Dear Educator,

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 (ADNE), the program features standards-based activities that will engage your students in critical thinking as they research, debate, and brainstorm ways to 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.

Please use the enclosed reply card or comment online at ymiclassroom.com/feedback-adane-hs to provide feedback. We look forward to hearing from you.

Sincerely,

Rick Naczi
CEO
American Dairy Association North East

Dr. Dominic Kinsley
Editor in Chief
Young Minds Inspired

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**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.
- Introduce students to career options in the agricultural sector.

**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 Standards, visit ymiclassroom.com/adane-hs.

**ACTIVITY 1**

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 eight 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.

**ACTIVITY 2**

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.

**ACTIVITY 3**

Full Circle

Begin by asking students what they know about dairy farming. After students take the quiz in Part 1, 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 this part of the activity by introducing students to some of the farm families featured on pages and in videos at americandairy.com/dairy-farms/farm-families/?page=1.


For Part 2, guide students in using O*NET Online as a resource for researching career paths. Point out that each career cluster includes a broad range of jobs in related industries, with opportunities for many education levels and areas of interest. Apart from the “Agriculture, Food, and Natural Resources” cluster, ask students to consider other relevant clusters, such as in government policy or manufacturing.

**EXTENSIONS**
- Have students research local farms and related businesses in the “Agriculture, Food, and Natural Resources” cluster. Ask them to record and share details about how the business contributes to the local economy and food supply.
- 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 to discuss.

**Resources**
- American Dairy Association North East: americandairy.com
- Virtual Farm Tours: americandairy.com/dairy-in-schools/virtual-farm-tour.stml
- Mercer Vu Farm: chesapeakebay.net/news/blog/there’s_no_separation_anxiety_at_this_pennsylvania_farm
- Raising Crops for Dairy Cows: youTube.ba/tA53MToFmWY
- Career Finder: onetonline.org/find/career?c=1

For questions, contact us toll-free at 1-800-859-8005 or by email at feedback@ymiclassroom.com.
Sustainability is a buzzword in media reports and government policy, but what does it really mean?

**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. ___________________________________________________

Can you think of 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. ___________________________________________________

_________________________________________________

**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

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.

<table>
<thead>
<tr>
<th>Proposal</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create community gardens for people to grow their own produce</td>
<td>• Access to fresh fruits and vegetables • Tailored to regional diets and environments</td>
<td>• Volunteers must be willing to participate • Land required • Unpredictable environmental conditions • Limited nutrient profile for volume produced</td>
</tr>
</tbody>
</table>

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 seven gallons of milk per day?


**Greener Pastures**

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 7 large rivers and 100,000 tributaries — protecting local waterways is critical.

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.

<table>
<thead>
<tr>
<th>Technology/System</th>
<th>Benefits to Ecosystem and Community</th>
<th>Benefits to Farm</th>
</tr>
</thead>
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<tr>
<td>Riparian (or forest) buffers</td>
<td>• Filters pollutants from storm runoff, leading to cleaner groundwater and streams&lt;br&gt;• Increases wildlife habitats&lt;br&gt;• Healthier drinking water</td>
<td>• Less work/money spent on soil maintenance&lt;br&gt;• Removes less productive, highly erodible cropland from use, allowing farmers to focus resources on more productive cropland</td>
</tr>
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<td>Cover crops and no-till fields</td>
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<td>Recycled manure and methane digesters</td>
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<td>Precision feeding</td>
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</tbody>
</table>
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.

1. About _______ of U.S. dairy farms are family owned and operated.
   A. 95%  C. 70%
   B. 45%  D. 15%

2. Cow manure can be recycled into _______ and even pots for planting.
   A. energy  C. bedding
   B. fertilizer  D. all of the above

3. 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

4. Each day, a cow drinks about 35 gallons of water — enough to fill a bathtub — and produces approximately _______ of milk.
   A. 7 gallons  C. 35 gallons
   B. 25 ounces  D. 1 gallon

5. Milk is tested for _______ on the farm and at the processing plant. If milk tests positive, it cannot be sold to the public.
   A. hormones  C. antibiotics
   B. viruses  D. excess fat

6. Cows spend about 8 hours chewing their cud every day.
   □ True  □ False

7. Cows can get nutrition from byproducts of other farms, like citrus pulp from juice farms and cottonseed from cotton farms.
   □ True  □ False

8. Cows’ diets are carefully designed by farmers and nutritionists to provide the best nutrition possible for optimal health.
   □ True  □ False

9. Robotic milking systems allow dairy farmers to put cows on a strict schedule for maximum production that automatically milks them every 1-2 hours.
   □ True  □ False

10. 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: Future Dairy Farmer?
Dairy farms create an estimated 900,000 jobs in the U.S. Whether you’re interested in agriculture and animals, food science, environmental protection, or even engineering, you can explore your area of interest in sustainability with career options across the dairy industry.

Visit O*NET Online (onetonline.org/find/career?c=1) and check out the career cluster, “Agriculture, Food, and Natural Resources.” Choose a path that best fits your personal interests, values, and career goals. Use what you find to complete the following chart, and note any career-specific information you would need before pursuing this option in the future. You can make another copy of the chart to check out more than one path.

