Food Up!

An Urban Agriculture Curriculum

2023

Developed By:

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With the support of Michael Bell (PhD) and the School for Urban Agriculture at the University of Wisconsin-Madison.

Food Up!
URBAN AG CURRICULUM

Module 0: How to use the *Food Up!* curriculum - tips, tricks, and background

Welcome to *Food Up!* —a hands-on urban agricultural curriculum specifically designed to be flexible for use with at-risk and special needs youth, by nonprofit organizations and community gardens, or any urban project in need of activity-based, modular programming.

Vulnerable, unhoused, and special needs youth are unlikely candidates for conventional urban agriculture training programs. However, enhanced understanding of food production and food systems can empower youth to explore otherwise unknown careers in agriculture, grow food for their own consumption, eat healthier and more sustainable diets, and even participate more actively in their own communities. By connecting with local organizations serving at-risk youth and special needs youth, there are opportunities to provide targeted, exciting, and *flexible* education linked to urban agriculture to this new audience. Many existing curricula rely heavily on classroom activities, reading/literacy skills, and long-term time investments. Reaching this diverse audience may occur via less formal or structured interactions—with churches, non-profit organizations, community groups, neighborhood gardens, or after school programs. Adult leaders in these settings may not be trained in agriculture or have backgrounds in education. Thus, Food Up! was designed as a flexible, easy to use, activity-based curriculum that can support better engagement and greater impact.

Food Up! includes nine modules that cover a wide range of topics, from food security and food justice to marketing and soil health, along with gardening basics, climate change, mental health, and even nutrition. Intended for use by a wide-range of garden projects, nonprofits, and community organizations in Wisconsin and beyond, *Food Up!* utilizes games, hands-on activities, visuals, personal reflection, and group discussion to reach a wide array of students with variable educational backgrounds. Importantly, the modular design allows for drop-in participation, as students need not complete all modules (or complete them in any specific order) to benefit. Each lesson includes teacher instructions, a teacher print kit and materials list, student handouts, and bonus cards that can be used to supplement activities. Additionally, specific tips for working with special needs and at-risk youth are provided to support educators. *Food Up!* builds on and adapts existing food system and urban agriculture curricula, providing clear references to relevant sources where teachers can obtain more information.

How to Use:

This curriculum is intended to be user friendly for teachers of all backgrounds and levels of experience. Although the lesson modules are numbered (1 to 9) instructors do NOT need to use this curriculum in any specific order. Module 2 builds some background for other lessons, so it is a great place to start. However, all the modules are designed to be completely stand-alone. Hence, it is a pick and choose as you go design. Some lessons are a bit longer and good for rainy days when you want to be inside (see "May we suggest…" Table below). Others are best for active outdoor days. All lessons are intended to be amenable for students with variable educational backgrounds and skill sets. For example, whenever reading is required, the teacher or volunteer is encouraged in the lesson plan to read aloud. Most handouts contain images with text, and hands-on activities rarely require writing more than a few words.

Each module contains the following three documents, which you will want to review in advance:

1. **Lesson Plan** - Lesson plans include time expected, learning objectives, background information for the teacher, materials list, suggested discussion questions, and activity plans. The activities often build on one another, so it is important to use the activities within the module in the order that they are written and numbered.
2. **Teacher Print Kit** - The teacher print kit includes materials like answer keys, teaching aids, and displays that only require one copy for the class. We recommend printing one copy for each module you plan to teach.
3. **Student Handouts** - Student handouts include student worksheets, card games, and displays that require closer inspection by students. Student handout documents have a header page with specific instructions on how many copies to print based on the number of students you plan to teach.

Bonus Cards:

In addition to the seven core Modules, *Food Up!* contains a Bonus Card Deck with strategies for gardening, nutrition lessons, and recipes for garden produce. These cards will be suggested as extra or optional material throughout the modules. They also serve as quick guides for gardening activities and discussions when your time in the garden calls for more informal learning. The Bonus Card deck includes:

1. *Kitchen Essentials* - lists of kitchen and recipe essentials to accompany the lesson plans.
2. *Recipes* - simple, easy to make recipes that you can make together, use as examples, or send home with students if they take produce home from the garden.
3. *Nutrition Basics* - key information on specific nutrients, crops, and foods that will help students think about the health impacts of their diet.
4. *Garden Strategies* - these cards will be a handy reference for instructors, with tips on compost, mulch, planting, and garden maintenance.

