Dear Educator,

Like many others in the U.S. agricultural industry, American egg farmers have made a commitment to environmental sustainability, and their success in achieving this goal can serve as an important model for teaching students about making daily sustainable choices that benefit the environment—an important concept in the science curriculum.

The American Egg Board (AEB) and award-winning curriculum specialists Young Minds Inspired (YMI) are pleased to bring you these lessons on sustainability. Supplementing the resources already found at the Egg Board’s home site, aeb.org, and at the AEB’s companion site, incredibleegg.org, these activities will introduce students to some of the scientific and technological advancements that have enabled the American egg industry to reduce its environmental footprint over the last 50 years.

We hope you will find these lessons helpful in supplementing the valuable resources already available at aeb.org/educators. Be sure to check back periodically for updates. Although the materials are copyrighted, you may make as many copies as needed for educational purposes.

Please comment online at ymiclassroom.com/feedback-egg-board to provide feedback. We look forward to hearing from you.

Sincerely,

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.

Target Audience
Middle school students in Science classes.

Program Objectives
• Educate students on the concept of sustainability.
• Introduce students to the application of science and technology in egg farming.
• Foster an understanding of egg farming as a model for sustainable agriculture.
• Interest students in science- and technology-based careers in agriculture.

Standards Alignment
This program aligns with Family and Consumer Science, Science, and Next Generation Science Standards. For more details, visit ymiclassroom.com/egg-board.

How to Use This Program
Download and photocopy this teacher’s guide and the three activity sheets. Review the materials to incorporate the lessons into your existing plans. Activity 2 will require 2-3 class sessions depending on the number of videos viewed. Activity 3 will require students to collect materials outside of class, plus time for project construction and presentation.

Activity 1
Eggs Past
PART 1: Have students use the link provided to complete the activity. Remind them that problem-solving leads to innovation, which advances hand-in-hand with technology. Improvements in the past paved the way for sustainability in agriculture. Answers:

1. Weather, predators, social issues, disease, consistent food sources. Most early problems with egg farming were associated with chickens living outside, where they were exposed to weather, predators, or parasite infestation and the spread of diseases from carriers such as rodents or even humans. Social issues resulting from “pecking order”—where bigger, more aggressive birds dominated the flock, leaving less food for others—were difficult to control, contributing to hen mortality and to inconsistent egg quality.

2. Selective breeding, special medicines. Selective breeding resulted in the healthiest, strongest birds with good egg-laying records becoming top breeders, passing on genetically favorable factors such as disease resistance and consistent egg production to the next flock. Special medicines helped control diseases such as parasite infestation.

3. Sanitation, waste control, and social issues resulting from hen pecking order.

PART 2: Answers will vary but should include the following:

A. Waste removal made easier; hens and eggs don’t make contact with waste.
B. Lower mortality rate; higher egg yield; fewer problems with pecking order; all hens can eat and drink freely.
C. Farmers can control feed without outdoor sources, resulting in uniform, high quality eggs.

D. Increased automation speeds egg collection and preserves freshness; lower labor costs; greater consumer value.

PART 3: Encourage students to read the industry statistics at incredibleeggs.org/good-egg-project/farm-to-table/reducing-our-environmental-footprint closely to identify as many connections as possible between improvements in egg production and sustainability. For example, improvements in waste removal can aid hen health as well as reduce emissions into the atmosphere. Answers: 1–C; 2–A; 3–D; 4–B, D.

Activity 2
Eggs Present
PART 1: Answers: 1–C; 2–A; 3–B; 4–A; 5–B.

PART 2: Videos may be screened and answers completed in class or at home. Answers will vary depending on the video(s) viewed.

• Farm-to-Table Virtual Field Trips at aeb.org/educators/farm-to-table-virtual-field-trips:
  • Hen health and the farm food web: Creighton Brothers and Pearl Valley Egg Farm
  • Natural producer/consumer/decomposer systems: Creighton Brothers
  • Sustainable practices: Pearl Valley Egg Farm

• Meet Our Farmers videos (Good Egg link) at incredibleeggs.org:
  • Water and emissions savings: Greg Herbruck and Clint Hickman links

Activity 3
Eggs Future

Have students work as a group, choosing an aspect of egg production that interests them and following the steps shown in the engineering design process graphic to create an idea for improvements to that aspect that might increase sustainability. For example, students might address hen health by designing a new cage system, a new device to dispense feed, or a new blend of scientifically balanced feed. They might address egg production and processing practices by designing a new machine to help with egg collecting or egg washing, etc. Plan your timeframe to include a special day for group presentations, to which you may also invite other classes, as well as administrators and parents.

