livestock in 1987, successfully containing a herd of goats within a designated test area. Throughout the 1990's, researchers studied the application of virtual fencing for cattle, proving that the system could effectively alter animal movement. However, early virtual fencing collars relied on radio frequencies from hand-held or ground-based transmitters, limiting their range and requiring human presence to function.

To overcome these limitations, Dr. Dean Anderson patented a GPS-based virtual fencing system in 2001. His design revolutionized virtual fencing by using GPS signals to create movable boundaries. The collar's electronics contained spatial software that detected when a cow approached the boundary and delivered a corrective stimulus on the appropriate side of the head to encourage movement in the desired direction away from the virtual boundary. This patent and the use of GPS satellites shaped the design and research of virtual fencing collars as used today.

As of 2026, there are five main virtual fence companies available commercially in the United States. Vence was the first collar to hit the market commercially in 2021, with Nofence, eShepherd, and Halter starting to sell collars in 2025, and Monil entering the U.S. market in 2026.

Like any new technology, there are learning curves and challenges, and the available technology is being regularly updated and improved. The potential benefits, including improved grazing management, labor efficiency, protection of sensitive landscape areas, and flexible pasture utilization, can make it a valuable tool for livestock operations. As adoption grows, ongoing research and producer feedback will continue shaping the future of virtual fencing.



Figure 2. Cows with eShepherd collars. (Photo Credit: Daniel Bonacker)

How Virtual Fence Works

Livestock are fitted with virtual fence collars that use GPS receivers or communicate through the internet via a cellular signal or on-the-ground tower base station. A producer draws the virtual fence boundary lines on a companies' app or web interface, and the system utilizes the GPS coordinates of the drawn fence and relays the information back to the collars. The collars use the GPS coordinates to create invisible barriers. The system alters livestock movements by having the collars emit sensory cues such as vibrations, sound, and electrical stimuli when the cattle approach or cross the virtual fence boundary.

Thus, virtual fence allows farmers to manage animal movements and create a flexible grazing system by creating an invisible boundary and eliminating the need for most ground-based structures like physical fences. The system's flexibility allows for easy modification of virtual boundaries, inclusion and exclusion zones and the ability to set the boundaries on a timed moving schedule. However, it must be noted that a physical perimeter fence is still recommended in case of technology malfunction or cattle not respecting the boundary.

Training Livestock On Virtual Fencing

Virtual fence is based on associative learning, so training is a key step after collaring livestock to ensure they know how to properly respond to the system's stimuli. The average time for livestock to be trained is 5-7 days. Training should be done in a physically fenced in area the cattle know and are comfortable in. Strong reactions from livestock to the stimuli at first is common but should subside within a few hours to days as training progresses.

If certain livestock do exhibit strong reactions to the virtual fence, it is important to monitor the animal to ensure they are not experiencing high amounts of stress. If livestock continue to show signs of prolonged stress and not learning the system, it may be necessary to remove that animal or extend the training period.

General timeline for training livestock to virtual fence

***Day 1**: Introduction to audio cue*

- Overlay the virtual fence with a physical fence to introduce the livestock to the virtual fence's audio cue.
- Allow livestock to hear the audio cue without receiving an electrical stimulus, letting them begin to associate the sound with a boundary.

***Days 2-5**: Gradual fence movement and introduction of electrical cue*

- Each day, gradually move one side of the virtual fence further inside the physical fence, keeping the other virtual fencing boundaries aligned with the physical fence.
- Gradual fence moves allow the livestock to encounter both the audio and electrical stimuli,