Lesson Plan Breakdown:

- **Module # and Title**: Remember, Modules are only numbered for convenience, they are not designed to be taught in order! The Module and Title will match the module # and Title for corresponding Teacher Print Kit and Student Handout set.

- **Goals and Objectives**: A quick overview of what will be taught in the lesson and learning objectives for students.

- **Time**: Each activity within the module has an estimated time to teach the lesson. The time on the first page of the Module is the approximate time required to teach the entire module, as well as the optional and extra activities.

- **Materials**: All materials required to teach the entire module are listed on the first page in a master materials list. Individual materials lists are included for each activity throughout the module under that activities' title. Materials for the optional activity are listed separately.
  - If "Supplies from Kitchen Essentials Card," is listed, the materials listed on the Kitchen Essentials card in the Bonus Card Deck will be needed. We suggest gathering the materials listed on the card and keeping them in a tote in your classroom or garden shed for easy access.

- **Teacher Background**: This section is a quick primer on the subject matter for the teacher. This will allow the teacher to engage students in richer discussions during the lesson.

- **Opening Discussion:** This often includes a brainstorm to get students thinking creatively and building curiosity around the module's topic.

- **Activities**: Each module includes 4-5 activities which build on one another. It is important to teach these activities in the order listed. Each includes a time estimate, materials list, and step by step instructions. You can break up a module across several sessions by teaching a couple activities per session, but they do build on each other.

- **Connecting to the Garden:** Each module contains a section that will help teachers connect the content directly to the garden. Typically, these include an activity in the garden or an exercise that pushes students to make observations in their own garden.

- **Closing Discussion**: Short discussion prompts to summarize the lesson and inspire action and further learning.

Adapting for Vulnerable Students and Those with Special Needs

This curriculum aims to make it easier to reach underserved populations, including at-risk and special needs youth. To effectively target these audiences, teachers need to take intentional action to adjust their teaching style. Below is a list of strategies and tips to use in this and other agriculture and gardening educational settings.

Relate

Personalizing lesson plans and relating them to students' lived experience supports better engagement and knowledge retention.[1]

- Make a connection to personal experience.
  - Be sure students know the emphasis is on sharing perspective rather than performing knowledge.[2] Critical thinking and conversation, rather than being correct, are the goals.
- Lessons should be relevant to real life. Throughout the curriculum, discussion questions are provided to help students make connections between food systems knowledge and their everyday life.
- Encourage dialogue among students and with instructors.[2]
  - Ask questions and seek clarification.
  - Redirect questions to peers.
  - Limit teacher moderation when possible.
- If sensitive topics, such as food insecurity, could trigger crises in teens' lives, consider having resource cards prepared including hotlines and local organizations that can help.
- Block out time to work in the garden with space for free-flowing conversation. Talking about life in the garden is a great way to build relationships with students. Sol Fire Farm's "Walk as If" ice breaker activity, listed below, has many great questions to spark conversation with teens.
- Use icebreakers at the beginning of a session. Icebreakers encourage participation by:
  - Creating a more relaxed environment for students.[3]
  - Giving students more ownership over their learning environment.[3]
  - Building bonds among students.[3]
- Sol Fire Farm's "Walk as If" ice breaker[7] is full of great questions to ask one another. We recommend printing the questions and keeping them handy to spark conversations in the garden, or to use as introductions. Here's a sampling:
  - Who do you admire most and why?
  - How do you want to be remembered?
  - What was your dream job growing up?
- When students answer questions in a group, if the answer is not correct, find the correct parts of their answer or acknowledge why the answer makes sense before calling on another student to add or clarify the answer. Work collectively to reach the right answer.

Emphasis on Project and Sensory-Based Learning

- Project based learning increases content retention, encourages complex thinking skills such as evaluation and creative thinking, and builds skills in collaboration.[6] Project based activities are included throughout this curriculum. Look to the Connecting to the Garden section, included in each Module, for rich project-based activities.
- Ask students to create something new. When learning about food pyramids, recipes, advertisements, or neighborhood maps, ask them to create their ideal version of what they are learning about. This is a great way to encourage students to think critically about the components of the lesson and use their creativity to engage in new knowledge more deeply.
- Engage the body and brainstorm ways to use all five senses. This is a great way to accommodate many different types of learning in one classroom.[6]