Resources
• ymiclassroom.com/egg-board
• American Egg Board: aeb.org
• The Incredible Egg: incredibleeggs.org
Scientists may never agree on which came first, the chicken or the egg, but it is a fact that birds and eggs existed on our planet well before humans did. While it remains a mystery as to how long it took for humans to domesticate wild fowl, the earliest historical references to egg production date from around 1400 B.C. in ancient Egypt and China.

Chickens arrived in the Americas with Christopher Columbus on his second voyage to the New World in 1493. But it was not until the 20th century that egg farming became an industry in the United States, supplying American families with millions of fresh eggs every day. Learn how by reading the history of U.S. egg production at aeb.org/farmers-and-marketers/history-of-egg-production. Look for eggs-amples of how problem-solving and innovation paved the way for today's sustainable egg farming practices. Then answer these questions.

**PART 1: The Early 1900s**
Most farmers kept chickens in their backyards to provide eggs for their families, taking extra eggs to local markets to sell. Some farmers increased flock size to make more money selling eggs, but there was not yet an organized egg industry.

1. List five problems American egg farmers faced in the early 1900s.
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________

2. List two improvements to hen health practices that helped begin the movement toward sustainability.
   __________________________________________
   __________________________________________

3. What three problems still existed for egg farmers as of the mid-1900s?
   __________________________________________
   __________________________________________
   __________________________________________

**PART 2: The Mid to Late 1900s**
Backyard egg farming gave birth to an industry as egg farmers made improvements that would support indoor living for hens. Use the chart below to identify the improvements that cage systems contributed to solving the problems and challenges listed.

<table>
<thead>
<tr>
<th>Problems and Challenges</th>
<th>Improvements with Cage System</th>
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</thead>
<tbody>
<tr>
<td>A. Sanitation and Waste</td>
<td></td>
</tr>
<tr>
<td>B. Hen Health</td>
<td></td>
</tr>
<tr>
<td>C. Hen Feed</td>
<td></td>
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<tr>
<td>D. Economics</td>
<td></td>
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</tbody>
</table>

**PART 3: Now make the connection between each of the egg farming issues listed above and the ways in which these improvements have reduced the industry's environmental footprint. Write the letter(s) of the issues next to the industry statistics below to which they apply. Use the information at incredibleegg.org/good-egg-project/farm-to-table/reducing-our-environmental-footprint for help.**

1. ______ Fewer resources are required to produce a dozen eggs.
2. ______ Decreased polluting emissions have reduced the industry's carbon footprint.
3. ______ Less energy demand saves money for both producers and consumers.
4. ______ Egg production is improved.
**PART 1:** Over the past 50 years, science has helped the American egg industry make great improvements toward sustainability. Visit incredibleegg.org/templates/gep-template/pdf/infographic-impact.pdf to review the statistics shown below, then circle the letter of the correct answer.  
*Note:* The “current” statistics are updated as of 2010.

1. Hens produce more eggs and live longer than they did 50 years ago because:  
   A. They are tougher birds that keep on producing, regardless of conditions.  
   B. It's to be expected that 27% more hens would produce more eggs.  
   C. They experience a better living environment, health, and nutrition.  

2. If the same technologies used in 1960 were used to produce today's supply of 77.8 billion eggs, those production efforts would require:  
   A. Millions more hens and millions more acres of corn and soybeans.  
   B. Chickens and egg farmers both working double shifts.  
   C. 72% more hens and 32% more egg farms.  

3. The egg industry's ability to use a little over half the amount of feed to produce a dozen eggs versus that used 50 years ago has helped reduce its environmental footprint because:  
   A. Hens' stomachs have decreased in size over time.  
   B. Hen feed is nutritionally richer than before and egg farmers use more efficient methods for feeding.  
   C. Hens were considered pickier eaters 50 years ago.  

4. The volume of water used by today's hens, 32% less compared to that used by hens in 1960, would be enough to:  
   A. Fill over 3,000 Olympic-sized swimming pools.  
   B. Cover a third of the Earth's surface.  
   C. Provide water for 50 new egg farms.  

5. Even with more laying hens providing 27% more eggs per day now than in 1960, the egg industry has still reduced its overall emissions by 71% compared to 50 years ago. This amount of CO₂ reduction is equivalent to:  
   A. The amount saved by not running your heat or air conditioner year-round.  
   B. Taking 5.2 million cars off the road for a year.  
   C. The amount you would use round-trip to visit an egg farm every week for a year.  

