

Are You This Cow's Herd?

Description

After an introduction to traits and several types of cows, students participate in a station demonstration and then visit three hands-on stations to gather data to compare a lost cow's traits to the traits of other cattle types. They analyze and interpret these data to help a rancher reunite the lost cow with her herd.

Objectives

Students will:

- Use traits to compare the lost cow (Ayuda) with individuals of various cattle types
- Analyze and interpret data in tables and graphs
- Use evidence to create and evaluate an argument about the cattle type of the lost cow

Grade Level

3rd Grade

Time

1 Hour

Phenomenon Question

Can traits of different types of cows be used to reunite a lost cow with her herd?

Cow Name Pronunciation

Rarámuri: räh-räh-mur-ē

Criollo: krē-ō-yō

Ayuda: äh-yoo-duh

Chianina: kee-a-nee-na

Background

The Rarámuri Criollo cattle bloodline goes back hundreds of years in southwestern deserts. In the 1600s, missionaries introduced Criollo to the Tarahumara Indians in the Copper Canyon area of Mexico. The Tarahumara gave the Rarámuri its name, which means “the light-footed ones.” Because the Tarahumara raised the cattle with limited outside crossing with other breeds, Rarámuri Criollo have lived in dry, hot regions in Mexico for many generations over hundreds of years. During this time, natural selection resulted in a cattle type well adapted to the desert environment.

Rarámuri Criollo cattle are easily identified by the physical traits of their horns and short hair. The short hair probably makes them more tolerant of high temperatures than other cattle. Horns may help defend against desert predators and to help cattle browse desert vegetation. Criollo are also smaller than other breeds raised in the Southwest, such as Angus. On average, Criollo cows weigh 370 kilograms (816 pounds), while Angus typically weigh 550 kilograms (1,210 pounds). Their smaller size helps them move over steep, rocky land and survive with less food.

In this lesson, we chose the rancher's name to honor Alfredo L. Gonzalez, a scientist who led some of the earliest research on the Rarámuri Criollo at the USDA-Agricultural Research Service's Jornada Experimental Range in Las Cruces, New Mexico. He and other scientists started research to determine if Rarámuri Criollo may help maintain beef production in the southwestern United States while reducing its environmental impact. Early research suggested that Rarámuri Criollo have the behavioral traits to

travel greater distances from water and spend more time traveling. Ranchers have observed that smaller framed and more mobile Rarámuri Criollo may have a lower impact on sensitive soils and vegetation.

The Sustainable Southwest Beef Project, started in 2019, is continuing to investigate Rarámuri Criollo. The project includes research at five ranches: Evergreen Ranching and Livestock in South Dakota, Dugout Ranch in Utah, Corta Madera Ranch in California, and the Jornada Experimental Range and Chihuahuan Desert Rangeland Research Center in New Mexico.

Next Generation Science Standards

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data	LS3.A: Inheritance of Traits	Patterns
Using Mathematics and Computational Thinking	LS3.B: Variation of Traits	
Engaging in Argument from Evidence		

Common Core State Standards

Mathematics

CCSS.MATH.CONTENT.3.MD.B.4 - Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

English Language Arts

CCSS.ELA-LITERACY.RI.3.1 - Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

CCSS.ELA-LITERACY.RI.3.2 - Determine the main idea of a text; recount the key details and explain how they support the main idea.

CCSS.ELA-LITERACY.RI.3.7 - Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

CCSS.ELA-LITERACY.RL.3.1 - Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

Materials / Student Needs

- Science Journal [one per student]
- 9 Rulers
- 6 highlighters
- 3 pieces of string (12 inches each)

- Anchor Charts (optional)
- Markers
- 1 Yardstick
- Horn posters (Fig. 1)
- Station task cards [three sets]
- PowerPoint presentation
- Computer (with internet and YouTube capability) and projector for educator
- Criollo Video: <https://youtu.be/ZgGli8cosr8>
- Reunion Picture (Ayuda and her mother)

Preparation

1. Print and (optional) laminate three sets of the station task cards.
2. Cut, tape, and (optional) laminate the horn posters for Horn Width demonstration (Fig. 1).
3. Cut three 12-inch pieces of string for the Height station.
4. Set up a computer and projector to display the PowerPoint presentation.
5. OPTIONAL: Make “Anchor Chart A,” “Anchor Chart B,” and “Anchor Chart C” (Figures 2, 3, and 4). These can also be drawn on the board.
6. Gather materials for the Horn Width Demo: cow horn posters and yardstick
7. Set up nine stations (three copies of the three stations) around the room with the following materials at each station.
 - a. Ear Length Station: task card, cow ear cards, two highlighters, and ruler
 - b. Hair Length Station: task card, hair lengths card, and ruler
 - c. Height Station: task card, multiplication card, 12-inch piece of string, and ruler
8. Print and staple three-page science journals [one per student].

