

Don't Fence Me In!

Description

Students are introduced to “virtual fencing,” a technology being studied by scientists in the Sustainable Southwest Beef Project. After conducting hands-on tests using models of traditional and virtual fences, students evaluate the potential of virtual fences to help ranchers save time and money and protect the environment.

Objectives

Students will:

- conduct two activities that model cattle ranching and the challenges experienced by ranchers.
- perform an activity to model how GPS collars and virtual fencing can help ranchers better manage their cattle and protect environmentally sensitive areas.
- use persuasive writing in the form of an advertisement, brochure, or commercial to present the pros and cons of virtual fencing.

Grade Level: 5th Grade

Time: 1 hour

Phenomenon

Can virtual fencing help ranchers save time and money while protecting the environment?

Background

Ranchers who raise cattle in the southwestern United States face many challenges. In a dry climate, ranches and the pastures within those ranches often need to be very large to make sure there is enough forage (food) for the herd. Rainfall does not fall evenly across a large ranch, which can lead to some places with low plant growth. These areas might need to be “rested” or protected from cattle grazing so the plants can recover. Additionally, cattle do not use rangelands uniformly. For example, cattle often graze extensively around water tanks. This uneven, concentrated grazing, along with decades of drought, has led to overgrazing in some areas, a loss of perennial grasses, greater exposure of soil to wind erosion, and increased dust emissions. Ranchers spend considerable time and money checking on the health of their livestock and rangeland across these large areas

To more equally distribute cattle across a ranch and keep cattle out of sensitive areas or sites that need time to recover, ranchers often use barbed-wire fences to create pastures. These fences can be expensive and require considerable time to build and maintain. This prevents the quick moving of cows and fences to take advantage of changing forage conditions in various parts of the ranch.

To overcome some of these challenges, scientists are investigating technologies like “virtual fencing” to improve ranchers’ ability to manage cattle more efficiently and sustainably. Virtual fences work similar to invisible fencing designed for dogs, but no physical barrier or buried wire is required. Cattle wear collars with Global Positioning System (GPS) technology. After a rancher has established a virtual fence line using their computer or phone, the collar emits an audible cue that intensifies when the cow

approaches the virtual fence. During a brief training period, cows learn to turn around when they hear the signal. If they continue to approach the virtual fence, they receive a mild electric pulse. Virtual fences may overcome many challenges and limitations of traditional fencing on large ranches in the southwest. For example, virtual fences can be moved quickly, providing ranchers with a more flexible means for controlling where their cattle graze.

Oklahoma Academic Standards for Science

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, evaluating, and communicating information	ESS3.C Human impacts on Earth’s systems	Systems and system models
Developing and using models	ESS2.E Living things affect the physical characteristics of their regions	
Engaging in argument from evidence		

Common Core State Standards

English Language Arts

W.5.1 - Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

W.5.2.D - Use precise language and domain-specific vocabulary to inform about or explain the topic.

W.5.9 - Draw evidence from literary or informational texts to support analysis, reflection, and research.

Materials

- Science journal - printable PDF [\[link\]](#) – 1 per student
- Marbles [1 per student]
- Approx. 2.5-foot piece of yarn or string [1 piece per student]
- Popsicle stick or pencil [1 per student]
- Computer with access to internet and projector for video display
- YouTube video [\[link\]](#)

Linked materials can be found at Asombro.org/free. Look for the *Don’t Fence Me In* under *Sustainable Southwest Beef*.

Preparation

1. Print science journals (double-sided suggested).
2. Set up a computer with the YouTube video link and connect it to a projector.

Procedures

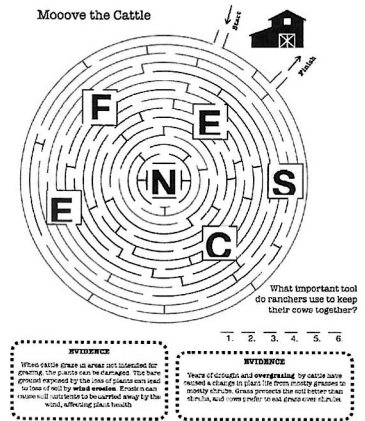
Introduction to the Importance of Cows

1. Hand out the science journals, and have students write their names on the cover.
2. Start the video and monitor for understanding. Pause the video as needed.
3. *Pause the video at approximately 1:45 minutes when instructed to do so in the video.*
4. Ask students to discuss with their neighbors and circle items they think were made from cows.

5. Restart the video to learn what items come from cows. Students may be surprised that all items listed come from cows. You may want to pause and explain some of the items.
6. Continue the video.

