National Agriculture in the Classroom

Relevancy and Engagement: agclassroom.org

The Remarkable Ruminant

Grade Level(s)

6 - 8

Estimated Time

3 hours

Purpose

In this lesson, students will follow the farm to fork process of producing beef, learn how cattle and other ruminants convert grass into nutrient-rich foods such as milk and meat, discover ways cattle recycle food waste, and identify careers in the beef cattle industry.

Materials

Interest Approach:

- Energy Chain image to display

Activity 1:

- LCD projector or TV to display PowerPoint presentation
- *Beef Life Cycle Board Game*, 1 copy per student
- *Beef Life Cycle* PowerPoint

Activity 2:

- Example rangeland images to display
- A Cow's Digestive System video
- *Remarkable Ruminant* handout, 1 per student

Activity 3:

- *Food Waste Scenarios* printout, 1 copy per class
- *Finding Value in Food Waste* printout, 1 copy per class

Activity 4:

- Blank sheet of paper, 1 per student

Essential Files (maps, charts, pictures, or documents)

- Food Waste Scenarios
  [https://naitc-api.usu.edu/media/uploads/2017/12/19/Food_Waste_Scenarios.pdf]
- Remarkable Ruminant handout
  [https://naitc-api.usu.edu/media/uploads/2017/11/09/Remarkable_Ruminant_handout.pdf]

- Mapping Out Commodities and Byproducts (Optional Enriching Activity)
  [https://naitc-api.usu.edu/media/uploads/2017/11/09/Mapping_Out_Commodities_and_Byproducts.pdf]
- Beef Life Cycle PowerPoint
  [https://naitc-api.usu.edu/media/uploads/2017/11/07/Beef_Life_Cycle.pptx]
- Beef Life Cycle Board Game
  [https://naitc-api.usu.edu/media/uploads/2017/11/07/Beef_Life_Cycle_Board_Game.pdf]
- Finding Value in Food Waste
  [https://naitc-api.usu.edu/media/uploads/2017/11/08/Finding_Value_in_Food_Waste.pdf]

Vocabulary

byproduct: an incidental or secondary product made in the manufacture or synthesis of something else

calf: the name for baby cattle

feedlot: a type of farm operation where cattle are fed balanced feed rations in preparation for harvesting

forage: bulky food such as grass or hay typically consumed by livestock

heifer: female bovine that has not produced a calf

rangeland: open country used for grazing or hunting animals

ruminant: an animal with a four-compartment stomach

steer: male bovine that has been castrated

Did you know? (Ag Facts)

- When beef cattle are harvested, approximately 98% of the animal is used for meat or other byproducts such as leather, glue, soap, insulin, or gelatin.[1]
- Disneyland in California sells over 4 million hamburgers each year.[1]
- The United States and Brazil are the top beef producing countries in the world.[2]
- More than 100 medicines, including insulin come from cattle.[2]

Background - Agricultural Connections

Beef From Farm to Fork
Beef cattle grow from young **calves** to mature **steers** or **heifers** in 14-18 months. Calves can be born any month of the year, but spring is the most common season. After a calf is born it will spend the first few months of its life side-by-side with its mother. The calf receives its nutrition from its mother's milk. As the calf grows, it will also begin to eat grass, hay, or other **forages**. When the calf reaches six to eight months of age, the calf will be weaned, or separated from its mother. The growing calf will continue to eat grass and other forages as it grows. Beef cattle typically spend the majority of their lives on private or public **rangelands** where their diet consists of grass and other forages. For most beef cattle, their final stage of growth takes place at a **feedlot** where their diet consists mostly of corn and hay which has higher nutrient density than most rangelands. This final stage of growth prepares the animal for harvesting. Once the animal is harvested, it is processed into various meat cuts, such as steak or roast, or processed into hamburger, a form of ground or chopped beef formed into the familiar patty of a hamburger or cheeseburger. The beef is then sold to consumers at a retail outlet, like a grocery store or a restaurant, completing the farm to fork journey.

