

# STUDENT GUIDE

## ELABORATE LESSON 24



### Part 1: Our Motivation

Record the next steps you want to take in the engineering design process.

I would like to find a way to present my solution in a meaningful and effective way to my peers and to relevant stakeholders.



### Part 2: Proposing Solutions

Develop a Solutions Presentation that showcases the solution you chose for the dairy system problem you identified. It can be a single solution or a combination of solutions. As you develop your solution, be sure to use the Look Fors to guide your response.

**Problem: Fertilizers pollute nearby waterways**

**Potential Solution: Building farms closer to consumers and incorporating rotational grazing practices on pastures**

This solution reduces the amount of synthetic fertilizer required for crops which means less fertilizer will pollute nearby waterways. This solution also increases soil fertility.



Changing farming practices to incorporate grazing cattle can somewhat negate the biodiversity impacts of growing monoculture crops; we learned this during Biodiversity and Other Environmental Impacts Module. It can sequester carbon in the soil, which eliminates it from the atmosphere. This information comes from our Greenhouse Effect and Carbon Cycling Module that shows how carbon cycles between the dairy food system and the atmosphere.



The potential downsides of the solution include:

- Requires farmers to grow specific crops that sequester nitrogen into the soil like soybeans or alfalfa
- Higher initial costs for some of these nitrogen fixing plants.
- Tradeoffs for other desirable plant traits such as drought tolerance or yield.
- Need more space to graze cattle
- More labor is needed to move cattle from pasture to pasture



#### How the Solution Maintains System Benefits

- Cattle that graze on grass from rotational grazing can still produce milk for consumers.
- Farms closer to consumers can get dairy products to local consumers faster.

#### How the Solution Improves on System Costs and Risks

- Pastures require less fertilizer because cattle manure is dropped on the pasture as cattle graze, which can enhance soil fertility
- This will also reduce the amount of synthetic fertilizer that is used which could reduce fertilizer pollution in waterways
- Perennial grass growth sequesters more carbon in the soil root system than do annual plants like corn.
- Less transportation distance means less greenhouse gases like carbon dioxide added to the atmosphere due to transit.

Solution Benefits	Explanation
Environmental	Requires less synthetic inputs, reduces runoff, sequesters carbon and nitrogen
Economic	More jobs for farmers to manage cattle, more jobs on more local farms
Social & Ethical	More people to connect with local farmers if they are closer to where the food is consumed
Scientific	Meets standards in the industry, fits what we know about the greenhouse effect





### Part 3: Providing Feedback on Proposed Solutions

Participate in a Gallery Walk to ask questions about the proposed solutions generated by each group. Brainstorm and record your questions in the space below.

Do you think this is the right solution choice? Could your solution better address additional costs and risks of the dairy system?

How does your design improve on the negative biodiversity impacts of the dairy system?

How can your design help produce dairy products while also improving on biodiversity impacts?

When you are ready with your questions, write them on the large chart paper placed near each group's solution posters.

Engage in After the Gallery Walk, choose one group to partner with and provide more in-depth feedback. Record your feedback in the Peer Feedback Handout provided.