Activity 1 – Mooove the Cattle Maze

1. In this activity, students will use the maze found in their science journal to model a common ranching activity—herding cattle from pasture to pasture.
2. Pause the video at 4:21 when the PAUSE BUTTON is on the screen to check that students have pencils and their journals are open to the maze.
3. Play the video segment that explains the activity’s purpose (4:22– 4:37 minutes).
 - a. Students work through the maze to discover the path that leads to each labeled pasture. This simulates the rancher moving the cattle from one pasture to the next.
 - b. After 1 minute, students record what letters or “pastures” they could get their cattle to in their journal.
4. Pause the video when the clock gets to zero and ask students if they could finish the maze and if it was challenging to get their cows to each of the pastures.
 - a. If students complete the entire maze, they will know the code word “Fences” and can write it in their journals. Ask students why fences are important to ranchers.



Fencing and the Impact of Cattle on Rangeland

1. Have students read the evidence boxes at the bottom of page 2.
2. Play the video for the discussion on fencing and managing cattle. In this video segment, rangeland scientists discuss difficulties with traditional fences.
3. Important takeaways and discussion points:
 - a. Fencing is expensive.
 - b. Fences require maintenance, but because they are distributed over large areas, keeping up with repairs is time-intensive and expensive.
 - c. Ranchers face challenges when gates are left open or fences are cut.
 - d. Cattle grazing in sensitive areas can result in loss of vegetation, soil erosion, and increased dust emission.

Activity 2 – Herd Your Marble!

1. Students will use a marble to represent a herd of cattle and a popsicle stick to move the herd.
2. Using the diagram of a rangeland in the journal, students move the marble from the west tank to the north tank, keeping their marble on the blank parts of the paper and avoiding the exclusion zone areas— patches of grass and sensitive soil.
3. Pause the video at 8:52 after the activity instructions.
4. Give students time to attempt this five times and tally successes and failures in avoiding the exclusion areas and perimeter fence in the Trial 1 table. The expected result is that students should have more failures than successes.
5. Discuss the Herd Your Marble activity outcomes and how the marble models the herd of cattle moving across a rangeland without fences.

Technology and Rangeland Management

1. Continue watching the video. Rangeland scientists discuss GPS technology and how it is used to monitor where their cows are grazing and their activities.
2. Have students read the evidence boxes on page 4.
3. Pause the video at 11:26 minutes when the PAUSE BUTTON is on the screen, and have students complete the prediction statement on page 3 in their science journal.
4. After students have completed the prediction, continue playing the video.

Activity 3 – Herd Your Marble Part 2: Adding a Virtual Fence

1. In the second marble activity, students will use a piece of yarn or string to model the barrier created by a virtual fence. Students can use scissors to cut the yarn if needed for their design.
2. Pause the video at 13:03 minutes when the PAUSE BUTTON is on the screen.
3. Give students time to attempt this five times and tally successes and failures in avoiding the exclusion areas and perimeter fence in the Trial 2 table. The expected result is that students should have more successes than they did in trail 1 without the virtual fence.
4. Students should compare their results from the two trials.
5. Continue the video after students have completed the activity.

Virtual Fencing Explained (video time 13:04 minutes)

1. Rangeland scientists explain how virtual fences are used to better manage cattle and protect Earth's natural resources.
2. Important takeaways and discussion points include:
 - a. Virtual fencing is a technology that allows ranchers to control the movement of their cattle.
 - b. Cattle are kept in a designated area without an actual barrier.
 - c. Audio and minor electrical cues change the cow's direction and keep it from going past boundaries determined by the rancher.
 - d. Virtual fence boundaries are easily changed from a computer or phone.

Activity 4 – Virtual Fence Persuasive Writing (video time 15:53 minutes)

1. Students will create an advertisement for either a traditional or virtual fence. The video discusses three formats which students can use to complete a persuasive writing assignment: advertisement, radio commercial, or brochure.
2. Give students time to create their advertisement in the drawing and writing spaces in the journal. Encourage students to come up with a name and slogan for their company.
3. Optional: Have students share their work with their classmates through presentations or a gallery walk.

