# **STUDENT GUIDE** EXPLORE LESSON 3



## Part 1: Our Motivation

Record what we were trying to figure out that led to this investigation.

If we figure out what the parts of the dairy system are, we can better understand their impact on the environment.

- What steps are there involved in producing dairy products?
- What happens at each step in the process?
- How does the dairy get from the cow to the store?

### Part 2: Summarize Information About Parts of the Dairy System

What kind of information about the steps in the system would be helpful for us to make progress on our investigation?

- We need to know if we have all the steps in the system.
- We need to know if the steps individually impact the environment.
- We need to know what is used in each component and what is created.
- We need to know more about the environmental impacts of transporting dairy products.
- We need to know more about feeding cattle and its environmental impact.
- We need to know more about the processing of dairy products to decide on their environmental impact.

In your groups, divide up the cards between your group members so each person has at least two cards. Each card gives information about the inputs, outputs, and functions of the different components of the dairy system.

- Read the literature and watch the videos on your cards.
- Individually write a 2-3 sentence summary that paraphrases the inputs/outputs/impacts and function/purposes of each component of the dairy system in the graphic organizer below.

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#### Card 1: Cows are fed

Description and function of component: Cows need to eat so they can produce milk. Farmers use a mix of different feeds to feed cattle.

Inputs	Outputs	Boundaries of this component
Cows are fed a mixed ration of grasses, grains, and byproducts. Cows digest the feed.	Cows produce manure.	Outside of boundaries: farmers, the transportation/manufacturing of feed, storage of poop. This means that this component doesn't include the growing, harvesting, or transporting of the feed to the dairy cows.

#### Card 2: Cows are milked 2-3 times a day

Description and function of component: Dairy cows must be manually milked for humans to get fluid milk. Some dairies use robotics others use people to run the milking machines.

Inputs	Outputs	Boundaries of this component
Machinery, humans, and cattle. Machinery: Large machines are used to milk cows. Some are automatic. Some are carousels. Milking units have rubber that attaches to the cow's udder and vacuums milk out. Humans: Look for concerns as cows are milked. Some dairies manually put on and take off milking units. Sanitize the udder before milking. Cattle: Cows must be milked 2/3 times a day because of the amount of milk they produce. It takes 5-7 minutes to milk each cow.	Milk: Milk is vacuumed out of cattle using milking units before it moves to steel pipes to be chilled.	This component starts when cattle get milked and ends when the milk is put into tanks. Outside of boundaries: what happens to the milk after extraction, what happens before cows start producing milk. Where the machines used to milk cows are from.

Join a classmate who has the same card as you. Share your findings for inputs, outputs, and boundaries. Below, write your group's consensus on this component of the dairy system. Description and function of component: Dairy cows must be manually milked for humans to get fluid milk. Some dairies use robotics, while others use people to run the milking machines.

Inputs	Outputs	Boundaries of this component
Machinery, humans, and cattle.	Milk: Milk is vacuumed out of cattle using milking units before it moves	This component starts when cattle get milked and ends when the milk is
Machinery: Large machines are used	to steel pipes to be chilled.	put into tanks.
to milk cows. Some are automatic.		Outside of boundaries: what
Some are carousels. Milking units		happens to the milk after extraction,
have rubber that attaches to the		what happens before cows start
cow's udder and vacuums milk out.		producing milk. Where the machines
		used to milk cows are from.
Humans: Look for concerns as cows		
are milked. Some dairies manually		
put on and take off milking units.		
Sanitize the udder before milking.		
Cattle: Cows must be milked 2/3 times a day because of the amount of milk they produce. It takes 5-7 minutes to milk each cow.		

Reflect on why boundaries were helpful in analyzing components of the dairy system.

- What do boundaries help you understand about what you are focusing on and what you are not focusing on in this system?
- How do they help you understand how each component of the system interacts with things outside of the system?

Boundaries are necessary in a model to determine what is and is not part of the system and to clearly and accurately determine the roles of all of the parts of a system that are being analyzed. In this component, I was looking at how humans use machines to milk cows efficiently. Thinking about the boundary of this component and what was not shown here helped me understand that we did not analyze what happens before cows start producing milk and what happens to the milk after it leaves the cow. Obviously, there is interaction between these components because all we know so far is that milking units take milk to steel pipes where it is chilled. We also thought that the milking machinery needs to be manufactured somewhere, so that process happens outside of the system component.