

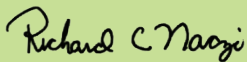
Dear Educator,

The recent battle against COVID-19 threw a spotlight on the complex process involved in getting food from farms to our tables in the U.S. But there are even greater challenges ahead. The United Nations projects that the global population will reach nearly 10 billion by the year 2050. Feeding this many people at a time when Earth's resources are already strained is a daunting task for farmers, who must find ways to provide *sustainable* nutrition — food that benefits human welfare *and* the environment.

Farming for the Future is a free educational program that explores the concept of sustainable nutrition by focusing on dairy farms, which already produce foods that pack a nutritional punch in an affordable and increasingly sustainable way. Created by the curriculum experts at Young Minds Inspired (YMI) in cooperation with American Dairy Association North East (ADANE), the program features standards-based activities that will engage your students in critical thinking as they research, debate, and brainstorm how farmers can feed the world in ways that support nutritional, economic, and environmental needs.

We hope that you will share this valuable program with other teachers in your school. Although the materials are copyrighted, you may make as many copies as needed for educational purposes. Return the enclosed reply card to let us know your opinion of this program, or comment at ymiclassroom.com/feedback-adane-hs. **Teachers who provide feedback have the chance to receive 36 free CowPots (pots you plant) and starter seeds for the classroom while supplies last.** We look forward to your comments.

Sincerely,



Rick Naczi
CEO
American Dairy Association
North East



Dr. Dominic Kinsley
Editor in Chief
Young Minds Inspired



 For questions, contact us toll-free at 1-800-859-8005 or by email at feedback@ymiclassroom.com.

FARMING *for the* FUTURE

Target Audience

Students in high school science and social studies classes

Program Objectives

- Guide students in understanding sustainable nutrition as the intersection between health, economic, environmental, and social impacts.
- Examine the value of dairy farming in sustainable food systems that support the needs of global populations, benefit animal care, reduce impact on surrounding ecosystems, and support local economies.
- Encourage students to think critically and to examine contemporary issues from a global perspective.
- Demonstrate how milk and dairy products are continually tested to ensure safety and quality.

Program Components

- This one-page teacher's guide
- Three reproducible activity sheets
- A colorful classroom wall poster
- A reply card for your comments, or comment online at ymiclassroom.com/feedback-adane-hs

How to Use This Program

Photocopy and distribute the activity sheets before displaying the poster in your classroom. Schedule the activities and provide ample time for classroom discussion of the relevant concepts. Students will need access to the internet for research. To review program alignment with Next Generation Science and Common Core standards, visit ymiclassroom.com/adane-hs.



What Is Sustainable Nutrition?

Begin by discussing what students may already know about sustainable nutrition. Ask them to consider each issue on the activity sheet on a local, national, and global scale. Then allow time for them to work in small teams to research and brainstorm ideas to complete the sheet.

Answers: Answers will vary. Download an answer key at ymiclassroom.com/adane-hs.

EXTENSIONS

- Explain to students that one in seven children in the U.S. faces food insecurity. Have the class research efforts by the dairy industry to close the hunger gap and ask students to brainstorm new products or distribution channels to get more dairy nutrition into the hands of more people, domestically or globally. Suggested links to get them started: usdairy.com/science-and-research/product-innovation and dairyfoods.com.
- Use this lesson as a starting point for teaching students to understand the difference between “essential” nutrients and those that the body can produce, complete versus incomplete proteins, or fortified versus naturally occurring nutrients.



Greener Pastures

Divide the class into groups of 2-3 students and provide time for them to research and complete the chart on the activity sheet following the example. Conclude with a discussion about each of the technologies featured, asking students which efforts were most interesting or surprising, and which they thought might have the greatest impact.

Answers: Answers will vary. Download an answer key at ymiclassroom.com/adane-hs.



EXTENSIONS

- High start-up costs can be a major barrier preventing small farms from implementing some of the technologies featured on the chart. Have students research and brainstorm ways to bring these systems to more farms without the burden of major debt (e.g., regional cooperatives).
- Using what they've learned, ask students to engineer additional systems farmers can use to grow their businesses while supporting local ecosystems and communities.