Additional Resources on Virtual Fencing

Cibils, A. 2019: Southwest Sustainable Beef Coordinated Agriculture Project: Precision Ranching

<https://southwestbeef.org/sites/default/files/2020-03/precisionranching.pdf>

Czech B., Heitschmidt R., Brown J., Hild A.; 2008, Rangelands Vol. 30, 33-37: *Sustainable Rangeland Management, Economic Growth, and the Cautious Role for the SRM*

<https://jornada.nmsu.edu/files/bibliography/08-041.pdf>

NoFence: World's first virtual fence for livestock – Cattle Product Tour

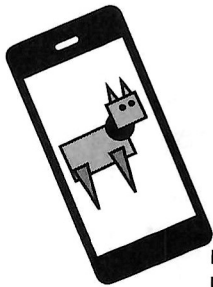
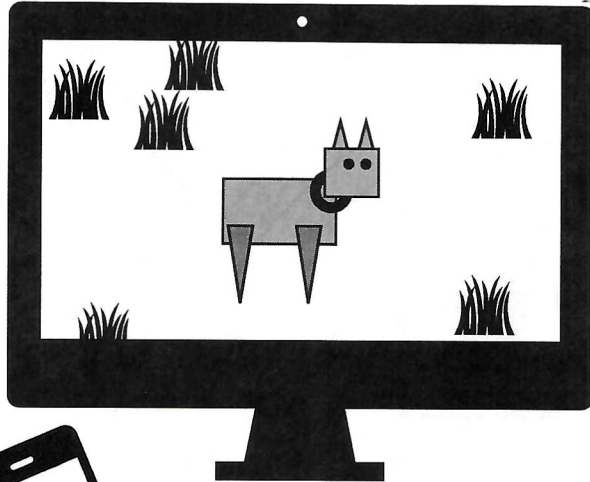
<https://www.nofence.no/en/product/cattle>

Edwards, W. 2012: Estimated Costs for Livestock Fencing. Ag Decision Maker. Iowa State University Extension and Outreach. Retrieved March 24, 2021

<https://store.extension.iastate.edu/product/Estimated-Costs-for-Livestock-Fencing>



Don't Fence Me In!



EVIDENCE

Cattle, or cows, make many products. A large amount of income in many southwestern states comes from cows.

GLOSSARY

Cue - word or sound that serves as a signal, warning, or reminder

Global Positioning System - a satellite-based navigation system that determines location

Natural Resource - a living or nonliving part of nature that humans and other organisms can use (for example, air, soil, and animals)

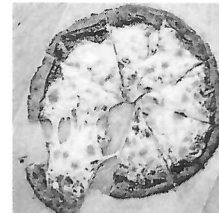
Overgrazing - excessive grazing resulting in damage to the rangeland

Rangeland - a vast land area grazed by domestic animals and wildlife

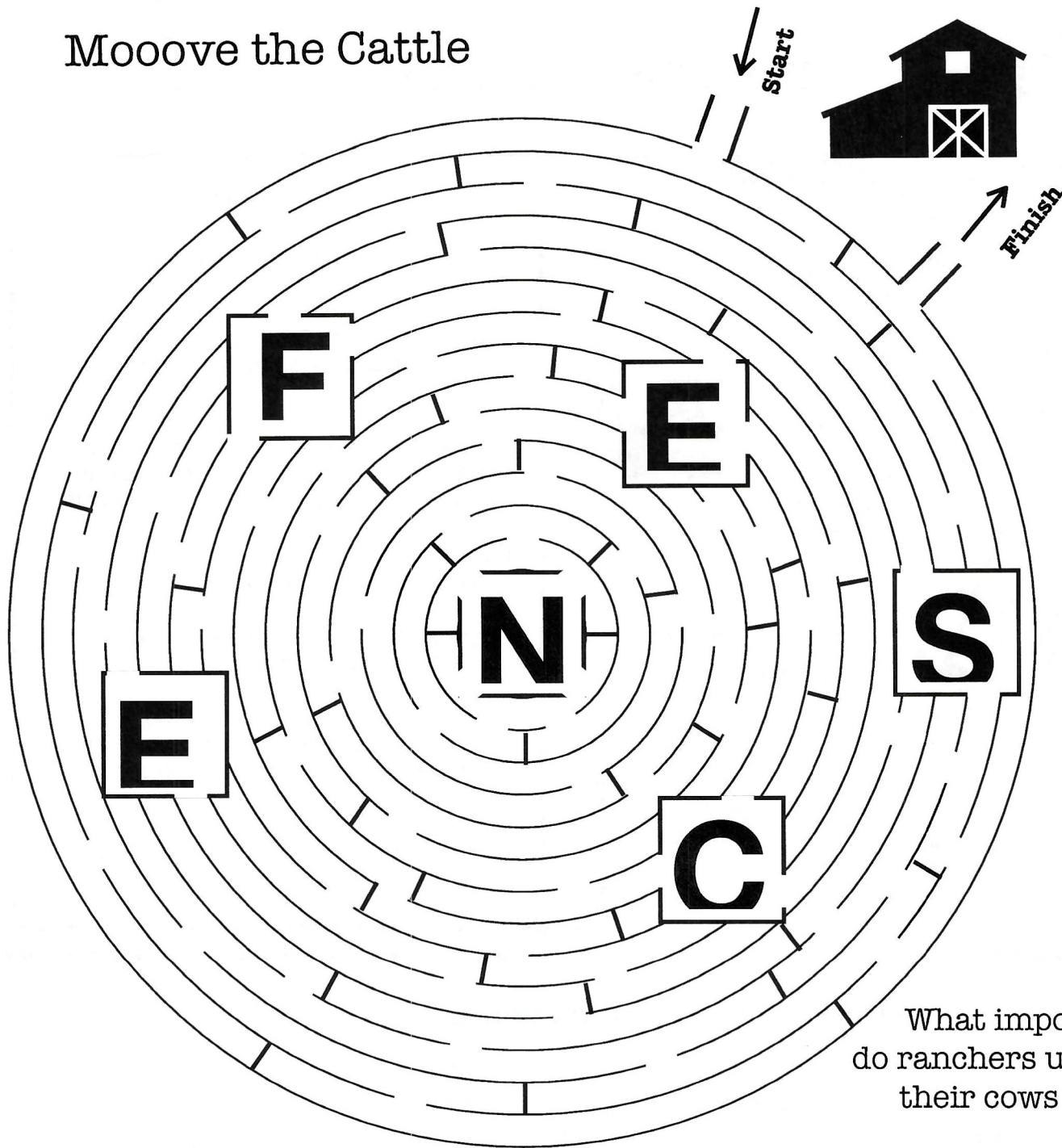
Virtual Fencing - a wireless fencing system composed of a GPS-fitted collar and sensor used to keep domestic animals in specific areas

