

Teacher's Guide

Welcome to Topic 2, Upcycling, of the *Exploring the Path of Beef Sustainability* Reader Series! This guide is here to help teachers like you make the most of this educational resource. We've divided it into sections and have some suggestions to make learning more enjoyable for your students.

Reader QR Code Links:

If your students are unable to use QR codes in the classroom here are the links to share in alternative ways.

- EdPuzzle: <https://bit.ly/47wMdaz>
- Byproducts: <https://bit.ly/3PAdOkT>
- Help Wanted Career Paths: <https://biwfd.com/3v918tp>
- Best Beef Sort: <https://bit.ly/3sn8eJF>
- How Cows Eat Grass worksheet: <https://biwfd.com/3GSGOiD>

Vocabulary Words

There are seven vocabulary words to be found throughout the reader. They are bold with a small explanation to help define the word. Other ways to learn more:

- Have your students find the definitions of the words on their own before reading.
- Draw pictures of the words which will help them make meaningful connections.
 - 30 second video that could be used to get students discussing why some land is only usable to cattle: <https://beef.widen.net/s/zb597vwjf9/r4-caption-v1>

Page 2

This page delves into how cattle transform non-digestible materials into usable products. Students will:

- Explore the distinctive stomachs and digestion abilities of cattle, engaging with an EdPuzzle that includes integrated questions. To access the video and record student responses, create a free educator EdPuzzle account.
 - **EdPuzzle Answer Key**
 1. 1,825,00 tons
 2. Answers will vary. E.G. consideration of why having happier, healthier cattle would be important to the farmer, consumer, etc...
 3. False
 4. Answers will vary. E.G. Less waste, use of materials that would otherwise go to a landfill, etc...
- Consider incorporating a lesson on various cattle byproducts used in daily life. For more in-depth exploration, utilize the ["Do You Know Your Moo?" Breakout Box](#) covering byproducts and additional cattle knowledge.
- Additional videos from the CLEAR Center at UC Davis vividly illustrate how cattle consume unconventional products:
 - <https://www.youtube.com/watch?v=GMTWp4tMMso>
 - <https://www.youtube.com/watch?v=RNRZmyUimkl>
 - https://www.youtube.com/watch?v=KNp_6sBr1Xc

- If you teach high school or have middle school students interested in this topic, the two articles below would be excellent resources. Utilize them to construct C.E.R.'s, research projects, etc.
 - <https://clear.ucdavis.edu/explainers/cattle-and-land-use-differences-between-arable-land-and-marginal-land-and-how-cattle-use>
 - <https://www.kansasbeef.org/on-the-farm/what-do-cattle-eat-in-the-winter>

Page 3

This page encourages student interaction with previously learned information. Students can:

- Use the QR code to access the *Best Beef Sort*. They will be prompted to make a copy – this is how it should be. As an educator, you can also create a copy and assign it via Google Classroom or your preferred LMS platform.
 - **Beef Sort Answer Key**
 - Things that come from cattle: Steak, Baseball Mitt, Band-Aids, Soccer Ball, Leather of Sneakers/Tennis Shoes, Marshmallows, Paintbrushes, Cheese, Tennis Racket Strings, Dice, Glue
 - Things from other animals: Eggs, Yarn
- Explore potential careers in agriculture, encouraging students to research and present on a career of their choice. The Ag Career cards provide a starting point, but numerous career options are available beyond those listed.

Page 4

The Ruminant Stomachs Lab offers insight into the structure and function of cattle and other ruminant stomachs.

- Understand ruminant stomach components, food processing, and why ruminants consume foods that are not suitable for human consumption.
- Encourage students to use graphics and reader insights to write a concise C.E.R. connecting the lab to beef sustainability.

Enjoy the journey through the Beef Sustainability Reader Series and have fun teaching your students!

Suggested Uses:

This reader can be used as a stand-alone activity, or you can pair it with other Kansas Beef Council offerings – bit.ly/46ao8p3

- Ideal for substitute teacher activities
- A valuable addition to science or STEM curriculum
- Suitable for small reading groups or reading centers
- Promotes the integration of science and reading
- Encourages career exploration
- Provides engaging content for filling time after quizzes and tests
- A valuable after-school resource for extended learning opportunities

Next Generation Science Standards (NGSS)

Middle School Science

- MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

High School Science

- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Reader Citations

Page 2. Upcycling.

- Baber, J.R. et al., 2018. Estimation of human-edible protein conversion efficiency, net protein contribution, and enteric methane production from beef production in the United States. *Trans. Anim. Sci.* 2: 439-450.
- EdPuzzle video. Whatcomfamilyfarmers.org.

Page 3. What Is Upcycling and What Does It Look Like?

- Baber, J.R. et al., 2018. Estimation of human-edible protein conversion efficiency, net protein contribution, and enteric methane production from beef production in the United States. *Trans. Anim. Sci.* 2: 439-450.
- Brooks, Ashley et al. 2017b. Corn as Cattle Feed vs. Human Food. OSU Extension ANSI-3296.
- USDA-NASS. 2021a. Crop Production 2020 Summary. Found on: Crop Production 2020 Summary 01/12/2021 (cornell.edu)
- United States Census Bureau. 2010. State Area Measurements and Internal Point Coordinates. Available at: <https://www.census.gov/geographies/reference-files/2010/geo/state-area.html>

Page 3. Possible Career Paths

- AgCareers.com

Page 3. Food Waste

USDA, 2022. Food Waste FAQs. <https://www.usda.gov/foodwaste/faqs>

Series written by Jessica Sadler, Science Educator and STEAM Facilitator

Series brought to you by beef farmers and ranchers from across the U.S.



Name: _____

Inside the Lab: Ruminant Stomachs

During this lab, you will construct a model of the “rumen,” which is one of the four parts of a ruminant animal’s stomach. Be sure to complete the *How Cows Eat Grass* worksheet on page 3 of the Reader before this Lab.

Rumen: The first large compartment of the stomach of a ruminant in which cellulose is broken down by the action of symbiotic microorganisms

Pre-Lab Questions:

1. Ruminant animals have bugs in their stomachs just like us. What are those “bugs” called?

Microbes, Microorganisms, or Bacteria

2. What might happen if those bugs were not in their stomach?

Without microbes, the ruminant digestive system would shut down and the animal would starve to death.

3. Why do you think ruminant animals need four different parts for their stomach?

Answers will vary. E.G. since cattle eat grass and other roughage, one stomach, like a human’s, would be insufficient. Ruminants use the four different compartments to break down foods, get the most nutrients, and pass waste more easily.

4. How are ruminant stomachs alike and different compared to the human stomach?

Answers will vary. E.G. both have stomachs and bacteria, different amounts of chambers, process different foods, etc...

Name: _____

ACTIVITY: How Cows Eat Grass Knowledge Check Answer Key

1. What is the definition of digestion?

Process our bodies use to break down and absorb nutrients stored within food

2. List the four main parts of a cow's stomach.

Reticulum, Rumen, Omasum, and Abomasum

3. Create a LABELED diagram of a cow's mouth anatomy using the information from the "Eating" paragraph.

4. Diagram 2 displays a dog's stomach. Dogs are "monogastric." Name three other monogastric animals.

Answers will vary but could include: Horses, pigs, humans, cats, poultry, rabbits etc...

5. List three examples of other ruminant animals.

Answers will vary but could include: Sheep, goats, moose, camels, deer, giraffes, bison

6. What is the most common microorganism found in the rumen?

Bacteria

7. Summarize in 3-4 sentences, using information from the article, why cattle can digest materials and by-products that aren't suitable for humans.

Answers will vary.