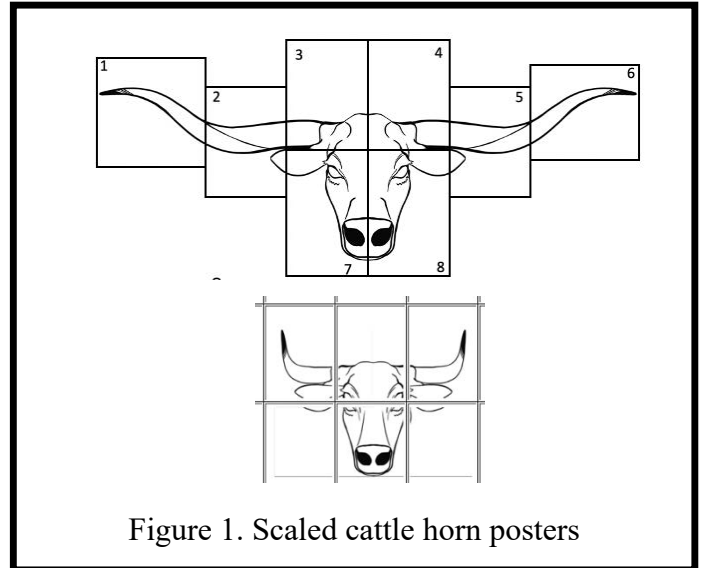


Figure 1. Scaled cattle horn posters

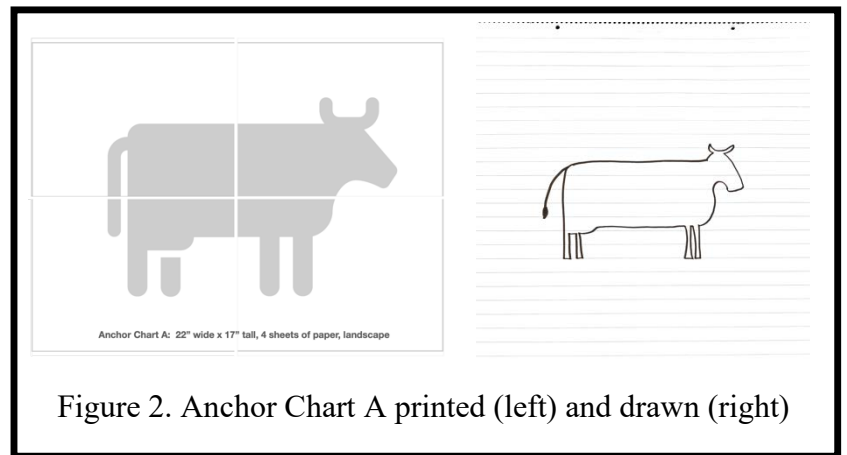


Figure 2. Anchor Chart A printed (left) and drawn (right)

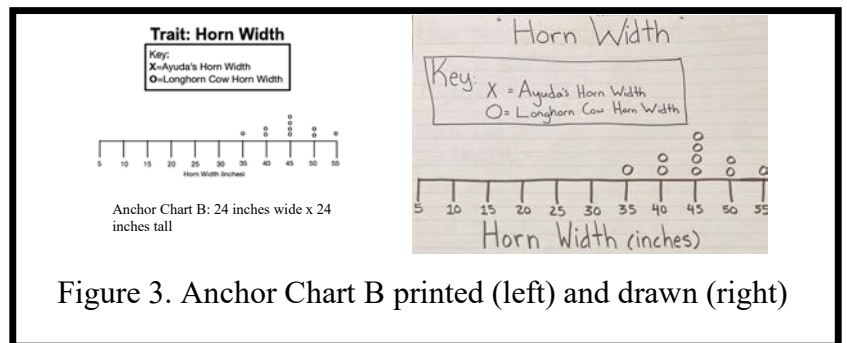


Figure 3. Anchor Chart B printed (left) and drawn (right)