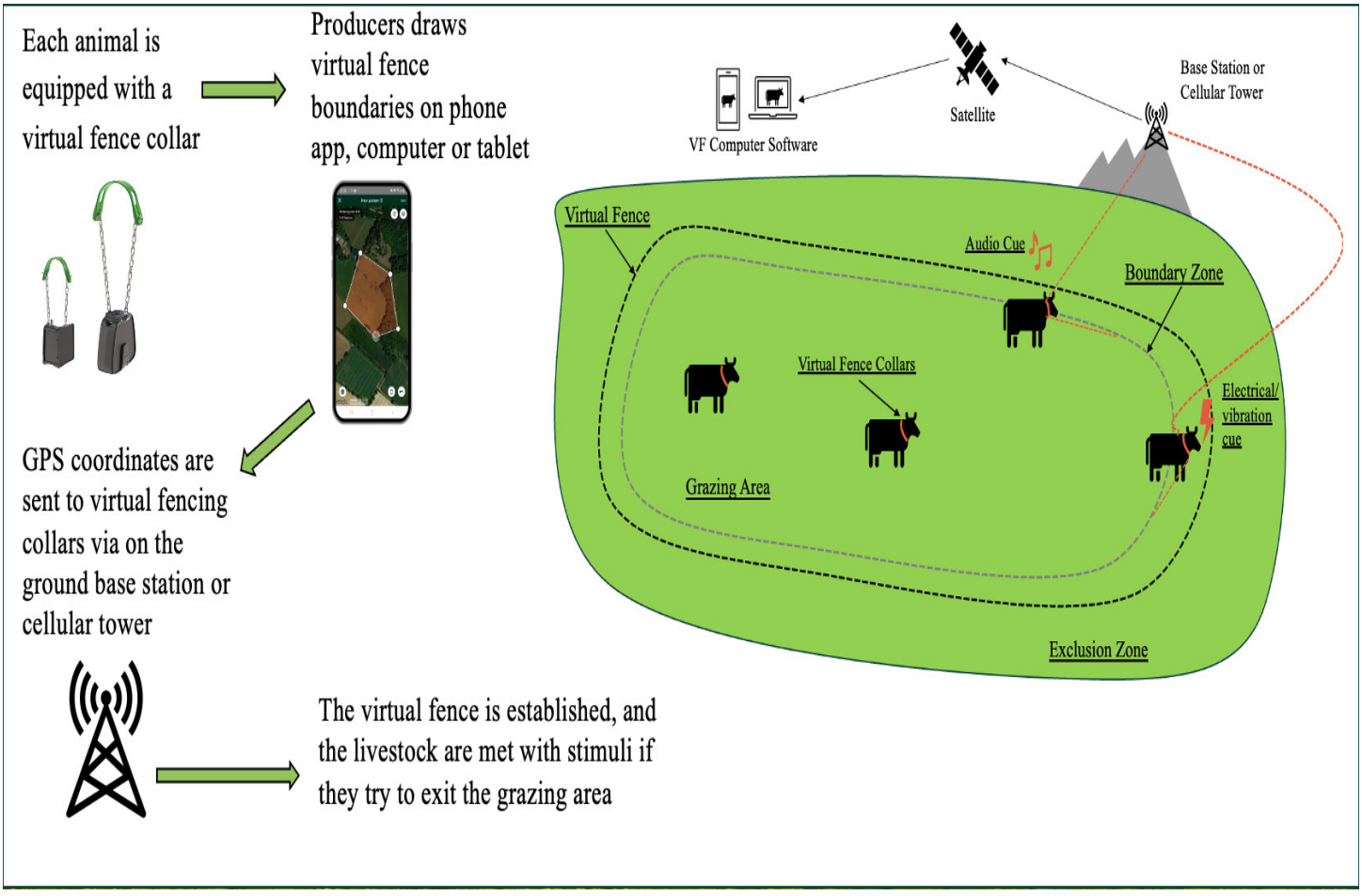


Figure 3. Graphic showing a virtual fence setup. (Graphic Credit: Kaitlyn Dozler-German)

reinforcing the association between the cues and boundary line.
- Livestock should start to respond to the audio cue alone, reducing the need for electrical stimuli.

***Days 6-7**: Boundary awareness and training success*
- The size of the virtually fenced grazing area should be about half of the physically fenced area.
- Producers should see a significant reduction in the number of electrical stimuli signals emitted as livestock learned to respond to the audio cue and stay within the new grazing boundary.

Livestock who are responding to the virtual fence without frequent reinforcement are successfully trained to the system.

A virtual fence is designed to act more as a cross-fencing system than a perimeter fence system. A physical boundary fence around all areas using virtual fence is always highly recommended.

Cellular, Tower, and Satellite Systems

There are three main systems virtual fencing companies utilize to send information and commands between the collars on the animals and the grazing manager.

Cellular Systems

These collars use cellular networks to communicate directly with the collars and the grazing manager via virtual fence software running as an app for phones or tablets or a web-based interface.