Full Circle

Begin by asking students what they know about dairy farming and processing of milk products. How far do they think milk travels from the farm to their grocery store? How do we know milk is safe to drink? After students take the quizzes in Parts 1 and 2, discuss the results as a class. Review any myths or misconceptions and ask students to share how their understanding may have changed. You can use this as an opportunity to discuss the importance of critical thinking that involves looking at issues from multiple perspectives.

Conclude the activity by introducing students to some of the farm families at americandairy.com/dairy-farms/farm-families/?page=1.

Part 1 Answers: 1. A; 2. D; 3. C; 4. A; 5. C; 6. T; 7. T; 8. T; 9. T (dairy cows voluntarily go in for milking two or three times a day); 10. T.

Part 2 Answers: 1. nutritious; 2. robotic; 3. degrees; 4. insulated; 5. standardized; 6. pasteurized; homogenized; 7. packaged; 8. grocery

EXTENSIONS

- Have students research local farms and related businesses in the “Agriculture, Food, and Natural Resources” cluster at O*NET Online, a resource for researching career paths (onetonline.org/find/career?c=1). Ask them to record and share details about how the business contributes to the local economy and food supply. Students can also explore career options and share the job details and skills.
- If you live in an agricultural area, ask students to bring in news articles about local farms that focus on animal care, economic issues, environment, and/or innovation in the region for the class to discuss.

Resources

- American Dairy Association North East: americandairy.com
- Virtual Farm Tours: americandairy.com/dairy-in-schools/virtual-farm-tour.html
- Dairy and the Environment: americandairy.com/dairy-farms/dairy-and-the-environment
- Sustainability on E-Z Acres Farms: americandairy.com/news-and-events/news/news/e-z-acres-wins-outstanding-dairy-farm-sustainability-award.html
- Mercer Vu Farm: chesapeakebay.net/news/blog/theres_no_separation_anxiety_at_this_pennsylvania_farm
- Raising Crops for Dairy Cows: youtu.be/tA53MT0FmWY
- Feeding America: feedingamerica.org/about-us/press-room/child-food-insecurity-could-hit-all-time-high
- Lessons: ymiclassroom.com/adane

Milk Production

- farmprogress.com/blog/dairy-industry-facts-0
- usdairy.com/news-articles/milk-more-local-than-you-may-think
- milk.procon.org/how-milk-gets-from-the-cow-to-the-store/

What Is Sustainable Nutrition?

Sustainability is a buzzword in media reports and government policy, but what does it really mean? For farmers like Bret Bossard, who owns Barbland Dairy in Fabius, N.Y., it means carefully following agricultural practices that will support the needs of the farm *and* its community now and for generations to come.

Part 1: Green Communities

Write your definition of sustainability in the following space. Give an example, such as solar energy, and explain what factors can make it sustainable.

Now list three considerations that you think would make a farm or other food source sustainable:

1. _____
2. _____
3. _____

List two local initiatives you've noticed in your community to increase sustainability, particularly in the food system. Use this example as a guide:

The local grocery store has a produce section identified as grown on nearby farms.

1. _____
2. _____

Food for Thought

When considering sustainable nutrition, the key is to strike a *balance* among environmental concerns, economics, and health needs. For example, almond beverage has been hailed as a greener alternative to cow's milk because it uses less water to produce. But did you know that it would take at least 32 ounces of almond beverage to get the same amount of protein as an 8-ounce glass of milk? And, unlike almond beverages and other alternatives, dairy milk is produced locally in all 50 states, reducing the need for long-distance transportation.



Local milk is available 365 days a year.

Part 2: Green Earth

The United Nations projects that global population will reach nearly 10 billion by the year 2050. What do you think it will take to feed that many people in a sustainable way? Here are some links to help you research the various aspects of this issue:

- National Health and Nutrition Examination Survey on meeting calcium needs: ncbi.nlm.nih.gov/pubmed/17081826
- Proceedings of the National Academy of Sciences of the United States of America study of impact of removing animals from food supply: pnas.org/content/114/48/E10301
- Nourishing people sustainably: dairygood.org/content/2019/sustainable-diets-must-nourish-people-protect-planet
- Innovation Center for U.S. Dairy: usdairy.com/science-and-research/product-innovation



Bret Bossard holding recycled fruit that cows enjoy as part of their total mixed ration (TMR).