Cattle Digestion
Along with animals such as goats, sheep, buffalo, deer, elk, giraffes, and camels, cattle have a four compartment stomach. The function of these four compartments allow cattle to physically and chemically digest food that cannot be utilized by humans or animals that only have a simple stomach with one compartment (monogastrics). The **ruminant** digestive system of cattle actually helps us use feed resources that would otherwise be discarded as waste. These waste products are known as **byproducts** or incidental products created by the manufacture of something else. An example is a potato peel. French fries are consumed regularly across our country. What happens to all the potato peels? The *Ore-Ida French Fry* processing plants in Oregon and Idaho send their potato

peels to be consumed by cattle in feedlots. The cattle eat the potato peels and convert a waste product into beef, a food rich in zinc, iron, and protein. In summary, humans cannot digest the majority of what cattle eat. They turn something of little value to humans (like grass) into highly nutritious beef.

When properly managed, cattle can also improve the quality and health of the rangelands where they live and graze. Typically, rangelands are located in areas that are too rocky, steep, or otherwise ineffecient for growing human food crops. Keeping this land in grass prevents soil erosion. Cattle also provide natural fertilizer for the land in the form of manure.

Careers
The entire farm to fork journey of beef products requires the joint efforts of many different careers. Farmers and ranchers, food processors, and transportation specialists each work with a team of people to produce, process, and transport beef products to be enjoyed by consumers.

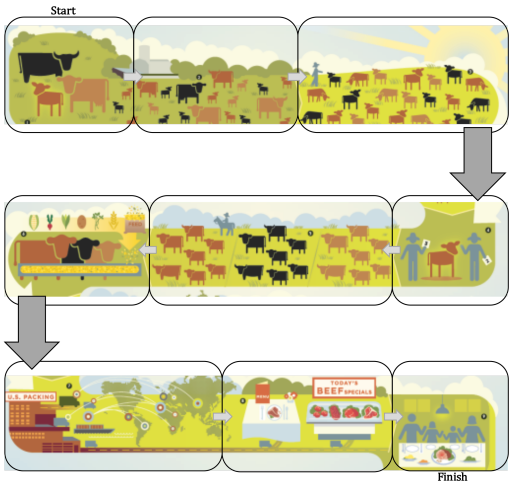
Interest Approach – Engagement

1. Ask students, "Can you name something that can convert grass into nutrient-rich foods that we eat?"
2. After students have time to think and offer answers, display the following image and add sunlight to the equation. "Energy comes from the sun and produces grass. Humans cannot digest and gain essential nutrition from grass. What *can* convert grass into foods like meat, milk, and other dairy products?"

3. The answer is livestock. Specifically, animals like sheep, goats, and cattle that have a unique digestive system allowing them to break down the cellulose in plants. Today they will be learning about the digestive system of cattle and other ways cattle recycle and conserve resources while producing nutrient-rich food.

Procedures

Activity 1: Beef From Farm to Fork



1. Explain to students that there are many processes in our life that follow a specific cycle from start to finish. Cattle, the source of our beef, go through a variety of steps from start to finish. This brief activity will explain and illustrate what cattle eat and where they live as they grow and mature.
2. Distribute the *Beef Life Cycle Board Game*, one per student.
3. Open the attached *Beef Life Cycle* PowerPoint.
4. Read through the instructions with the students and go through the PowerPoint as they take notes on their game board.
5. After finishing the worksheet, have students write a “$2 summary” of the lesson on the back of their game board. Each word is worth 10 cents, and students must write until they reach $2.
   - This summary activity can be scaffolded by giving students specific words related to the learning that they must include in their summaries. You may also increase to any amount of money to require additional length. Possible words to include in the summary include: beef life cycle, calves, ranch, feed yard, harvest, or supermarket.