Wind Erosion - the movement of soil by wind

Which of these items come from cows?



Mooove the Cattle



What important tool do ranchers use to keep their cows together?

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

EVIDENCE

When cattle graze in areas not intended for grazing, the plants can be damaged. The bare ground exposed by the loss of plants can lead to loss of soil by **wind erosion**. Erosion can cause soil nutrients to be carried away by the wind, affecting plant health.

EVIDENCE

Years of drought and **overgrazing** by cattle have caused a change in plant life from mostly grasses to mostly shrubs. Grass protects the soil better than shrubs, and cows prefer to eat grass over shrubs.



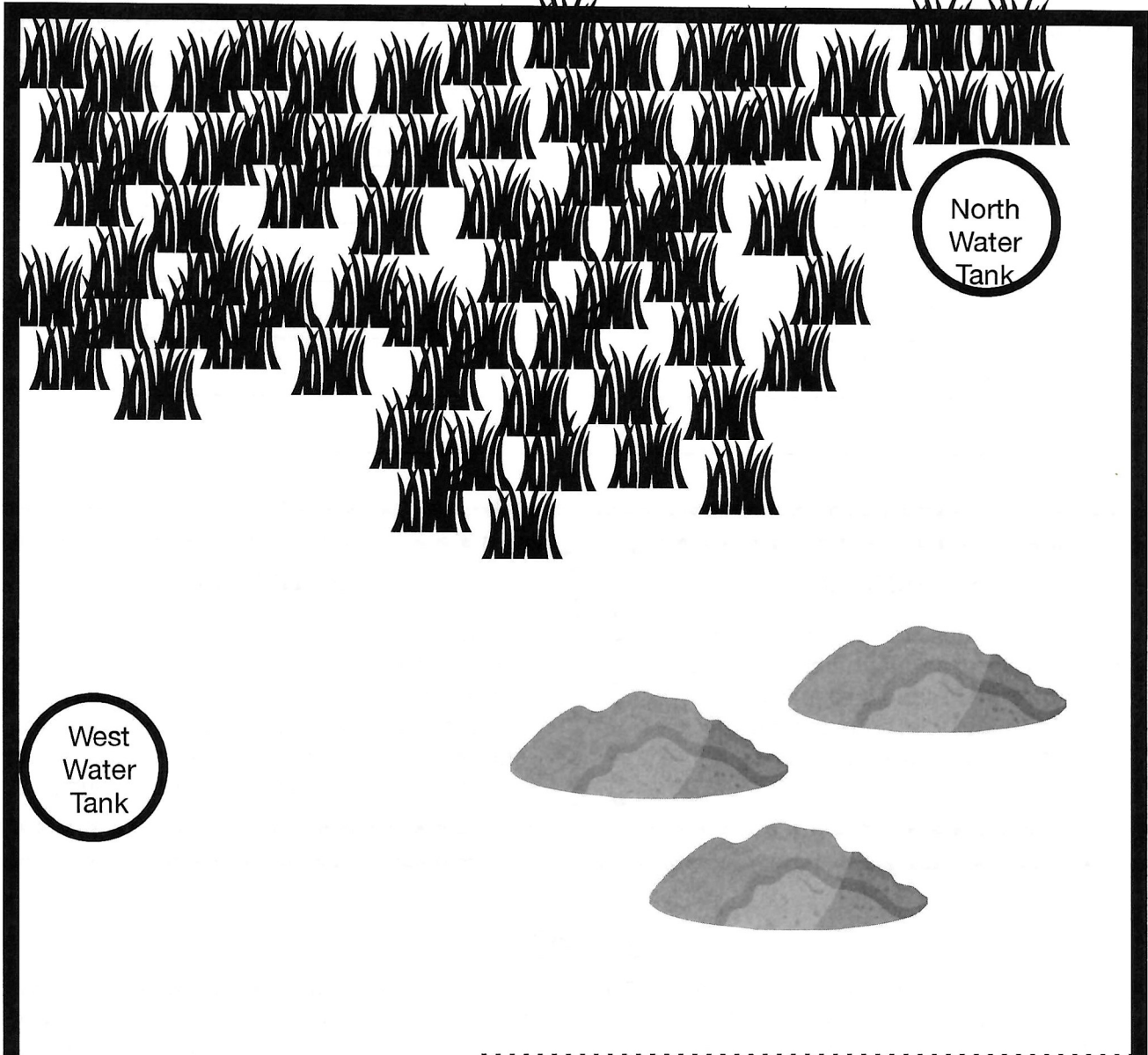
Grazing Area



Black Grama Grass - Exclusion Area



Sensitive Soil - Exclusion Area



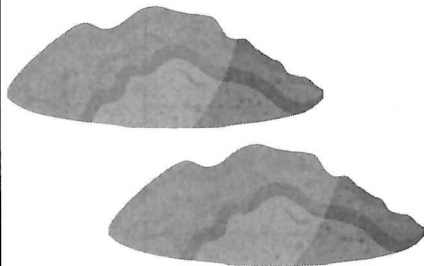
West
Water
Tank

North
Water
Tank

Make A Prediction

Circle **will** or **will not** in the sentence below.

Virtual fencing (**will / will not**) help ranchers manage their cattle and protect the Earth's natural resources.



Trial 1

Use the popsicle stick to push the marble from the West to North Water Tank in a straight line. Record your successes and failures in avoiding the “exclusion areas” for 5 attempts.

Attempt	Success in avoiding the “Exclusion Areas”	Failure in avoiding the “Exclusion Areas”
1		
2		
3		
4		
5		

EVIDENCE

Virtual fences can help ranchers reduce overgrazing and soil erosion and protect sensitive areas by excluding cattle, thus protecting Earth’s **natural resources**.