They do not require on-farm infrastructure such as a tower base stations. Cellular-based collars can often work with modest cellular signal in the grazing area, such as the signal level needed to send text messages, as opposed to a stronger signal needed for phone calls. Regardless of signal strength, be sure to work with the virtual fencing company to determine if cell coverage will be adequate.

Some benefits of cellular-based collars are easier system setup and flexibility for collar use across large areas with cell service. However, producers could face limitations if cellular coverage is poor or nonexistent. In that situation, collars are not able to relay animal location to the producers and virtual fence boundaries cannot be altered if the collars are not receiving cellular signals. Fortunately, any virtual fence boundary already active on the collar will still be functional if the animal moves into an area with no cellular signal. This means the animal will still receive boundary warnings if it tries to leave a currently active grazing boundaries.

Base Station Systems

These collars utilize LoRaWAN (Long Range Wide Area Network) signals to communicate to the collars through a tower base station located on or near the grazing area. The tower base station acts as a relay to pass information between the collars and the internet by connecting to nearby cellular towers or another internet source. As with the cellular-based systems, the grazing manager still manages the livestock and grazing boundaries through a virtual fencing app or web-based interface.

The main benefit is that the system works well in remote areas where cellular coverage is limited because the collars themselves do not need direct cell service. However, producers are limited by the signal range of the tower base stations. Factors like terrain and distance between grazing areas could require the producer to purchase more than one tower base station to cover their grazing area.

Satellite Systems

Satellite collars are the newest version of virtual fence collars available to producers. The collars communicate directly to satellites to transfer information between the collar and mobile phone app. This system eliminates the need for a tower or cellular signal for the collars to function. The full functionality of the new system is still unknown due to the collars being so new to the market.

Areas of dense tree cover, or where the collars have a limited view of the sky could be a challenge for the system.

Currently only one company offers direct-to-satellite collars to producers. As other companies release new direct-to-satellite connectivity, those new systems could function differently.

What To Consider When Selecting A Virtual Fence Company

While each virtual fencing company provides producers with the same foundational technology, there are some differences to the software (apps) and hardware capabilities that each company offers. When deciding which company would best fit a particular grazing operation, a producer must consider several factors.



Figure 4. Virtual fence collaring demo on sheep. (Photo Credit: University of Missouri Extension)

Initial questions producers should consider when deciding between companies:

- The terrain of the area utilized.
- The area's cellular coverage.
- How far apart are the different pastures or fields.
- The size of the herd and whether the company offers collars for the species of livestock.
- The number of towers possibly needed to cover your operation.
- Is there data you hope the system collects or technology features that are only available from certain companies?
- Will you be utilizing the collars year around or only during certain parts of the grazing season? Some companies allow producers to only pay for the months the collars are in use.
- The battery life of the system.
- Will multiple people be able to access the app to check on and move livestock if needed?
- What is the expected lifespan and warranty plan on the technology?
- The cost of the system, both up front and ongoing subscription fees and costs for replacing materials.

Software Apps Used To Manage Virtual Fencing

Each virtual fencing company has a different software platform for producers to use to manage their herds, whether that is drawing new paddocks, planning livestock moves, or marking physical landscape features. Some companies utilize both a web-based and a phone/tablet type app while others just utilize one platform.