**PART 2:** Time to eggs-plore! Follow your teacher’s directions to view a Farm-to-Table Virtual Field Trip to an egg farm at aeb.org/educators/farm-to-table-virtual-field-trips or the Meet Our Farmers videos on the Good Egg Project link at incredibleegg.org. You may view videos of more than one farm.

As you watch, take notes or make and label illustrations that show at least two sustainable practices you observe. Record the issue at right that each practice represents, such as hen health, hen feed, water, emissions, etc.

**NAME OF FARM:**  
____________________________________________  
Issue: _____________________________________  
Sustainability Eggs-ample(s):  
____________________________________________  
____________________________________________

**NAME OF FARM:**  
____________________________________________  
Issue: _____________________________________  
Sustainability Eggs-ample(s):  
____________________________________________  
____________________________________________
No one knows for sure what new technologies await the egg farming industry, but you might have some ideas! Follow the process in column 2 to create a new design or invention for the egg farmer of the future for an issue that most interests you. Remember, you don’t have to be an egg farmer to practice the design process that leads to scientific innovation!

**Eggs-traordinary Science!**

1. Research the links below to learn about typical management issues related to egg production, including hen health and well-being, environmental control, and production systems.
2. Choose the issue that interests you most. Use it as the basis for creating an idea for a new design or invention that could improve sustainability practices related to that issue.
3. Follow the engineering design process outline shown at right to guide your project development.
4. Write a paragraph to explain how your design or invention would work. Use more paper if you need it.

**Research Links**

- **Incredible Egg—Farm to Table**: incredibleegg.org/good-egg-project/farm-to-table/animal-nutrition-raising-healthy-hens
- **Incredible Egg—Eggscyclopedia**: incredibleegg.org/egg-facts/eggscyclopedia/t/treatment-of-hens
- **Incredible Egg—Meet Our Farmers**: incredibleegg.org/good-egg-project/meet-our-farmers
- **American Egg Board—Eggs 101 Video Series**: aeb.org/educators/video
- **American Egg Board—Factors That Influence Egg Production**: aeb.org/farmers-and-marketers/ftip

**Management Issues**

- **Hen management** (feed, housing, egg production systems that include conventional, free-range, cage-free, organic, and enriched colony)
- **Environmental management** (sanitation and manure management, water efficiency, henhouse climate control)
- **Manufacturing management** (egg processing, egg grading)

**The Engineering Design Process**

1. **ASK:** What is the challenge or problem?
2. **IMAGINE:** Brainstorm an idea to address the problem.
3. **PLAN:** Sketch the idea.
4. **CREATE:** Make a model of the design. Record model production steps.
5. **IMPROVE:** List any changes that could make the idea more efficient.

**My Plan of Action**

_____________________________________________
_____________________________________________
_____________________________________________
_____________________________________________
_____________________________________________
EGG FARMING: PAST, PRESENT, AND FUTURE

**Grades 6-8 Standards Alignment**

<table>
<thead>
<tr>
<th>Family and Consumer Science Standards</th>
<th>Activity 1</th>
<th>Activity 2</th>
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<tr>
<td>2.4 Evaluate the effects of technology on individual and family resources.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2.5 Analyze relationships between the economic system and consumer actions.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3.1 Analyze career paths within consumer service industries.</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>3.5 Demonstrate skills needed for product development, testing, and presentation.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>14.4 Evaluate factors that affect food safety from production through consumption.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>14.5 Evaluate the influence of science and technology on food composition, safety, and other issues.</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**Next Generation Science Standards**

**From Molecules to Organisms: Structures and Processes**

| MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. | x          |            |            |
| MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. |            | x          |            |

**Biological Evolution: Unity and Diversity**

| MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals’ probability of surviving and reproducing in a specific environment. | x          |            |            |
| MMS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits and organisms. |            | x          |            |

**Earth’s Systems**

| MS-ESS2-1 Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process. | x          | x          | x          |

**Earth and Human Activity**

| MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. | x          |            |            |
| MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth’s systems. | x          | x          | x          |

**Engineering Design**

| MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. | x          |            |            |
| MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. |            | x          |            |
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

**National Science Standards**

**Science as Inquiry**
- Abilities necessary to do scientific inquiry: x x x
- Understanding about scientific inquiry: x x x

**Life Science**
- Structures and function in living systems: x x x
- Reproduction and heredity: x x x
- Regulation and behavior: x x x
- Populations and ecosystems: x x x

**Science and Technology**
- Abilities of technological design: x x x
- Understanding about science and technology: x x x

**Science in personal and social perspectives**
- Populations, resources, and environments: x x x
- Science and technology in society: x x x

**History and Nature of Science**
- Science as a human endeavor: x x x
- Nature of science: x x x
- History of science: x x x