EVIDENCE

Collars warn cattle when they are near the virtual fence by producing a sound. If the cattle ignore the **cue** and continue past the virtual fence, they receive a mild electric shock. Cattle learn to turn around to avoid the electric shock after a few days.

Trial 2

Use your yarn to create a “virtual fence.” You do not have to use all of the yarn, and you can cut the yarn. Use the popsicle stick to push the marble from the West to North Water Tank while staying in the shape. Record your successes and failures in avoiding the “exclusion areas” for 5 attempts.

Attempt	Success in avoiding the “Exclusion Areas”	Failure in avoiding the “Exclusion Areas”
1		
2		
3		
4		
5		

Create an Argument For or Against Virtual Fencing

Based on the video, your experiment, and the evidence about ranching, cattle, and fencing in your journal, create an advertisement, a radio commercial, or a brochure about virtual fences and whether or not they will help ranchers better manage their cattle and protect Earth's natural resources.

What argument will you make?

Circle **will** or **will not** in the sentence below.

Virtual fencing (**will / will not**) help ranchers manage their cattle and protect the Earth's natural resources.

Drawing Space

Use this space to draw an advertisement or brochure.

Writing Space

Use this space to write your sentences.
Write for your advertisement and come up with a cool name!
Write 3-5 sentences for a radio commercial.
Write 1-2 sentences for a brochure.