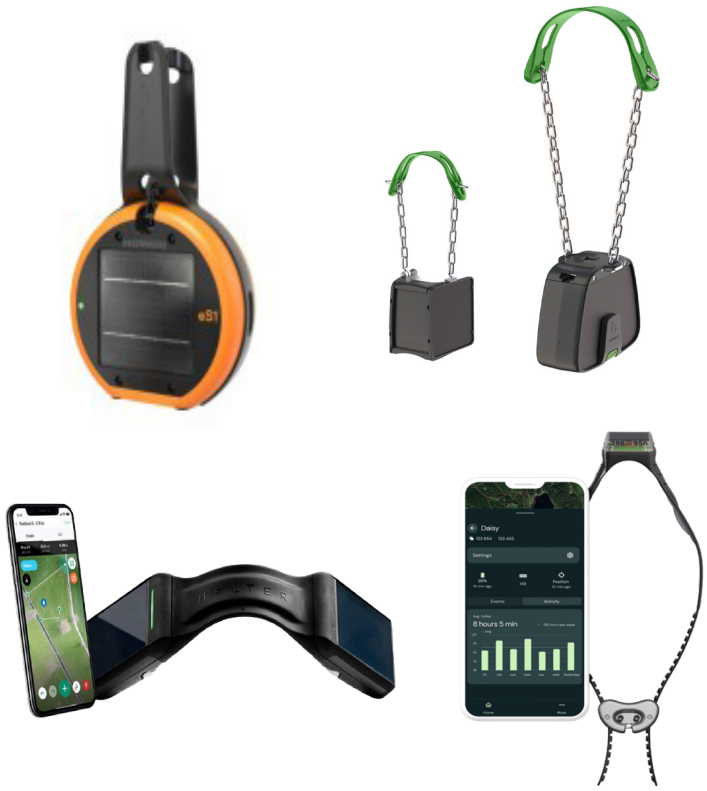


Figure 5. Virtual fence collars that are currently available for use in Missouri. Top left: eShepherd; top right: Nofence; bottom left: Halter; bottom right: Monil.

The company information below is based on individual company approaches in May of 2026 and is subject to change.

Vence: All livestock management is web-based. There is an app but it is a viewing platform and not for livestock management.

eShepherd: Livestock management can be done both in the app and on the web-based platform.

Monil: All livestock management is app-based.

Nofence: All livestock management is app-based. There is a web platform but it is a viewing platform not for livestock management.

Halter: All livestock management is app-based. There is a web platform, but it is a viewing platform and does not allow livestock management.

Cost Of Implementing Virtual Fence

There are many factors to consider when considering implementing virtual fence. The cost of virtual fencing depends on several factors, including the company, livestock species, number of collars needed, and any extra equipment required.

There are two main pricing models that companies use:

Subscription-based Model

- No upfront cost for collars.
- Producers pay an annual fee per collar (ranging from $40 to $96 per collar).

Upfront Purchase + Annual or Monthly Fee Model

Producers buy the collars upfront and then pay either a monthly or annual fee per collar.

- Upfront Collar Costs:
    - Cattle: $250 to $350 per collar
    - Sheep and goat: $199 to $250 per collar
- Monthly fees from $1.50 to $2.00 per collar.

Some virtual fence systems require extra equipment or services:

- Tower base stations: Needed for some systems, costing $4,500 to $10,000 per tower.
- Internet or cellular fees: May apply depending on the system.
- Battery replacements: Some collars require periodic battery replacement, which adds to long-term costs.

When considering the cost of virtual fencing, it's important to view it as a long-term investment. By breaking down the cost per head and depreciating it over the expected lifespan of the technology, the price becomes more reasonable for the average producer. Factors such as labor savings, time efficiency, and the potential to increase stocking rates or extend grazing days should also be considered when evaluating the overall value of virtual fencing.

Cost Breakdown Examples - *Examples do not reflect the exact prices of the virtual fencing companies.*

Example A: Subscription-based Model

A producer is considering virtual fence for 100 cows. The collars have an annual fee of $74 per collar, and a tower base station is required, with the tower costing $6,000. The expected lifespan and tower of the collars will be six years

Upfront cost per head:
- Collars: No fee
- Subscription fee: $74 x 100 head = $7,400 per year
- Tower Base Station: $6,000 (one-time cost)

Annual cost averaged over six years:
- Tower depreciation: $6,000 / 6 years = $1,000 per year
- Subscription fee: $7,400 per year
- Total annual cost: $8,400 per year
- Total cost per head per year: $8,400 / 100 head = $84 per cow per year

Example B: Upfront Purchase + Annual or Monthly Fee Model

A producer is considering virtual fence for 100 cows. The collars' purchase price is $300 per collar and a monthly fee of $3 per collar. The collars are cellular collars, so no tower base station is required. The expected lifespan of the collars will be 6 years.

Upfront cost per head:
- Collars: $300 x 100 head = $30,000 (one-time cost)
- Monthly subscription fee: $3 x 100 head = $300 per month
- Total monthly subscription fee for one year = $3,600

Annual cost averaged over six years:
- Collar depreciation: $30,000 / 6 = $5,000 per year
- Subscription fee: $3,600 per year
- Total annual cost: $8,600 per year
- Total cost per head per year: $8,600 / 100 = $86 per cow per year



Figure 6. Halter collar sizing at Wurdack Extension and Education Center (Photo Credit: University of Missouri Extension)

Every operation is different, so it's essential to compare pricing models and choose the system that best fits your needs and budget. Consider factors such as features, upfront investment, annual fees, warranty, company support, and long-term cost efficiency when evaluating virtual fencing options.

