Module 6: Animals in Agriculture

Food Up!
URBAN AG CURRICULUM

Goals and Objectives:

Animals—from livestock to honeybees—play a critical role in agricultural systems and human diets across the globe. Their cultural, social, nutritional, and environmental value varies widely. Humans have a unique relationship with animals in the food system, and both farmers and consumers need to understand their role to make informed decisions.

In this lesson, students will examine several dietary food pyramids used in various contexts and determine how animal product consumption recommendations have changed over time, across cultures, and why. Students will explore the impacts of industrial animal farming on society and the environment by considering the three legs of sustainable agriculture: community, environment, and economy. During a hands-on garden activity, students will catalog and consider small animals—including pollinators and decomposers—important to agriculture. Lastly, students will learn about ecological animal farming to address the ills of modern industrial animal farming.

Time: 1 hour 35 minutes

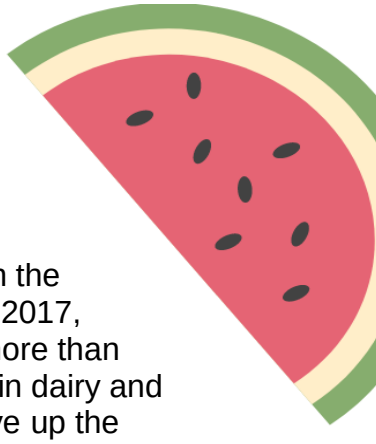
Note: There is no required Teacher Print Kit needed for this module. However, some optional pages are available as a reference.

Materials:

- ☐ Module 6 Student Handouts
- ☐ Pens (1 per student)
- ☐ Blank sheets of paper (1 per student)
- ☐ Technology with internet access to watch a video
- ☐ Whiteboard and markers (or large sheet of paper and markers)
- ☐ Tape (or about 40 magnets)
- ☐ String (about 50 feet)
- ☐ Blank notebook paper (Activity #3)
- ☐ Scissors

Optional:

- ☐ Module 6 Teacher Print Kit
- ☐ Trowels (1 per group of 3, if available)
- ☐ Microscopes (1 per group of 3)



Teacher Background:

Animal agriculture has become a cornerstone of the agricultural economy in the United States, with the majority of our crops grown to feed livestock.[1] As of 2017, consumption of meat in the United States outpaced the world average by more than half, at over 124.1 kilograms consumed per person per year.[2] A diet heavy in dairy and meat is a resource-heavy diet, given that we lose energy each time we move up the food chain. It takes about 10 pounds of corn to produce one pound of beef, and two pounds of corn to produce one pound of chicken.[1] To meet demand for meat in the United States, we have made drastic compromises that impact the quality of our air and waterways, our greenhouse gas emissions, the humane treatment of animals, and treatment of workers in the industry. In addition to sacrifices to the wellbeing of our planet and communities, human health has suffered as diets rich in animal protein and saturated fats have become the norm.

The US livestock industry, including cattle, calves, hogs, and pigs totaled $82.7 billion in 2020,[3] and the dairy industry totaled $36.7 billion in 2017.[4] These industries have substantial lobbying power, and the United States Department of Agriculture (USDA) has a vested interest in protecting industries that bring value to the economy. Unsurprisingly, the USDA's nutrition guidelines therefore reflect both the economic interests of the US agricultural industry and modern nutritional science. Compared to Harvard Medical School's Healthy Eating Plate, which is solely based on nutritional science, USDA's MyPlate recommendations include three servings of dairy per day, whereas the Healthy Eating Plate recommends just one to two, citing harmful side effects of a dairy heavy diet. The Healthy Eating Plate also recommends limiting processed and red meats, encouraging consumers to substitute it for poultry, fish, and plant-based sources of protein. Although the USDA recommends varying protein sources in the diet, there are no recommendations to limit red meat consumption, even though diets high in red and *processed* meat have been associated with increased risk of colorectal cancer and cardiovascular disease.[5]

In addition to potential negative health outcomes from extensive livestock production and consumption, the environmental impact is alarming. Beef is particularly damaging to the environment, as it requires more land and freshwater per ton of protein produced than all plant-based proteins or any other animal-based protein. Beef also is responsible for more greenhouse gases (GHG) emissions from feed production, land-use change, and methane from enteric fermentation.