On a separate sheet of paper, list and analyze a few of the proposals you read about, as well as any of your own ideas. Use the example below as a guide.

Proposal	Pros	Cons
Create community gardens for people to grow their own produce	<ul style="list-style-type: none"> • Access to fresh fruits and vegetables • Tailored to regional diets and environments 	<ul style="list-style-type: none"> • Volunteers must be willing to participate • Land required • Unpredictable environmental conditions • Limited nutrient profile for volume produced

Now take a look at the nutritional profile of milk on the wall poster. Reflect on this information and your research findings to write a short position paper describing the role dairy could play in sustainable diets on a global scale. Think about the amount of food, and the different types of food, that would be required to replicate the nutrients found in milk. How would the environmental footprint and cost of all those varied resources compare to the cost and footprint of providing three servings of dairy, considering that a cow can produce up to eight gallons of milk per day?



AMERICAN DAIRY ASSOCIATION NORTH EAST



Greener Pastures



The Reinford Family, Reinford Farms, Mifflintown, Pa.

Technology and modern agricultural practices enable dairy farmers to be good stewards of the environment while building successful businesses. For example, farms like Reinford Farms in Pennsylvania use anaerobic digesters to convert methane, a greenhouse gas released from cow manure, into a source of electricity. And for dairy farmers in the Chesapeake Bay watershed — an ecosystem that is home to 18 million people and fed by seven large rivers and 100,000 tributaries — protecting local waterways is critical.



Methane digester

Read the article at americandairy.com/dairy-farms/dairy-and-the-environment and review the Chesapeake Bay watershed map to learn more about efforts to reduce runoff and erosion. As you follow the links on the page to watch the videos and learn more about manure separation, water management, forest buffers, etc., think about the many people involved in the dairy industry and the complex economic and environmental considerations of each decision.

Use this chart to list how each agricultural practice or technology benefits the local ecosystem and/or community, and the farm itself. One has been provided as an example.

Technology/ System	Benefits to Ecosystem and Community	Benefits to Farm
Riparian (or forest) buffers	<ul style="list-style-type: none"> • Filters pollutants from storm runoff, leading to cleaner groundwater and streams • Increases wildlife habitats • Healthier drinking water 	<ul style="list-style-type: none"> • Less work/money spent on soil maintenance • Removes less productive, highly erodible cropland from use, allowing farmers to focus resources on more productive cropland
Cover crops and no-till fields		
Recycled manure and methane digesters		
Covered manure storage		
Recycled materials for barn stall bedding		
Reuse of water two to three times for farm operations		
Woodchip bioreactor		
Precision feeding		



Local milk is available 365 days a year.



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Full Circle



Milk is a nutritional powerhouse, and over the past decades, agricultural practices have enabled dairy farmers to produce more milk with fewer resources. In fact, more milk is produced today with only 9 million cows than with 26 million cows in 1944. How? Dairy farmers take great care to provide the best environment, food, and medical care for their cows, because comfortable cows are productive cows!



Caroline Zimmerman, Dry Creek Farm, Martinsburg, Pa.

Part 1: Myth vs. Reality

How much do you already know about the care of dairy cows and the value of their milk? Take this quiz to test your knowledge. In the left column, circle the correct answer. In the right column, check off whether the statement is true or false.