Prices for cost breakdown examples were acquired in February 2026, for the most up to date pricing information please contact the companies directly.

Potential Virtual Fence Challenges

Virtual fencing may not be suitable or cost effective for every grazing operation. It can be a significant financial investment and there is a learning curve. It is important for agriculturalists to examine how the technology would truly help their operations when deciding if virtual is a smart investment. The technology is most applicable to a producer who is already doing rotational grazing and wants to reduce labor while gaining more management data and options. For a producer who is just leaving grazing animals in a relatively large pasture and not moving them regularly, the use case may not fit for virtual fencing unless it helps provide a pathway to start managing livestock in a more management intensive fashion. Other considerations include:

Cost

The cost of implementing a virtual fence system varies by company but can be a significant financial investment for agriculturalists.

Potential technical malfunctions

This is still a new technology; although existing products have been user tested there may be situations where they don't perform perfectly, with physical or software malfunctions. Livestock can create unexpected wear and tear on the collars, with potential for broken collars or collars that fall off (some products have features to help find fallen collars).

Virtual fence does not provide 100% stock proof barriers. A physical perimeter fence is strongly recommended around areas where a virtual fence is used to ensure livestock and human safety. Virtual fences are meant to replace interior cross fences typically used in a rotational grazing system. On occasion one or more animals may pass through a virtual fencing boundary. Escaped animals can return to their herd without penalty of shock.



Figure 7. A ram with a Nofence virtual fence collar. (Photo Credit: University of Missouri Southeast Research and Extension Center)

Despite escaped animals typically staying within herd proximity, it is critical to keep livestock from wandering into roadways or other undesired areas. It should also be noted that young livestock are not normally collared, and while they will generally stay close to their collared mothers, they may wander a short distance away, far enough to get onto a road if no physical fence is present.

What Can Virtual Fence Do For Missouri Grazing Systems?

Easier implementation of rotational grazing

This technology allows grazing managers to create virtual boundaries in minutes, reducing time, labor, and cost of physical fence.

Producers can place fence lines in areas not typically suited for physical fence, such as allowing goats to be grazed in woodlands to manage invasive brush.

Real time livestock location tracking and monitoring

Virtual fence allows producers to know their livestock's location and grazing habits to monitor forage utilization. Some systems alert producers when livestock is outside the virtual fence boundary or exhibiting unusual behavior, such as an animal that has stopped moving. Some producers have noted it's easier to find a cow that has gone off to calve because of the monitoring system.

Some virtual fencing systems give producers the ability to create heat maps to show where livestock have recently been grazing. This can make it easier to evaluate if a particular part of a grazing area is providing better forage or otherwise analyze the patterns of the livestock grazing.

Virtual fence can create flexible grazing boundaries and multiple planned moves ahead of time.

Virtual boundaries can be set to move automatically over a set period of time. For example, a producer utilizing high intensity grazing could set the virtual boundary to move automatically multiple times a day for several days in advance.

Producers can place fence lines in areas not typically suited for physical fence, such as areas prone to flooding.

Re-enclose "escaped" livestock

Most virtual fencing systems provide notification when one or more animals passes through a perimeter boundary. At that point, a manager can wait for the animal to rejoin the herd, since there is no penalty to the animal for recrossing the boundary. There is also the option of easily redrawing the grazing boundary to re-enclose any collared animals that have gone past the prescribed boundaries.

Protect streams, wetlands, and other sensitive areas more easily

Producers can easily fence out sensitive areas such as stream banks, riparian areas, or wildlife habitat. These areas can be protected more simply than with temporary electric fencing since there is essentially no labor involved to fence off a sensitive area. It's also easier to make irregular boundaries with virtual fence mapping than with electric fencing, such as following the edges of a meandering stream. Furthermore, most virtual fencing systems allow for "exclusion zones" within a grazing paddock, so animals can be kept out of a particular area such as a pond, wetland, newly planted patch, or other designated area.