To support our heavy reliance on animal products, most animal agriculture has transitioned from natural pastured operations on existing grasslands throughout the animal's life to partial or complete rearing in Confined Animal Feeding Operations (CAFOs), or to man-made pastures in previously forested areas. In a pasture or grazing operation, animals have full access to the outdoors, and eat grasses and insects naturally present on the farm. About 95% of cattle begin their lives on pasture but end them in grain-fed feedlots (CAFOs).[6]

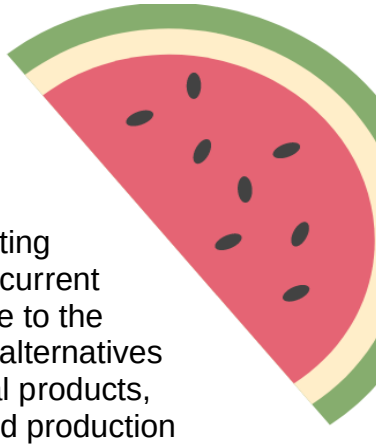
In a CAFO, animals are kept in tight quarters that are mostly indoors, while feed is brought in, and manure is shipped out. Although CAFOs are hailed for their production efficiency, consequences of the industrialized animal industry can be devastating to local and global natural environments, as well as the people involved. Impacts of industrial animal agriculture include:

Deforestation: In order to grow all of the feed necessary to support the ten pounds of feed necessary to produce one pound of beef, forests around the world have been cleared to either grow feed or become pasture. Between 2001 and 2015, 45.1 million hectares of forest were cleared to support the beef industry, a rate up to five times higher than any other product causing deforestation.[7]

Greenhouse gas emissions: In 2008, global livestock production accounted for 18% of human generated greenhouse gases.[1] Meat production emits more greenhouse gasses per unit of energy generated than plant-based foods. Due to enteric fermentation, cattle and other livestock are significant emitters of methane, an especially potent greenhouse gas.

Water pollution: When animals are raised indoors or in tightly confined areas, their manure must be transported away to be returned to the soil. Given that a single CAFO can produce as much manure as a mid-sized city, farmers often are not able to find proper ways to return all the nutrients in the manure to the soil properly. [8] Manure is frequently spread on fields to nourish the soil and manage waste. It is estimated that the nitrogen from runoff from this spreading causes over 25% of fish kills in the state of Iowa.[1] These toxic dead zones will continue downstream and cause harm not just locally in rivers and groundwater, but in oceans many miles away.

The crowded nature of CAFOs also influences human health and animal welfare. Animals are kept in such close quarters that pigs, for example, are often not able to turn around. Hen beaks are clipped to avoid the consequences of aggressive stress behaviors, rarely seen in less crowded, more natural conditions. In many states, animal agriculture is exempted from laws that mandate humane treatment of animals.[9] Due to overcrowding, disease among animals can become rampant without the use of antibiotics. Overuse of antibiotics in the meat industry is contributing to antibiotic resistance in bacteria, which is causing concern among medical and veterinary professionals about the maintenance of effective medical treatment for the human population. In 2019 alone, more than 6.1 million kilograms of antibiotics were given to US farmers.[10] Additionally, farmworkers involved in animal care and slaughter are often pushed to work in unsanitary, unsafe conditions detrimental to their physical and mental health. About 38% of US slaughterhouse workers are foreign born. It is estimated that 71% of these foreign-born workers do not have legal immigration status. Lacking this status gives workers less options for work and fewer legal grounds to fight back against exploitation at work.[11]



Animals are an important part of agroecosystems across the globe. Eliminating them from such systems would be a shortsighted, knee jerk reaction to our current agricultural woes. However, there is a need to rethink animal agriculture due to the the environmental and ethical drawbacks. Fortunately, there are numerous alternatives to modern, industrial animal agriculture. By embracing a diet lower in animal products, consumers can vote with their dollars for more sustainable, plant-based food production systems. Supporting ecological farming efforts that allow animals to graze on natural grasslands longer allows animals to engage in natural behavior, eating grass and insects directly from the land (eliminating the need to truck in crops and cut down trees for growing those crops) and eliminate their waste directly onto the soil where their nutrients came from. Sustainable dairy and meat production is possible and is happening every day. We can eat less meat, research where our animal products come from, and support local farmers to be part of the change.