- About _____ of U.S. dairy farms are family owned and operated.
A. 95% C. 70%
B. 45% D. 15%
- Cow manure can be recycled into _____ and even pots for planting.
A. energy C. bedding for cows
B. fertilizer D. all of the above
- Many dairy farmers also recycle _____ up to 3 times — first, for cooling milk, then for cleaning stalls, and finally as a nutrient-rich fertilizer for the fields.
A. packaging C. water
B. corn husks D. storage tanks
- Each day, a cow drinks about 35 gallons of water — enough to fill a bathtub — and produces approximately _____ of milk.
A. 8 gallons C. 35 gallons
B. 25 ounces D. 1 gallon
- Milk is tested for _____ on the farm and at the processing plant to be sure it is safe for consumers to drink.
A. hormones C. antibiotics
B. viruses D. excess fat
- Cows spend about 8 hours chewing their cud every day.
 True False
- Cows can get nutrition from byproducts of other farms, like citrus pulp from juice farms and cottonseed from cotton farms.
 True False
- Cows' diets are carefully designed by farmers and nutritionists to provide the best nutrition possible for optimal health.
 True False
- Robotic milking systems enable cows to be milked on their own schedules — two to three times per day — and help farmers spend time caring for cows in other ways.
 True False
- In free-stall barns, cows can move about to eat, drink, and rest whenever they like; these enclosures let in fresh air and sunshine, while providing shade and protection from the wind, cold, or rain.
 True False

Part 2: Farm to Family

Have you ever wondered how the dairy products you enjoy get from the farm to your refrigerator? It takes careful coordination by a bustling, localized industry and frequent testing along the way that ensures that milk is one of the safest foods you can purchase. And it is never touched by human hands until you open the container.

To test how much you know, use the word bank to fill in the blanks.

robotic degrees
grocery homogenized insulated
nutritious pasteurized packaged
refrigerated standardized

- On a dairy farm, cows receive plenty of _____ food, fresh water, comfortable housing, and regular veterinary care.
- Using a _____ milking machine, cows choose when they want to be milked, generally two to three times a day.
- Milk is cooled to 35 _____ and then transported in a milk truck, which is a refrigerator on wheels.
- _____ tanker trucks haul this fresh milk to a processing facility.
- Then, it is _____ to various fat levels (fat-free, 1%, 2%, or “whole” milk).
- Next, the milk is _____, or heated to kill potentially harmful bacteria, and _____ so it doesn't separate and rise to the top.
- Finally, the milk is _____ or processed into cheese, yogurt, etc.
- Refrigerated trucks transport milk and dairy foods to _____ stores or local schools for you and your family to enjoy!

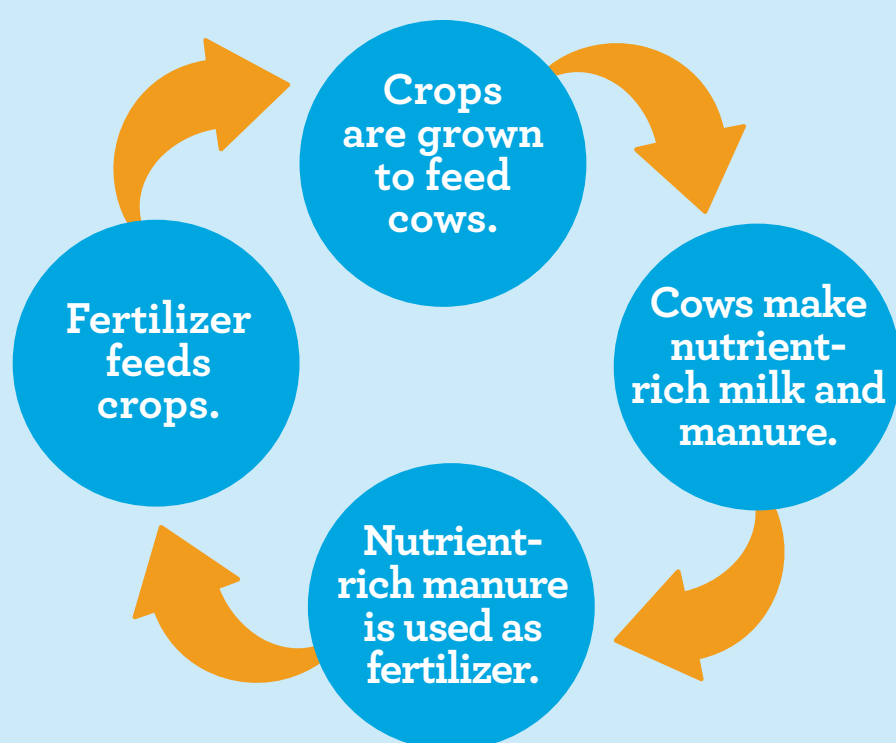




SUSTAINABLE NUTRITION *in* EVERY GLASS

Environmentally Sustainable

- Dairy farms have reduced their carbon footprint by more than 60% since the 1940s.¹
- Milk is produced in all 50 states, supporting local economies and reducing need for long-distance transport.
- Dairy contributes only 2% of the United States' greenhouse gas emissions.² Farmers are continuously working to find new ways to further reduce its GHG emissions.
- Dairy farmers practice sustainability by recycling water and waste.