Using Virtual Fencing To Enable Easier Cover Crop Grazing

Cover crop grazing is becoming recognized as not only an effective way to build soil health but also as a particularly effective way to add profit to farming systems. To fully reap the benefits of grazing cover crops, producers must consider the necessary grazing infrastructure. Water access and fencing are typically the biggest barriers to implementation. Traditional fencing requires significant investment in both time and money that can potentially be reduced with virtual fencing.

According to the University of Missouri Pasture Construction Budget:

Data from April 2026

- Woven wire with a top barbed wire: $5,202 per quarter mile
- Five-strand barbed wire: $3,993 per quarter mile
- Six-strand non-electrified smooth high-tensile wire: $3,498 per quarter mile
- Two-strand electric interior fence with step in fiberglass posts: $1,384 per quarter mile

In addition to the high cost, traditional fencing can make it more difficult to implement management intensive or adaptive grazing practices that create the most profit when grazing cover crops. Rotational grazing on cover crops can offer benefits such as improved forage utilization, reduced soil compaction, improved soil health, and in some cases higher animal performance and increased grazing days. Moving livestock between paddocks or adjusting paddock size is often time consuming and labor intensive. Virtual fencing allows the opportunity to greatly reduce the labor involved with cover crop grazing, although a perimeter physical fence (even electric wire) is still recommended around crop fields that have road access.

Cover crops are known for providing numerous soil health benefits, including reducing erosion, suppressing weeds, sequestering carbon, and replenishing nutrients. However, one often-overlooked advantage is their potential as a high-quality forage. For livestock producers, cover crops offer valuable grazing opportunities when perennial forages are unavailable or of poor quality, helping to reduce feed costs and extending the grazing season. For row crop farmers who don't have livestock, leasing cover crop fields to nearby livestock producers can create an additional revenue stream while also enhancing soil health through manure, hoof action, and improved water infiltration.

Conclusion

Virtual fencing has the potential to transform how producers manage regenerative grazing systems. By allowing for strategic grazing plan implementation while reducing time and labor, this technology offers a new level of flexibility in livestock management. However, it's important to recognize that virtual fencing is not a one-size-fits-all solution.

Some producers may already have well-established fencing systems or management practices that meet their needs. Virtual fencing does not replace good stockmanship or physically checking livestock. It serves as another valuable tool in the producer's toolbox, helping to enhance regenerative agriculture practices, improve livestock management, and create more sustainable and efficient operations. While virtual fencing isn't necessary for every operation, it remains an exciting new tool with the potential to positively impact modern grazing management for years to come.

Resources

Dozler, Kaitlyn E., "Virtual Fencing in Livestock Management: Effects on Beef Cattle Stress and Enhancing Wildlife Conservation" (2024). School of Natural Resources: Dissertations, Theses, and Student Research. 387.
https://digitalcommons.unl.edu/natresdiss/387

Rangelands Gateway
https://rangelandsgateway.org/virtual-fence

Virtual Fence Websites

These are websites only for virtual fence companies that operate commercially in the U.S.

Halter: halterhq.com/en-us
eShepherd: eshepherd.com
Nofence: nofence.com
Monil: monil.com/us
Vence: merck-animal-health-usa.com/hub/vence

Virtual Fence Companies Currently Available in the U.S.

Virtual fence company information was acquired in October 2026. For the most accurate and up-to-date company information and pricing, please see the various company websites.

Virtual Fence Company	Livestock	Cellular, Tower or Satellite Based Collars	Initial Fee (per collar)	Subscription Fee (per collar)	Additional Infrastructure	Battery
Halter	Cattle	Tower & Satellite	No up-front fee	Annual fee per collar (must purchase at least 100 collars)	Tower (if needed), and annual internet fee	Solar charged
eShepherd	Cattle	Tower & Cellular	Varies on the number of collars purchased	Monthly fee per collar	Tower or no additional	Solar charged
Nofence	Cattle, sheep, & goats	Cellular with Satellite backup	Varies on the species of livestock	Monthly or Annual fee per collar	No additional	Solar charged
Monil	Cattle	Cellular	Varies on the number of collars	Annual fee per collar	No additional	Solar charged
Vence	Cattle	Tower	No up front fee	Annual fee per collar	Tower and set-up fee	Replaceable battery