In addition to animal agriculture for meat and dairy, this module covers the important work of insects in our agricultural system. Insects play several key roles in the food system: they pollinate our crops, aerate soil, assist with decomposition, and are also a good source of food for people and feed for animals. Worldwide, pollinators are necessary to the production of approximately 35% of the food that lands on our plates.[12] In addition to the production of honey and beeswax, honeybees alone pollinate over 100 commercial crops in the United States.[13] Worldwide, pollinators are estimated to be responsible for 217 billion dollars in agricultural productivity.[14] Pollinators not only pollinate crops for food production, but they are also an important part of the life cycle for plants that prevent soil erosion, create habitat, and increase carbon sequestration. Due to many changes in our global environment, including an increase in monocultures and vast decrease in biodiversity and pollinator habitat, our pollinator population is declining at a rapid rate. We can do our part to protect pollinators by supporting farmers and ecologists who maintain biodiversity and reduce or eliminate pesticide use.

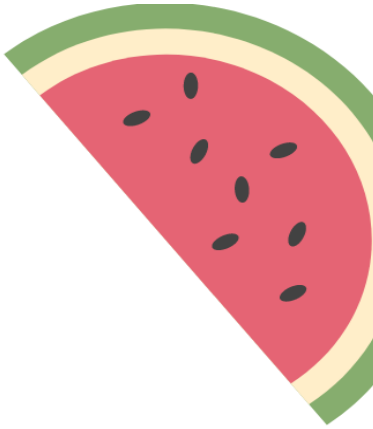
Insects are integral players in healthy soils, providing both aeration and decomposition services to ensure soil health. Beneficial insects provide pest management to crops, and pollinators play a key role in ensuring diversity in our diets. A conservative estimate of the ecological services provided by insects in the United States has been argued to be at least $57 billion.[15] Additionally, more than 2,100 insect species are edible, providing a nutritious and resource efficient protein source to people across the globe.[16] Edible insects are an incredible source of protein (including essential amino acids), healthy fats, and vitamins for humans, and require fewer resources to produce than conventional meat. Not only can edible insects be an incredible source of human food, but they are also an invaluable part of feeding animals, especially poultry and fish. Many species are adept recycles, capable of converting organic wastes and agricultural byproducts into a nutrient-dense and safe food/feed resource.[17]

Opening Discussion:

Ask your students the following questions to generate discussion on this topic and get the lesson started.

- *What are your family and cultural traditions around eating meat and dairy? Do you eat meat and dairy on special occasions or often? Do you think this is different from your ancestors?*

- *When you are eating an animal product, you are putting trust in your farmer to treat the animal in a fair way. What are a few things you think an animal raised for agriculture should have, in order to be considered as treated humanely?*



Activity #1: Animals, Nutrition, and Culture

Time: 30 minutes

Materials:

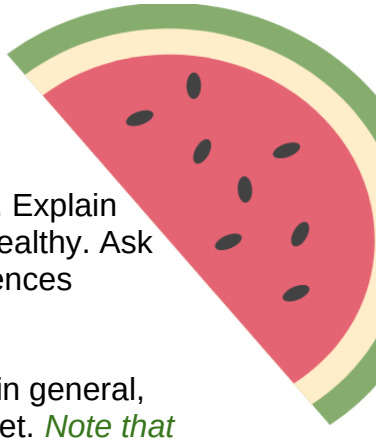
- ☐ Student Handouts (print 1 copy per 2-3 students)
  - ☐ Includes: Meat Consumption Charts (pages 1-3)
  - ☐ Includes: Food Pyramids (pages 4-11)
  - ☐ Includes: Pyramid Comparison worksheet (page 12) (1 copy per student)
- ☐ Pens (1 per student)
- ☐ Blank sheet of paper (1 per student)

Lesson:

1. Divide students into groups of 2-3 and pass out the Meat Consumption chart and the set of Food Pyramids in the Student Handout to each group.