Program Structure

1. Introduction to the lesson (5 minutes)
2. Cow traits and cattle types (5 minutes)
3. PowerPoint storytime and demonstration of horn width station (15 minutes)
4. Activity stations (15 minutes)

5. Reviewing data from the stations (5 minutes)
6. Criollo video and discussion (5 minutes)
7. Creating an argument from evidence (10 min)

Procedures

Introduction and Activating Prior Knowledge (5 minutes)

1. **Slide 1:** Today, we will be doing the lesson, "Are You This Cow's Herd?"
2. **Slide 2:** As a third-grader, you have observed many things, including people and dogs. Do you think that all people look the same as one another? What about dogs? Do you think that all dogs look the same as one another?
3. **Slide 3:** Think about Labrador Retrievers and Weiner Dogs (Dachshunds). Do they look the same?
 - a. [Click to advance.] These dogs have different traits or characteristics. Variations in traits are what make you look different from other people you may know in your family. Variation in traits also makes these two different types, or breeds, of dogs look very different too.
 - b. Even with variation in many traits, though, people are all still humans, and the Labrador Retriever and Weiner Dog [Click to advance] are still dogs.
4. **Slide 4:** Today, we will investigate the variation of traits found in cattle (or cows) by being rangeland scientists! A rangeland scientist studies how wild and domestic animals, like cows, use large landscapes for grazing and other purposes. We will collect evidence to solve a mystery and help a rancher named Alfredo find a lost cow's mother and herd or family.
5. **Slide 5:** What do you already know about cows?
 - a. We will help Alfredo with a lost cow named Ayuda, which means "help" in Spanish.
 - a. They need to find the right pasture to be able to find Ayuda's mother and herd.
 - b. Let's see what you already know about cows.
 - i. What are some traits of cows? What do they look like?
 - ii. Use "Anchor Chart A" or a cow outline drawn on the board to write down the student-generated terms (e.g., calf, cow, herd, horns, hooves, coat/hair, produce milk, etc.).

Cow Traits (5 minutes)

1. **Slide 6:** Do all cows look alike?
2. **Slide 7:** Show students the cattle types.
 - a. These are the same cattle types students will see in the activity stations.
 - b. Have students share what differences and similarities they see.
3. **Slide 8:** Tell students these characteristics they observed are called **traits**. Traits are characteristics that can be **inherited** or passed down from a person's or animal's parents.
4. **Slide 9:** Because many traits are inherited, we can use this information to help solve a mystery by the end of the lesson today.

PowerPoint Story Time (15 minutes)

1. **Slide 10:** Storytime!

Use the data you collected at each station. What are Ayuda's traits?

horn width = _____ inches ear length = _____ inches

hair length = _____ inches height = _____ inches

Cattle Type
Does Ayuda Share These Traits?

Trait	Longhorn	Brahman	Highland	Charolais	Criollo
Horn Width	Yes No	Yes No	Yes No	Yes No	Yes No
Ear Length	Yes No	Yes No	Yes No	Yes No	Yes No
Hair Length	Yes No	Yes No	Yes No	Yes No	Yes No
Height	Yes No	Yes No	Yes No	Yes No	Yes No

Anchor Chart B: 24 inches wide x 40 inches tall

Use the data you collected at each station. What are Ayuda's traits?

horn width = _____ inches
ear length = _____ inches
hair length = _____ inches
height = _____ inches

Does Ayuda share these traits?

