

## Cows Moo-ving Soil

### Outdoor activity for Upper Elementary

**Program Summary:** Students will model Criollo and Angus cattle feeding behaviors through an interactive game. They will evaluate how different behaviors affect plant cover and soil disturbance.

**Phenomenon:** Cattle grazing can cause soil erosion. Can ranchers adapt to this by choosing cattle types that have minimal impact?

**Time:** 30 minutes

#### Oklahoma Academic Standards for Science

2.ESS2.1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.\*

3.ESS3.1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems	ESS2.A: Earth Materials and Systems	Stability and Change
Analyzing and Interpreting Data	ESS3.B: Natural Hazards	Cause and Effect
Constructing Explanations and Designing Solutions		Influence of Engineering, Technology, and Science on Society and the Natural World
Engaging in Argument from Evidence		

#### Materials

100 red popsicle sticks and 100 yellow popsicle sticks	Photos of cattle breeds to show out
8 Cones to outline pastures	One green crayons per student optional
One worksheet per student	

## Background

Arid ecosystems are susceptible to wind and water erosion. The loss of and changes in vegetation due to drought, over-grazing, and the trampling effect of grazing animals (Baddock 2011; Miller 2017) can lead to increased wind erosion and dust emission. Some types of cattle have different foraging behaviors that may lead to varying degrees of environmental impact. The typical Angus cross is reluctant to forage very far from a water source, leading to concentrated, localized over-grazing. Also, Angus tend to concentrate grazing in areas that are easy to graze and have preferred vegetation.

In contrast, desert-adapted Criollo cattle forage farther away from water sources, may eat a broader range of plant types, and readily forage in rough terrain. The Criollo foraging behaviors may lead to a diminished environmental impact when compared to the Angus cross.

The movement of grazing animals is an important contributor to soil disturbance and erodibility of soil (Baddock 2011; Miller 2017). Ten cows passing through an area caused a 30% increase in dust emitted compared to a single cow pass. In addition, cow manure added to soil can alter the soil particle size and increase soil erodibility.

## Preparation

- Use the cones to set up two rectangular pastures measuring approx. 20ft X 30ft next to each other.
- Scatter 100 yellow sticks in one pasture and 100 red sticks in the other pasture.

## Presentation:

### 1. Introduction (5 minutes)

- a. Have you ever been outside when the wind starts getting strong and dust gets in your eyes? Where do you think this dust comes from? It comes from the ground.
- b. Trampling Effect of Cattle: Ask the students to stand up and stomp their feet in the grass. Then have them look at the ground, what effect did their stomping have. If possible have students move to a dusty area and stomp their feet again. What do they notice this time? Which location showed more effects from their stomping, the grassy area or the bare area?
  - i. Expected Answer: The bare area.
- c. The problem: Imagine you are a rancher. You have noticed that more dust devils have been appearing in your pastures and lots of dust is ending up in your house. You want to do something to help reduce the amount of dust created around you. You hear from a friend that switching what cattle breed you raise could help this issue. We will do an experiment to investigate this. However, since we don't have cows to help with the experiment, students will have to model the cows behavior.
- d. Tell students they get to be cows! Divide students into groups representing two types of cattle- Angus and Criollo. Show photos.
- e. Point out the two "pastures." Remind students what they observed when stomping their feet. You are going to graze like cows by picking up popsicle sticks, which represent grass. We are looking at how cattle grazing can affect erosion because

plants are effective at preventing soil erosion. When we stomped our feet in the grassy area, less dust was created because the grass was protecting the soil.

## 2. Game Instructions and Play Time (15 minutes)

- a. Divide students into Angus-students and Criollo-students, each group will line up at the edge of a different pasture. Students will be cows, they will eat plants by picking up popsicle sticks. Each time they move, students will walk a specific number of steps and pick up ONE popsicle stick.
  - i. Angus Behavior: Angus cattle do not like to stray far from their water source. To model this, they will only be allowed to take one step per round.
  - ii. Criollo Behavior: Criollo cattle are more willing to wander and spread out to find food, so they will be allowed 4 steps per round.
  - iii. If there is a popsicle stick/grass near the cattle that they can reach WITHOUT moving their feet, they can pick it up. They can only pick up ONE popsicle stick per round.
  - iv. Demonstrate to the students how to take steps and pick up sticks as a cow. Tell students they can only move when you say "Go" and they have to FREEZE when they are done taking their total steps (1 or 4). It helps if they all count their steps together. (No jumping, skipping, etc) Tell students they hold on to their popsicle sticks once picked up.
  - v. General Game Play: Start each round by saying "Go" or "Moooo-ve." Play for 5-7 rounds depending on the amount of time available. Stop the game when the Angus pasture has lost about 25% of its plants.
    1. At the beginning of each round, students pick a direction and walk their allotted number of steps in that same direction. They can change direction between rounds. If they get to the "edge" of the pasture before finishing their total steps then they can turn back toward the pasture.
- b. At the end of the grazing time, ask students to carry their sticks back to the starting line and place them on the ground at their feet.

## 3. Wrap Up (10 minutes)

- a. At the end of Game Play, students will analyze the results looking for differences in the Angus and the Criollo pastures. Ask students to compare what they see in each pasture. Ask students to think about what the pasture looked like before grazing. Point out that there are now some large bare patches with no grass/popsicle sticks.
- b. Have students shade in the pastures on their paper to show where grass is still growing, recording the placement of the remaining sticks. You may want to demonstrate this on your own paper.
  - i. Ask students when you remove plants what is left behind? Answer: bare ground

- ii. Ask students what pattern/s they see from the remaining sticks. Are the bare patches of ground bigger in the Angus pasture or the Criollo? Have students answer Question 1 on their worksheet.
    - 1. When cows over-graze an area and trample the ground, like in the Angus pasture, ask students to predict if there would be more or less dust created by wind erosion.
  - iii. Did the Angus cattle trample the ground more compared to Criollo? Why might this be a problem? Will one pasture have more erosion than the other? Have students answer Question 2 in their journal.
  - iv. *Expected results – in the Angus pasture, the exposed soil patches are concentrated in one area. In the Criollo pasture, the exposed soil patches are smaller and spread out.*
- c. Discussion questions:
- i. What can ranchers do to limit dust emission? Which cow would you prefer if you were a rancher here in our desert? Have a couple of students present their ideas until time to rotate to the next station. Make sure they include data / evidence in their response.

### References

- Baddock, M.C. T.M. Zobeck, R.S. Van Pelt, and E.I. Fredrickson. 2011. Dust emission from undisturbed and disturbed, crusted playa surfaces: Cattle trampling effects. *Aeolian Research* 3:31-41.
- Miller, S., S. Warren, and L. St Clair. 2017. Don't bust the biological soil crust: Preserving and restoring an important desert resource. *Science You Can Use Bulletin Issue 23*. Fort Collins, CO. Rocky Mountain Research Station. 10 p.

Scientist Name \_\_\_\_\_ Date \_\_\_\_\_

## Cows Moo-ving Soil



Criollo



Angus

Criollo pasture	Angus Pasture
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Shade in the parts of each pasture that have grass growing after the game

1. Which cattle breed pasture has smaller areas of disturbed soil?

**Angus**      **Criollo**

2. Which cattle breed do you think protects the soil better?

**Angus**      **Criollo**

Explain your answer.