2. Discuss:
   - *How does North America compare to other continents in its meat consumption?*
   - *Do you think our consumption is healthy for our bodies?*

3. Ask students to pull out their copies of the MyPlate pyramid and Healthy Eating pyramid.
   - *MyPlate is a nutritional infographic based on nutritional recommendations from the United States Department of Agriculture (USDA). The Healthy Eating pyramid is based on nutritional recommendations from Harvard Medical School. Look at the infographics, and the narratives that come with them. What differences do you see in the overall nutrition recommendations? What differences do you notice in the two institutions' recommendations on animal product consumption? Use the Key Differences between MyPlate and Healthy Eating Plate slide in the Student Print Kit to help answer these questions. Note these answers on your Pyramid Comparison Worksheet.*
     - *Why do you think there are slight differences in the recommendations between the USDA's advice and Harvard Medical School's advice?*
     - *The USDA is responsible for nutritional recommendations for Americans; however, it is also responsible for agricultural interests in the American food industry. Commercial and political groups play a role in the USDA's nutrition recommendations. Harvard Medical School has the freedom to publish advice based entirely on modern nutritional science without the influence of lobbying and commerce.*



4. Ask students to pull out the four Oldways Traditional Food Pyramids. Explain that traditional diets from around the world have been shown to be healthy. Ask students to take a few minutes to note or draw similarities and differences between these pyramids on their Pyramid Comparison Worksheet.

5. Next, ask students to compare Oldways Traditional Food Pyramids, in general, with the Healthy Eating Plate on their Pyramid Comparison Worksheet. *Note that traditional foodways are much in line with the most modern nutritional science. Eating a diet of mostly unprocessed plants, with fish and seafood consumed a few times a week, is a recipe for nutritional success and health.*

6. Ask students to draw their own food pyramid based on what they have eaten in the last three days on a blank sheet of paper. They can use the categories listed in MyPlate or Healthy Eating Plate to form a base for their plate. Ask students to try to make the size of the categories in their pyramid proportionate to their dietary habits over the last three days. Ask students to then fill the categories with drawings (or written word) of examples of foods the students have eaten recently.
    - *What are the similarities between your food pyramid and traditional foodways? What are the differences?*
    - *Based on the food pyramid you created, how does your intake of animal products compare to a healthy diet?*
    - *Based on the chart of per capita meat consumption, how does meat consumption in North America stack up against nutritional science?*
    - *Do you think USDA MyPlate guidelines affect how you eat? Does it affect how your family eats? Does it affect what is offered at school?*
    - *Do you think most North Americans eat enough meat to achieve a healthy diet? Do you think most North Americans eat too much meat to achieve a healthy diet?*

Activity #2: The Meatrix

Time: 20 minutes

Materials:

- ☐ Technology to watch a video clip as a group

Lesson:

1. Opening Discussion:
   - *In Activity #1, we learned that North Americans consume much more meat than many other societies. We also learned that our level of animal product consumption, on average, is not healthy long term.*

   - *Eating animal products is resource intensive. It not only affects our health, but the health of the environment, community, economy, and animals. We will take a look at a short film called The Meatrix. As shown in the video, most of our animal products in the United States are raised in industrial setting. Pay attention to any new facts you learn from the video.*

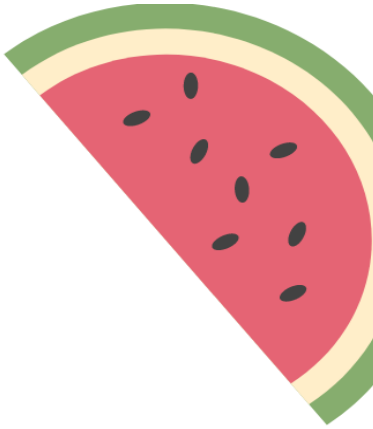
2. Watch *The Meatrix Clip* at themeatrix.com. Depending on the time you have available, you can watch the first clip, or all four.
   - The Meatrix Original 3:48
   - The Meatrix II: Revolting 4:11
   - The Meatrix II: Part II 2:23
   - The Meatrix Resurrections 2:47