Trait	Longhorn	Brahman	Highland	Charolais	Criollo
Horn width	Yes No	Yes No	Yes No	Yes No	Yes No
Ear length	Yes No	Yes No	Yes No	Yes No	Yes No
Hair length	Yes No	Yes No	Yes No	Yes No	Yes No
Height	Yes No	Yes No	Yes No	Yes No	Yes No

Figure 4. Anchor Chart C printed (left) and drawn (right)

- a. [Click to advance] Alfredo, a young rancher, finds a cow wandering on his family's ranch.
2. **Slide 11:** The cow looks familiar, but he knows it doesn't belong on his ranch since they are ostrich farmers.
3. **Slide 12:** Alfredo has an idea. He can visit some cattle ranches to help return this cow to her mother and herd.
4. **Slide 13:** Alfredo notices that this cow has a collar with a nametag that says "Ayuda." He asks Ayuda if she knows where her mother is.
5. **Slide 14:** The cow, of course, doesn't answer but is friendly to Alfredo.
6. **Slide 15:** Alfredo isn't sure where to start, but he is determined to help Ayuda get back to her mother and herd.
7. **Slide 16:** They need a **rangeland scientist** to help.
 - a. [Click to advance] Will you help Alfredo and Ayuda?
8. **Slide 17:** Alfredo and Ayuda will go to the different ranches to compare Ayuda's traits to the traits of cattle at the ranch.
 - a. [Click to advance] You will follow their journey by going to four stations to represent the four ranches they will visit.
 - b. Pass out the science journals to students and have them put their names at the top.
9. **Slide 18:** At each station, students should read the comic and follow the instructions to complete the tasks at the station and answer the questions in the journal.
10. **Slide 19:** Let's do the first station together: Horn Width
 - a. Ayuda and Alfredo visit this ranch and meet a Longhorn cow.
 - b. First, we will read the comic and then follow the instructions to do the tasks and answer questions in the science journal.
11. **Slide 20:** Horn Width Comic
 - a. Notice the title at the top of the comic (Trait: Horn Width).
 - b. *Read aloud while pointing to each panel on the comic:*
 - i. Turn to page 1 in your science journal for the section Trait: Horn Width. Show students where to find the page number in the bottom right corner of the page.
 - ii. Longhorn cows have the trait of wide horns.
 - iii. Step 1: Measure Ayuda's horn width and write an X on the line plot.
 1. Have one or more students help use the yardstick to measure Ayuda's horn width.
 2. Use "Anchor Chart B" or a line plot drawn on the board to mark an X for Ayuda's horn length (Answer: between 17 and 19 inches).
 - iv. Step 2: Measure the Longhorn's horn width and write an O on the line plot.
 1. Have one or more students help use the yardstick to measure the Longhorn's horn width.
 2. Use "Anchor Chart B" or a line plot drawn on the board to mark an O for the Longhorn's horn length (answer: between 45 and 48 inches).
 - v. Step 3: Next, observe all of the Longhorn cows on your line plot represented by an O.
 - vi. Step 4: Answer questions 1, 2, and 3 in your science journal. Leave everything at this station as you found it.
12. **Slide 21:** Now, let's use our data (as shown on the line plot) to help us answer the questions on the first page of your science journal.
 - a. **Question 1:** How many cows have horns that are wider than 35 inches?

- i. Help students answer the question by modeling to NOT count the O at 35 and to INCLUDE the O they added to the line plot. (Answer: 10 cows)
 - b. **Question 2:** Are most Longhorn horns wider, narrower, or the same as Ayuda’s horn width? (Answer: Wider)
 - c. **Question 3:** Based on the trait of horn width, do you think Ayuda is a Longhorn cow?
 - i. While most students will likely answer “No,” the other two answers are still possible. Ask your students to explain their reasoning. For example, a student might say “Maybe” because we can see from the data that there is **variation** in the Longhorn horn widths, from 35 inches to 55 inches. It is possible, but probably not likely, that Ayuda is a Longhorn with unusually narrow horns for this cattle type.
- 13. **Slide 22:** Now that you have done one station together, students are ready to visit the other three “ranches” with a partner. Go over the guidelines with students:
 - a. You will work in partner pairs.
 - b. You will have 15 minutes to visit the remaining three stations. Note: Some groups may need up to 20 minutes to work through all three stations.
 - c. There are three sets of the three stations. Make sure you visit three different stations.
 - d. Here are the rules:
 - i. No running.
 - ii. Complete the task at the station and leave the station neat.
 - iii. Complete your work in your journal before moving to the next station.
 - iv. There is a limit of TWO groups per station, but one group per station is better.