Activity 2: The Remarkable Ruminant

1. Ask students, "How many people currently live on the earth?" Accept an answer of approximately 7 billion or go to the World Population Clock for a more precise answer. Follow up by asking students if the world population is expected to increase or decrease in coming years. *(increase)*
2. Conclude with students that it is, and will become, increasingly important to use our land wisely to provide homes, food, space, and resources for a growing population.
3. Ask, "Can we use ALL of our open space to grow crops for food?" Display the following images for illustration.



4. Ask students:
   - Is some land too dry or too wet for crop growth?
   - Is some soil too rocky or sandy to grow crops?
   - Could steep inclines or cold climates prohibit a farmer from growing crops successfully?
5. Ask students to think back to what they have learned so far. Could the land that is unsuitable for crop farming be used by cattle (or sheep) to produce food? (Yes!) Tell students that this is possible due to a unique digestive system. Show the video clip, A Cow's Digestive System (1:35 mins).

6. Distribute the *Remarkable Ruminant* handout to students. Instruct students to read the article on page 1 and highlight each example they find of ways cattle convert otherwise unusable resources into useable resources. Students will then complete pages 2 and 3 of the worksheet.

Activity 3: How Cattle Recycle

Preparation: Prior to class, print 1 copy of the attached *Food Waste Scenarios*. Cut scenarios into individual strips and save until you reach step three. Print 1 copy of the attached *Finding Value in Food Waste* and cut into eight individual strips. Distribute the slips around the room before students arrive. You can leave them visible or hide under chairs, tape to the walls, etc.

1. Ask students to brainstorm all of the places where food goes to waste. Students will likely think of uneaten food at their home, school cafeteria, or restaurants. Once students have exhausted their own ideas, provide a prompt. Ask, "When you are preparing food at home is there any portion of the food that you throw away?" Provide examples such as:
   - Do you ever peel a fruit or vegetable and throw away the peel?
   - Do you ever throw away the core of an apple or the rind of a watermelon?
   - Do you always eat the heel/crust of a loaf of bread?

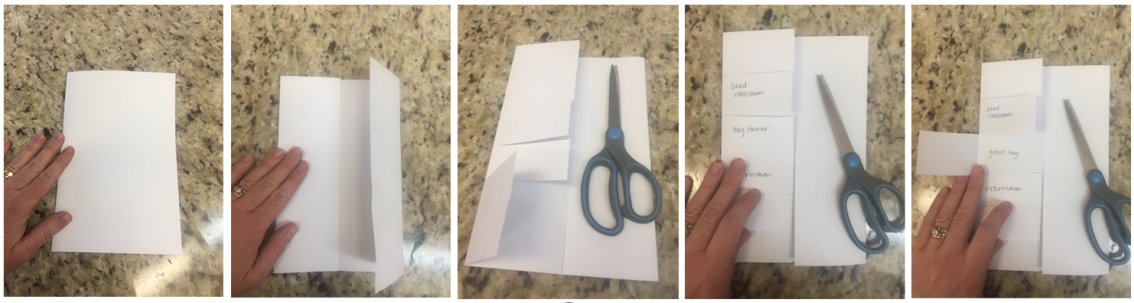
2. Point out that on a house-by-house basis, the amount of food waste may be relatively small (though potentially impactful). Ask students to think about the waste from a large food processing facility. Ask, "Are there food processing facilities that could produce truckloads of waste?"
3. Divide the class into eight groups. Give each group one *Food Waste Scenario* slip. Allow groups to read and discuss their assigned scenario and come up with a potential solution.
4. Next, introduce the concept of cattle being able to digest food and receive nutritional value from foods that humans either do not choose to eat or cannot eat because it provides little/no nutritional value to our bodies.
5. Inform students that they will find strips of paper around the room that contain the nutritional value of the food product represented in their scenarios. Instruct students to search for the papers to find the information they need to determine if the food waste from their scenario could be used in another way.
6. Once students have found the slip of paper to match their scenario, have them come up with another solution for the food waste based upon what they learn. Have each group share their scenario and solution with the class.
7. After each group has shared with the class, use the following questions for reflection:
   - What is the definition of a byproduct?
     - *An incidental or secondary product made in the manufacture of something else.* To learn about additional feeds from byproducts, see the *Enriching Activity* below titled, "Digging Deeper into Byproduct Feeds."
   - What limitations can farmers/ranchers face in feeding their cattle byproduct feeds?"
     - *Some byproduct feeds have geographic limitations. For example, citrus fruits are only grown in a few states. To further discuss the geography of these byproducts, see the Enriching Activity below titled, "Mapping Out Commodities and Byproducts."*
   - What makes cattle different from humans and allows them to digest food waste products like the ones we discussed today?
     - *Cattle are ruminants which means they have for compartments in their "stomach" allowing them to break down and digest plant products that other animals and humans cannot.*
   - So what? Why does this matter or why is this important?
     - *The world population is growing exponentially which places a greater demand than ever before for food. Using alternative food sources that would otherwise go to waste, and feeding them to ruminants like cattle, allows farmers to efficiently and economically produce food for this growing population.*