3. Discuss as a group:
   - *Did you learn any new information from the clip? If so, what facts did you learn? What were the overall messages of the film?*

   - *Do you think the clip was fair and unbiased? Try to back up your position with specifics.*
     - *Were the facts correct or inaccurate? How could you check the facts? Did they leave out important information? If so, what is it? How do the graphics affect the message?*

   - *Does geography matter? Are there parts of the country or the state that are like the movie? Are there areas where livestock farming is not like that?*

   - *Does the clip make you think about meat production differently? Why or why not?*



Activity #3: Meat Effect

Time: 20 minutes

Materials:

- ☐ Student Handouts
  - ☐ Includes: Industrial vs. Ecological Farming Images (pages 14-15)
  - ☐ Includes: The Meat Effect Card set (pages 16-21)
- ☐ Whiteboard and markers (or large sheet of paper)
- ☐ String
- ☐ Tape or about 40 magnets
- ☐ Scissors

Prep:

- ☐ Cut strings into 24 pieces, each approximately 2 feet in length
- ☐ Cut out the Meat Effect Card set

Lesson:

1. Present the Industrial vs. Ecological Farming Images to students.

2. Ask students to brainstorm benefits and drawbacks to each type of farming based on pictures. This is an introduction to the activity, so do not worry if there aren't many ideas yet!

3. Make three labeled columns on the board based on the Three Legs of Sustainability: Community, Environment, and Economy.

4. Pass out Meat Effect cards to students one at a time until all are distributed, reading aloud the effects as you pass them out.

5. Ask students to one-by-one post their card(s) under the leg of sustainability they think the card applies to.

6. Once all cards are posted, ask students to find connections between cards, and connect the cards with string (and tape or magnets). Students will approach the board one by one to make a connection with a string. Ask students to explain why they are making the connections that they are.
   - Example:
     - Our high consumption of meat is related to deforestation because we need to develop more cropland to grow large amounts of feed for animals in feeding operations.

7. Keep your cards up on the board! You will need it for Activity #4.

8. Discuss:
    - *How does our high consumption of meat relate to environmental degradation? Is environmental degradation necessary for meat production?*
    - *How does our meat consumption relate to community degradation? Is community degradation necessary for meat production?*
    - *How does our meat consumption relate to humane treatment of animals? Is inhumane treatment of animals necessary for meat production?*

Activity #4: Farmers and their Animals

Time: 25 minutes

Materials:

- ☐ Technology to show a video
- ☐ Completed board from Activity #3
- ☐ Student Prink Kit
  - ☐ Includes: Regenerative Agriculture Card Set (pages 22-23)

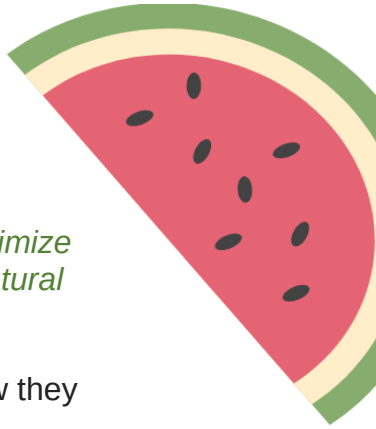
Lesson:

1. Introduce students to grazing as an ecological alternative to industrial animal farming.
   In a grazing system, animals have access to the outdoors during their entire lives and eat the grass and insects that are naturally available on the farm. Ecological animal farming does a lot to reduce the negative impacts that are associated with industrialized animal farming and even provide meaningful benefits to the sustainability of a farm. As you watch the following video, keep in mind some of the problems that we identified with industrialized animal farming. See if you can find solutions to some of those ills in the video clip and watch out for the benefits that ecological animal agriculture can bring to a farm and its community.