Packed With Nutrients

The USDA recommends that Americans age 9 and older consume 3 servings of dairy products every day, because dairy is a nutritional powerhouse! It contains 9 essential nutrients that can be hard to replace in a healthy diet pattern.

Three 8-ounce cups of milk provide:³

Nutrient	As Much Nutrition as Approximately:
Protein	4 large hard-boiled eggs
Calcium	17 cups of raw kale
Phosphorous	3 cups of cooked kidney beans
Vitamin A	3 cups of sliced red peppers
Vitamin B2 (Riboflavin)	4/5 cup of whole almonds
Vitamin B3 (Niacin)	6 large white mushrooms
Pantothenic Acid	5 cups of chopped broccoli
Vitamin B12 (Cobalamin)	1 lb. of pork chops
Vitamin D	15 sardines

Sustainable Nutrition



Sources:
¹Capper, J. L., R. A. Cady, and D. E. Bauman. 2009. The environmental impact of dairy production: 1944 compared with 2007. *J. Anim. Sci.* 87:2160–2167. Available at <https://academic.oup.com/jas/article/87/6/2160/4731307>.
²Thoma, G., Popp, J., et al. Greenhouse gas emissions from milk production and consumption in the United States: A cradle-to-grave life cycle assessment circa 2008. *International Dairy Journal* 31, Supplement 1:S3-S14, April 2013. Available at https://www.researchgate.net/publication/256686442_Greenhouse_gas_emissions_from_milk_production_and_consumption_in_the_United_States_A_cradle-to-grave_life_cycle_assessment_circa_2008.
³National Dairy Council. "Three Servings of Milk Deliver a Unique Nutrient Package." 2018. Available at nationaldairyCouncil.org/content/2018/three-servings-of-milk-deliver-a-unique-nutrient-package.



Local milk is available 365 days a year.

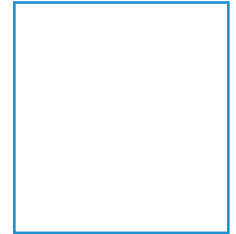


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605 Washington Avenue, North Haven, CT 06473

Look inside for another FREE educational program!



FARMING *for the* FUTURE



Explore how dairy farmers pair nutrition and sustainability to benefit cows, the planet, and you

OPEN TODAY!

Meets
Next Generation
Science Standards

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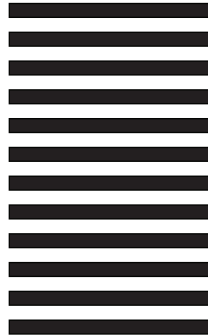
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Your opinion of this program is important to us. Please take a moment to comment.

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ANSWER KEY TO ACTIVITIES



What Is Sustainable Nutrition?

Part 1: Answers will vary. Definitions of sustainability should focus on the use of a resource without depleting it, or a system that is economically viable enough to continue long-term. For example, solar power is sustainable because the sun's energy can be harnessed without any damage to the sun or reduction in the amount of light it will emit in the future. Recycling is sustainable if the recycled materials can be used for a new product.

To support sustainable nutrition, food sources must provide for successful long-term management of resources, economies, *and* consumer health. Local sustainability ideas could include purchasing locally grown produce to reduce emissions from transportation; using solar power for homes as well as schools and town centers; and “Too Good to Toss” events in which communities swap old clothing and home goods instead of throwing them into a landfill.

Part 2: Although responses will vary, below is an overview of the ideas featured in the articles.