Activity 4: Careers

1. Create a T-chart on the board and brainstorm careers related to producing beef. The left side will focus on careers directly related to the farmer/rancher. The right side will focus on careers that help market/sell the beef to consumers.
   - **Left side:** Careers directly related to the cattle farm/ranch
     - *Seed Salesman*: needed to grow hay and grain to feed cows
     - *Grain and Hay Farmer*: grows hay and grain
     - *Veterinarian*: help manage and oversee prevention of disease and treatment of sick cows
     - *Feed Salesman/Animal Nutritionist*: cattle need feed to eat; nutritionists help formulate balanced rations for cattle
     - *Feedlot Manager*: cattle are finished growing in feedlots
     - *Extension Agent*: provide continuing education for farmer/rancher which helps them learn the newest and most updated information for growing beef
   - **Right side:** Careers that help market/transport beef
     - *Farm Reporters or Broadcasters:* report on cattle markets
     - *Auctioneers or Livestock Market Managers*: assist farmers in selling cattle
     - *Cattle Buyers:* buy cattle for processing facilities

- *Truck Drivers*: transport cattle to harvesting facility and boxed beef to distribution centers and restaurants
- *Food Service Providers* (e.g. US Foods): deliver specific cuts of beef to restaurants and chefs
- *Restaurant and Grocery Store Employees*: serve up beef as a part of meals and provide a place for consumers to buy beef

2. Create a foldable to organize notes on. See pictures below for illustration.
   a. Place paper in landscape orientation and fold in half (left to right). Open paper back up.
   b. Fold the left side to the midline and the right side to the midline to create a tri-fold.
   c. Use scissors to make 6 tabs on both the left and right sides of the foldable allowing each tab to be opened individually.
   d. Use the careers listed on the T-chart, list one career per tab.
   e. Use the descriptions of each career from the T-chart to complete the foldable. The career will be listed on the outside of each tab and a description of the career will be written on the inside. The left side of the t-chart (careers directly related to the cattle farm/ranch) will be on the left side of the foldable and the right side of the t-chart (careers that help market/transport beef) will be on the right side of the foldable.



3. To summarize the activity, have students turn the foldable over so the solid back (no tabs) is facing up. Instruct them to complete a 3-2-1 summary.
   - Record **three** things the student learned about agriculture careers.
   - Record **two** careers the student found interesting and would like to learn more about.
   - Record **one** question the student still has about agriculture careers related to beef.