2. Next, watch a short film on Regenerative Farming
   - Farming Sustainably with Regenerative Agriculture | Restoring Paradise

3. Return to the cards posted on the board. Ask students to point to cards that they think can be remedied (in part or on a whole) by a grazing system.
   - For each card identified, discuss as a group:
     - *How might ecological animal agriculture help improve or heal this particular issue?*
     - *What other issues might we address by addressing this one? Students can use the previous connections made between cards to facilitate discussion of this question.*

4. Pass out the Regenerative Agriculture Card Set. Read each card aloud as you pass it out.
   - Ask students to come up to the board one by one and post their card next to a problem from Activity 3 that they think their card solves. Ask students to explain to the group why their card solves that issue.



5. Ask students: *What choices can you make in your own eating to minimize harmful effects and maximize positive effects on your community, natural environment, and economy?*

   Examples:

   - Buy locally to get to know your farmer and understand how they manage their livestock
   - Eat less meat
   - Avoid eating meat at fast food chains or restaurants where it is cheap and unclear where the meat comes from

Garden Connection: Insects! The Gardener's Secret Scavenger Hunt

Time: 20-40 minutes

Materials:

- ☐ Student Handouts
  - ☐ Includes: Gardener's Secret Scavenger Hunt Insect List (pages 24-27) (1 copy per group of 2-3)
  - ☐ Includes: Gardener's Secret Scavenger Hunt Checklist (page 28) (1 copy per group of 2-3)

Optional:

- ☐ Teacher Print Kit
  - ☐ Includes: Gardener's Secret Scavenger Hunt Teacher Insect List (pages 2-3)
- ☐ Tape or 4 magnets to post cards on the board
- ☐ Trowels (1 per group of 3, if available)
- ☐ Microscopes (1 per group of 3)

Lesson:

1. On the board, write the four categories of insects for students' visual reference: Pollinators, Decomposers, Aerators, and Pest Managers.
   - *In this lesson, we will explore four categories of insects that are necessary for healthy food production. They include pollinators, decomposers, aerators, and pest controlling insects.*

2. Use the Insect List on pages 2-3 in the teacher print kit (optional), or the descriptions below, to explain the use of each category of insect. Teachers or student volunteers can read these descriptions aloud.

   - Pollinators - Pollinating insects transport pollen from one flower to another, enabling the production of fruit and seeds. Many pollinators today are endangered, largely due to pesticide use.[18]

   - Decomposers - Decomposing insects break down organic material into usable nutrients for plants (and sometimes animals). These insects help to create excellent soil health, as well as reduce disease by breaking down plant material before harmful bacteria can initiate the decomposition process.

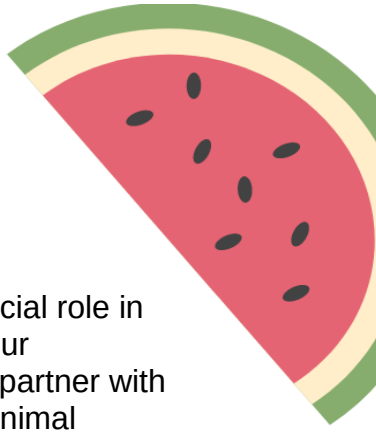
- Aerators - Aerating insects create channels in the soil for water and air to move through the soil. Without aeration, roots can lose access to water, the soil nutrients dissolved in the water, and air, creating a detrimental environment for the plants growing in the soil.

- Pest managers - Many insects serve to control pests in the garden. Beneficial insects can eat insects that eat plants or spread disease. Beneficial insects can also dominate areas suitable for the growth of young larvae, making it challenging for pest insects to breed.

3. Pass out a Gardener's Secret Scavenger Hunt Insect List and Checklist (Student Handouts pages 24-28) to each group of 2-3. If using, point to where magnifying glasses and trowels are available and encourage students to use them during exploration in the garden.