Proposal	Pros	Cons
Reduce consumption of meat and dependency on animal-derived foods	<ul style="list-style-type: none">• Reduction of greenhouse gas emissions• More farmland available for crops	<ul style="list-style-type: none">• Removing animals from food supply shown to have less of an impact than expected• Meat and dairy are nutrient-dense and would need to be replaced by very large quantities of alternative foods
Increase access to dairy products globally	<ul style="list-style-type: none">• Nutritional powerhouse• Can be tailored to regional environments (cows, goats, etc.) and scale of economy• Modern practices can reduce resource use and pollution	<ul style="list-style-type: none">• Communities may need training to properly care for animals• Local production overseas might impact U.S. exports



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Greener Pastures

Although charts will vary, these are some general concepts which can be found at americandairy.com/dairy-farms/dairy-and-the-environment/.

Technology / System	Benefits to Ecosystem and Community	Benefits to Farm
Riparian (or forest) buffers (1,6)	<ul style="list-style-type: none"> Filters pollutants from storm runoff, leading to cleaner groundwater and streams Increases wildlife habitats Healthier drinking water 	<ul style="list-style-type: none"> Less work/money spent on soil maintenance Removes less productive, highly erodible cropland from use, allowing farmers to focus resources on more productive cropland
Cover crops and no-till fields (2,4)	<ul style="list-style-type: none"> Reduce soil erosion and water pollution Healthier drinking water 	<ul style="list-style-type: none"> Save money on soil preparation Can result in healthier crops and more abundant feed for cows Lower inputs (e.g., fertilizer, pesticides) in some cases
Recycled manure and methane digesters (2,3,4,5,6)	<ul style="list-style-type: none"> Reduce greenhouse gases and water pollution Alternate source of electricity 	<ul style="list-style-type: none"> Costly start-up but can save money over time Can be a source of revenue Healthier cows (when recycled manure is used for bedding)
Covered manure storage (1,4,6)	<ul style="list-style-type: none"> Reduced methane emissions Reduced risk of leakage into groundwater 	<ul style="list-style-type: none"> Although expensive for setup, keeps the land healthy for future generations Properly sized storage lagoons reduce the need to apply manure onto land when weather and agronomic conditions are unfavorable
Recycled materials for barn stall bedding (2,3,4)	<ul style="list-style-type: none"> Less waste of bedding materials More comfortable cows 	<ul style="list-style-type: none"> Cost-effective
Reuse of water two to three times for farm operations (3)	<ul style="list-style-type: none"> Less waste 	<ul style="list-style-type: none"> Cost-effective
Woodchip bioreactor (6)	<ul style="list-style-type: none"> Safer habitats and water supply Reduction of water pollutants 	<ul style="list-style-type: none"> Help reduce nutrients from farm runoff
Precision feeding (4,6)	<ul style="list-style-type: none"> Reduces the amount of nitrogen and phosphorus excreted in animal waste Increased supply of milk without higher cost 	<ul style="list-style-type: none"> Less costly to process More productive cows

Sample source links:

- E-Z Acres Wins Outstanding Dairy Farm Sustainability Award: <https://www.americandairy.com/news-and-events/news/news/e-z-acres-wins-outstanding-dairy-farm-sustainability-award.shtml> and <https://youtu.be/j-E2SONw8ew>
- Raising Crops for Dairy Cows: <https://youtu.be/tA53MT0FmWY>

- How Do Dairy Farmers Recycle?: <https://youtu.be/P3bHBWMoVs0>
- There's no separation anxiety at this Pennsylvania farm: https://www.chesapeakebay.net/news/blog/theres_no_separation_anxiety_at_this_pennsylvania_farm
- Reinford Farms: <http://www.reinfordfarms.com>
- Dairy Farmers' Commitment to a Clean Chesapeake Bay: https://www.americandairy.com/_resources/pdf/chesapeake-bay-watershecompressed.pdf



Full Circle

Part 1: 1. A; 2. D; 3. C; 4. A; 5. C; 6. T; 7. T; 8. T; 9. T (dairy cows voluntarily go in for milking two or three times a day); 10. T.

Part 2: 1. nutritious; 2. robotic; 3. degrees; 4. insulated; 5. standardized; 6. pasteurized; homogenized; 7. packaged; 8. grocery.