Concept Elaboration and Evaluation:

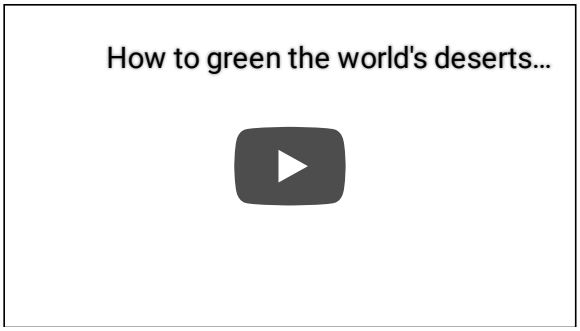
After conducting these activities, review and summarize the following key concepts:

- Cattle have a unique ruminant digestive system allowing them to gain energy from food such as grass, hay, and other forages that are of no nutritional value to humans.
- Cattle provide beef (hamburger, steak, roasts) and dairy products to our diet as well as many byproducts such as leather, medicines, etc.
- Cattle can utilize land that is too dry, rocky, wet, or steep for crop production. Well managed grazing practices promote healthy rangelands.
- Cattle can eat food processing byproducts rather than sending the waste to landfills.

We welcome your feedback! Please take a minute to tell us how to make this lesson better or to give us a few gold stars!

Enriching Activities

- Have students read the Huffington Post article, Farm Animals Actually Eat People's Leftovers - And It's Good For the Planet. If desired, use a KWL chart to increase engagement. Discuss student findings.
- For a useful handout comparing the monogastric and ruminant digestive systems, see pages 6-7 of A Stomach At Work, created by Michigan State University Extension. For a lab activity demonstrating how the monogastric stomach works, see pages 1-4.
- Have students watch the TedTalk, How to Fight Desertification and Reverse Climate Change.



- **Digging Deeper into Byproduct Cattle Feeds:** In *Activity 3*, students learned about eight byproducts that can be fed to cattle. There are many more examples. Assign students to research other common cattle feeds that are otherwise waste if not used as livestock feed. Possible feeds include:

barley or hops hulls	cereal by-products	citrus pulp	culled vegetables
cotton seed husks	grasses	molasses	soy hulls
sugar beet pulp	Grape Peels	Corn Gluten	Corn Stalks

- **Mapping Out Commodities and ByProducts:** To help students understand the geographic limitations of using byproducts for feed, distribute the attached *Mapping Out Commodities and Byproducts* activity sheet to each student. Have students research where the list of food products are commonly grown in the United States. The U.S. Department of Agriculture National Agricultural Statistics Service and the Interactive Map Project are two helpful websites that can be used or students may conduct their own internet search. Students may research products individually, work in groups, or do a special report on just one product.
  - If time allows, encourage students to explore the maps to find out what food products or waste products are local to your state and may be fed to cattle.
  - Note that bakery waste will likely not be listed. Instruct students to think of a local grocery story or bakery and have them think about what the store does with bakery items that are not sold. This is considered bakery waste and stores either need to dispose of it in the trash or have farmers pick it up.
  - If students research the entire list, they will need to use both websites to find the food commodities.

Suggested Companion Resources

- The Girl Who Thought in Pictures: The Story of Dr. Temple Grandin (Book)

  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=868]
- Amazing Grazing (Book)

  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=184]
- Ranch Starter Kit (Kit)

  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=256]
- Where Does Your Cheeseburger Come From? (Poster, Map, Infographic)

  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=942]

- Are consumers ready to embrace and eat lab-grown meat? (Multimedia)
  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=973]
- Why Can a Cow Eat Grass? Video (Multimedia)
  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=650]
- TedTalk- How to Fight Desertification and Reverse Climate Change (Multimedia)
  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=488]
- Before the Plate Website (Website)
  [https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=996]

Sources/Credits

- Beef lifecycle image in *Activity 1* is from the explorebeef.org website.
- *Remarkable Ruminant* worksheet in *Activity 2* is from the Iowa Beef Council.

Sources:

1. http://beef2live.com/story-cattle-101-hist-breeds-fun-facts-terms-0-104671
2. https://www.meat-online.co.za/10-interesting-facts-about-beef-and-cattle/

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