4. In this garden exploration, we will hunt for beneficial insects in the garden. Use your Gardener's Scavenger Hunt Insect List to try to find at least one insect in each insect category on your checklist:
   - Pollinators
   - Decomposers
   - Aerates
   - Pest Control

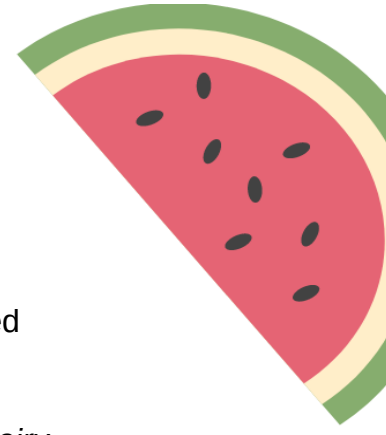
5. After students have had at least ten minutes to explore the garden, ask each group to share with the class what they found in the garden.
   - *Did you find any insects that weren't identified in the card set?*
   - *What are you curious to know about the insects you did find?*
   - *Based on the health of the plants in the garden, are there any insects that you think we need more of? Less of?*
     - Examples:
       1. *Pale leaves, or lack of fruit on a full-grown plant may indicate lack of nutrients. Aerators can make nutrients more available to roots, and decomposers can break down nutrients in the soil to be absorbed by plants' roots.*
       2. *Wilting, rotting leaves can indicate disease. Often, decomposing insects help manage decomposing material, creating less of a breeding ground for bacteria to grow.*
       3. *Are there holes in your leaves? There could be aphids feeding on your plants. Pest controlling insects could be necessary in your garden.*
       4. *Are there many flowers, but very little fruit? This could be an indicator that your garden does not have enough pollinators visiting.*



Closing Discussion:

The way we care for our farm animals in our agricultural system plays a crucial role in the health of the animals, our bodies, our economy, our environment, and our communities. When we are strategic about animal husbandry, animals can partner with us to be a boon to soil, local economies, and our health. In recent history, animal agriculture has changed dramatically, often at a detriment to local economies and the environment. We can take action to make healthy, sustainable animal agriculture commonplace once again.

- *What are some of the things you've learned today about animal agriculture?*
- *Are animal products a significant part of your diet? Why or why not?*
- *What habits related to meat and dairy can you change to support a healthier body, community, and planet?*
- *What are some benefits of insects in the garden or on farms? Why might you want to think carefully about using pesticides in a garden?*



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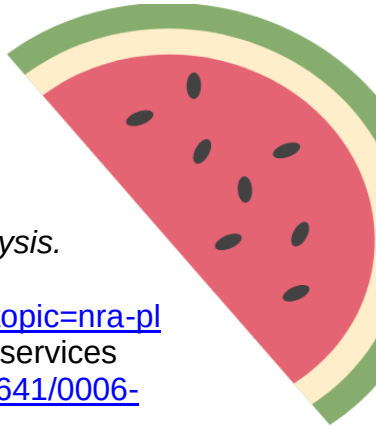

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17. Stull, V. J. and Patz, J. A. "Research and Policy Priorities for Edible Insects." Sustainability Science, June 27, 2019. https://doi.org/10.1007/s11625-019-00709-5.

Activity 2:
Please credit the Global Resource Action Center for the Environment (GRACE) and Free Range Graphics and Sustainable Table (Including web addresses) when you screen the movie

Movie: The Meatrix Resurrections

Discussion questions taken from Center for Integrated Agricultural Systems at the University of Wisconsin-Madison *Toward a Sustainable Agriculture* curriculum. Module III Section A: Activities.

Activity 3:
Card Set Information provided by:

- Center for Integrated Agricultural Systems. Module III Section A: Animals in the Food System
- Eurogroup for Animals. Beef production drives deforestation five times more than any other sector.
- National Public Radio. A Nation of Meat Eaters: See How it All Adds Up
- *Web*MD. Science reveals how red meat harms the heart.

Activity 4:
Regenerative Agriculture Video:
Farming Sustainably with Regenerative Agriculture | Restoring Paradise

Garden Connection:

18. Lawrence, M. (2022, June 10). *Protecting pollinators critical to food production.* United States Department of Agriculture. https://www.nifa.usda.gov/about-nifa/blogs/protecting-pollinators-critical-food-production

Lesson plan adapted from *9.18 Importance of Insects.* (2019, October 3). CK-12 Foundation. https://flexbooks.ck12.org/cbook/ck-12-middle-school-life-science-20/section/9.18/primary/lesson/importance-of-insects-ms-ls