Activity Stations (15 minutes)

Ear Length Station

- Ayuda and Alfredo meet a Brahman cow. Brahman cattle have very large ears. Students will help Alfredo measure the ear length of Ayuda and the Brahman cow.
 - Questions on the worksheet:
 - Table: Ayuda’s ear length (Answer: 5 inches)
 - Table: Brahman ear length (Answer: 8 inches)
 - Question 4. What is the difference in length between Ayuda’s ear and the Brahman cow’s ear? (Answer: 3 inches)
 - Question 5. Based on the trait of ear length, do you think Ayuda is a Brahman cow?

Hair Length Station

- Ayuda and Alfredo meet a Highland cow. Highland cows have very long hair. Alfredo and students measure the length of the Highland cow’s hair and Ayuda’s hair.
 - Questions on the worksheet:
 - Table: Ayuda’s hair length provided (Answer: 2 inches)
 - Table: Highland’s hair length provided (4¼ in., 4½ in., 4 in.) and fill in the blanks (3½ in., 4 in., 3¾ in.)
 - Question 6. What is the most common whole-number length of hair for the Highland cows? (Answer: 4 inches)
 - Question 7. Based on the trait of hair length, do you think Ayuda is a Highland cow?

Height Station

- Ayuda and Alfredo meet a Chianina cow (pronounced kee-a-nee-na).

- Chianina cows are very tall. Alfredo measures the height of Ayuda and the Chianina cow using a piece of string he found in his pocket. Ayuda is four strings tall, and the Chianina is six strings tall. Measure the length of string and multiply by 4 to get the height of Ayuda and multiply by 6 to get the height of the Chianina cattle type.
 - Questions on the worksheet:
 - Length of string (Answer: 12 inches)
 - Chianina's height (12 in. x 6 = 72 inches)
 - Ayuda's height (12 in. x 4 = 48 inches)
 - Question 8. Which cow is taller? (Answer: Chianina cow)
 - Question 9. Based on the trait of height, do you think Ayuda is a Chianina cow?

Review Data Collected from Stations (5 minutes)

- When students have finished the three stations, have them return to their seats.
- Use "Anchor Chart C" or a table you have drawn on the board to assist students in using the data table in their journals.
- Slide 23:** Ask students to help you fill in the blanks with Ayuda's data by going back to the data they collected in their journals from each station. Fill in Anchor Chart C as students report the following data.
 - Ayuda's horn length (page 1 of journal): 18 inches
 - Ayuda's ear length (page 1 of journal): 5 inches
 - Ayuda's hair length (page 2 of journal): 2 inches
 - Ayuda's height (page 2 of journal): 48 inches
 - You've collected data from three other breeds of cattle. Let's review what you discovered.
- Slide 24:** Using Ayuda's data, ask students if Ayuda shared the trait as the cow type from each station and circle either "yes" or "no." [Answer: Ayuda does not share any of the traits with the Longhorn, Brahman, Highland, or Chianina cattle.]
- Slide 25:** Have students turn to page 3 of their science journal to copy information from "Anchor Chart C" to their journal. You'll notice that there is one more cattle type on the table: Criollo (pronounced krē-ō-yō). Let's continue our story and visit the ranch with Alfredo and Ayuda.

Use the data you collected at each station. What are Ayuda's traits?

horn width = _____ inches ear length = _____ inches

hair length = _____ inches height = _____ inches

Trait	Cattle Type				
	Longhorn	Brahman	Highland	Chianina	Criollo
Horn Width	Yes No				_____ inches
Ear Length		Yes No			_____ inches
Hair Length			Yes No		_____ inches
Height				Yes No	_____ inches

Criollo Video and Discussion (5 minutes)

- Slide 26:** Alfredo and Ayuda travel to the last ranch ...
 - [Click to advance] When they get to the ranch that is supposed to contain Criollo cattle, they are nowhere to be seen.
 - [Click to advance] Luckily, Alfredo has his phone with him and is able to pull up a YouTube video about the Criollo cattle.
 - [Click to advance] We will watch this video now to see if Ayuda shares any traits with the Criollo cattle.
 - Use the link to play the video. (<https://youtu.be/ZqGli8cosr8>)
- When asked to pause to think about Criollo traits, help students add data from the paused video screen to the last column on the data table on page 3 of their journal (also on Anchor Chart C).