<table>
<thead>
<tr>
<th>Career Path</th>
<th>Education needed</th>
<th>Additional skills required</th>
<th>Average salary</th>
<th>Job environment (work activities/context)</th>
<th>Occupational outlook</th>
<th>Reasons it seems like a good fit</th>
<th>Reasons it may not be a good fit</th>
<th>Notes to research further</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>
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:

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>As Much Nutrition as Approximately</th>
</tr>
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<tbody>
<tr>
<td>Protein</td>
<td>4 large hard-boiled eggs</td>
</tr>
<tr>
<td>Calcium</td>
<td>17 cups of raw kale</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>3 cups of cooked kidney beans</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>3 cups of sliced red peppers</td>
</tr>
<tr>
<td>Vitamin B2 (Riboflavin)</td>
<td>98 cup of whole almonds</td>
</tr>
<tr>
<td>Vitamin B3 (Niacin)</td>
<td>6 large white mushrooms</td>
</tr>
<tr>
<td>Pantothenic Acid</td>
<td>5 cups of chopped broccoli</td>
</tr>
<tr>
<td>Vitamin B12 (Cobalamin)</td>
<td>1 lb. of pork chops</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>15 sardines</td>
</tr>
</tbody>
</table>

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 The dairy industry is continuously working to find new ways to further reduce its GHG emissions.
- Milk producers practice sustainability by recycling water and waste.

FARMING for the FUTURE

How dairy farmers pair nutrition and sustainability to benefit the planet and you

OPEN TODAY!

Meets Next Generation Science Standards
Please fill out and return this response card to receive FREE YMI programs in the future or respond online at ymiclassroom.com/feedback-adane-hs

Name ____________________________________________
(Please print clearly.)

School ____________________________________________

Address ____________________________________________

City ____________________________________________ State _____ Zip ______________

Email ____________________________________________ Phone ______________

I teach grade(s) ____________________________ Subjects ____________________________

Number of teachers using this program ________ Number of students using this program ________

Please rate this program’s appeal to students: □ Excellent □ Good □ Fair □ Poor

Please rate this program’s educational effectiveness: □ Excellent □ Good □ Fair □ Poor

I would like to serve on YMI’s Educator Advisory Panel for future programs. □ Yes □ No

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

YMI will not disclose your name to third parties.
FARMING for the FUTURE

YMI
605 WASHINGTON AVE SUITE 13
NORTH HAVEN CT 06473-9903
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.

<table>
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| Reduce consumption of meat and dependency on animal-derived foods | • Reduction of greenhouse gas emissions  
• More farmland available for crops | • 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 | • Nutritional powerhouse  
• Can be tailored to regional environments (cows, goats, etc.) and scale of economy  
• Modern practices can reduce resource use and pollution | • Communities may need training to properly care for animals  
• Local production overseas might impact U.S. exports |
Greener Pastures

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

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<tr>
<td>Cover crops and no-till fields (2,4)</td>
<td>• Reduce soil erosion and water pollution • Healthier drinking water</td>
<td>• 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</td>
</tr>
<tr>
<td>Recycled manure and methane digesters (2,3,4,5,6)</td>
<td>• Reduce greenhouse gases and water pollution • Alternate source of electricity</td>
<td>• Costly start-up but can save money over time • Can be a source of revenue • Healthier cows (when recycled manure is used for bedding)</td>
</tr>
<tr>
<td>Covered manure storage (1,4,6)</td>
<td>• Reduced methane emissions • Reduced risk of leakage into groundwater</td>
<td>• 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</td>
</tr>
<tr>
<td>Recycled materials for barn stall bedding (2,3,4)</td>
<td>• Less waste of bedding materials • More comfortable cows</td>
<td>• Cost-effective</td>
</tr>
<tr>
<td>Reuse of water 2 to 3 times for farm operations (3)</td>
<td>• Less waste</td>
<td>• Cost-effective</td>
</tr>
<tr>
<td>Woodchip bioreactor (6)</td>
<td>• Safer habitats and water supply • Reduction of water pollutants</td>
<td>• Help reduce nutrients from farm runoff</td>
</tr>
<tr>
<td>Precision feeding (4,6)</td>
<td>• Reduces the amount of nitrogen and phosphorus excreted in animal waste • Increased supply of milk without higher cost</td>
<td>• Less costly to process • More productive cows</td>
</tr>
</tbody>
</table>

Source links:
2. Raising Crops for Dairy Cows: https://youtu.be/tA53MT0FmWY
3. How Do Dairy Farmers Recycle?: https://youtu.be/P3hHBWMoV40
4. There's no separation anxiety at this Pennsylvania farm: https://www.chesapeakebay.net/news/blog/theres_no_separation_anxiety_at_this_pennsylvania_farm
5. Reinford Farms: http://www.reinfordfarms.com
6. Dairy Farmers' Commitment to a Clean Chesapeake Bay: https://www.americandairy.com/_resources/pdf/chesapeake-bay-watershcompressed.pdf
Full Circle


Part 2: Answers will vary based on research and information found at O*NET Online.