3. Ask students if these measurements were the same or similar to Ayuda's. [Answer is similar.]
 - a. We don't expect that Ayuda will look EXACTLY like her mother or other Criollo in her family, but we expect that her inherited traits will be more similar to cows in her family than to other types of cows – just like we expect a young wiener dog will look more like an older wiener dog than like a young Labrador Retriever.
 - b. Un-pause the video and continue watching.

Creating an Argument from Evidence (10 minutes)

1. You have helped Alfredo collect a lot of information about Ayuda and other cattle.
2. Now it's time to make a claim that is supported by the evidence you collected. You will write two sentences providing evidence to support the type of cow you believe Ayuda is and why.
 - a. Students may explain their reasoning based on the traits that she does not have compared to the other cattle types or her traits that are similar to a Criollo cow.
 - b. Students can be provided the sentence stems of, "I think that Ayuda is a ___ cow. Ayuda has the trait of ___."
3. Assist students in writing their two sentences with evidence from their investigation. When students have finished writing, have them talk to an elbow partner about their answers.
 - a. OPTIONAL EXTENSION: If there is more than an hour available for the lesson, you can have all students present the sentences they've written to the whole class.
4. Have students answer the final question on the worksheet: Do you think that your argument from the evidence is strong for the type of cow Ayuda is? Yes/No
5. Reveal that Ayuda is a Criollo cow, and show how similar her traits are to the average traits of Criollo.
6. Tell the students that we have successfully found Ayuda's herd, and she is now reunited with her mom and herd! Show students the "Reunion Picture" of Ayuda and her mother.

Additional Information About Criollo and Other Cow Types

Anderson, Dean et al. *Criollo cattle: Heritage Genetics for Arid Landscapes*. Society for Range Management. 2015. (Discussion of history/ancestry of Criollo cattle, their well-adapted traits and potential for improving resiliency of dryland ranching industry.)

Decker, Jared E. et al. *Worldwide Patterns of Ancestry, Divergence, and Admixture in Domesticated Cattle*. PLOS Genetics. 2014. (Scientific study of domestic cattle genetics finds evidence of Iberian and North African ancestry in American Criollo cattle.)

Dunmire, William W. *New Mexico's Spanish Livestock Heritage*. University of New Mexico Press. 2013. (Includes history of early livestock importation from Iberia and the Canary Islands to the Caribbean and then mainland Mexico.)

Elias, E., Aney, S., Duff, G., Spiegel, S., et al. 2020. *Snapshot of rancher perspectives on creative cattle management options*. *Rangelands*, 42, 191-195.

Estell, R.E. et al. *Increasing Shrub Use by Livestock in a World with Less Grass*. *Rangeland Ecology & Management*. 2012. (Discussion of Criollo's potential usefulness due to their evolution and adaptation to arid environments and their specifically well-adapted traits.)

McIntosh M.M, Cibils AF, Nyamuryekung'e S, et al. 2020. *A Phenotypic Characterization of Raramuri Criollo Cattle Introduced into the Southwestern United States*. *Archivos Latinoamericanos De Produccion Animal*. 28:111-119.

Nyamuryekung'e, S., Cibils, A.F., McIntosh, M., et al. 2021. *Foraging behavior of heritage versus desert-adapted commercial rangeland beef cows in relation to dam-offspring contact patterns*. *Rangeland Ecology & Management* 74, 43-49.

- Peinetti, H. Raul et al. *Foraging behavior of heritage versus recently introduced herbivores on desert landscapes of the American Southwest*. Ecosphere. 2011. (Study at Jornada Experimental Range demonstrating the contrast between Criollo and Angus abilities to exploit scarcer resources.)
- Russell, N.D. et al. *Genetic differentiation among geographically isolated populations of Criollo cattle and their divergence from other Bos Taurus breeds*. New Mexico State University. 2000. (Genetic study of criollo cattle, their fitness in desert landscapes, and their rich genetic diversity.)
- Scasta, John Derek et al. *Drought Mitigation for Grazing Operations: Matching the Animal to the Environment*. Society for Range Management. 2016. (Discusses Criollo cattle's fitness for desert landscapes.)
- Spiegel, S., A.F. Cibils, B.T. Bestelmeyer, et al. 2020. *Beef production in the southwestern United States: strategies toward sustainability*. Frontiers in Sustainable Food Systems 4 (114).