Engage Community

- Engage youth mentors.
  - Youth mentors can be from the wider community or from within the group.
    - Throughout the Modules, ask students to share what they already know about a topic with the class.
    - Engage youth mentors in the community that are working or volunteering in your students' area of interest. Seeing others doing inspiring work can help foster independence among students.[5]
  - You can gauge interest for peer teaching in your group. Assign an activity for a student to teach and meet one on one with the student to coach them on how to teach the activity to the wider group. Have them practice teaching you the lesson before teaching their peers.
- Engage community members and seek opportunities for community based and service learning. Working with community members allows students to widen their professional networks, explore career paths, and increase their understanding of various cultures present in their community.[4]
- Invite experts from your community to speak about topics you are learning about in class.
- Schedule a field trip.
- Increase student engagement by doing work in the community that is creating change in the real world. Students are more motivated to learn when they see real world consequences to their actions.[4]

Focus on Small Group Learning

- Encourage students to work in small groups of 2-6
- Answer questions in small groups using the following methods:

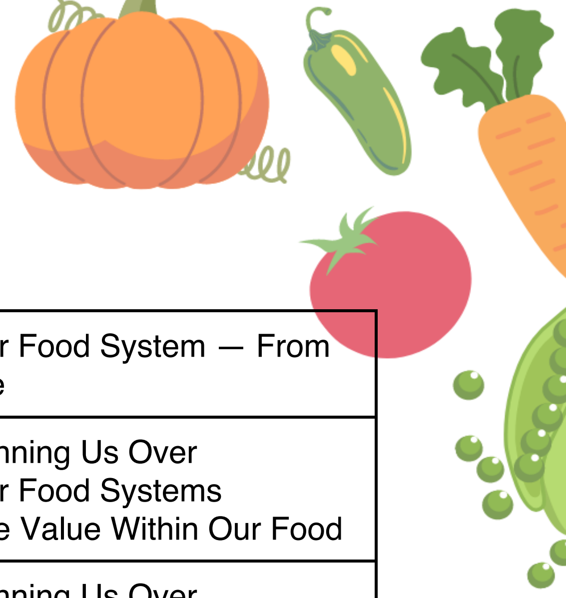
- Turn and talk: Encourage students to answer a question posed to the class by sharing with their neighbor. Answers can then be elicited for sharing with the entire class.[1]
- Pro-Con Caveat Grids: Students independently write pros and cons to a solution for a problem. They then partner up to create a more complex pros and cons grid. Afterwards, teams pass their grid to another team, where they will share what they agree and disagree with and will look for anything on the other teams' grid that they find interesting or surprising.[1]

- Why Small Group Learning?
  - Compared to individual or competitive learning, small group learning has been proven to:
    - Increase academic performance.[1]
      - In small groups, students are better at solving problems, form a deeper understanding of material, and retain information learned for longer.
    - Develop social skills.[1]
      - Small group work helps those who are resistant to sharing in a larger group feel more confident to speak into a conversation.
      - In small groups, students learn to handle peers who tend to dominate conversation.
      - Groups learn to create balance of participation.
      - Students who work together are more likely to integrate among gender, ethnic, ability, class, and other groups.
    - Increase Self Esteem.[1]
      - Group work increases self-esteem among participants.

Increase Accessibility for students with low literacy and learning disabilities.

- Focus on project-based learning. Projects allow learners of all abilities to approach a topic in a way that they learn best. For example, a student who processes information visually may choose to create a diagram of information, while an auditory processor may choose to create a spoken word piece.[6]
- Include natural movement in lessons where possible.[6] Providing physical games, opportunities to approach the board, and fidget toys are all ways that students who absorb information better through movement can better process the content being taught.
- To accommodate students with lower literacy levels:
  - Use voice recorded background information for lessons or ensure that all information includes audio instead of or in addition to written text.
  - Use videos for background information.
  - Use symbols and pictures posted on the board in addition to simple written language.
- To create clear schedules that are accessible to those with ADHD or autism:

    - Add video to explanations of gardening tasks. Video record garden tasks from a “first person” view by holding a camera close to your head while doing a garden task. This helps students see a task from their own perspective.
    - Break down tasks into checklists to help students organize their time. Even breaking down simple tasks like planting carrots into a printed checklist can greatly increase accessibility for those with autism or ADHD. Students can use *Food Up!* Garden Strategies (in the Bonus Card Deck) to break down garden tasks into bite-sized pieces.
    - Create visual schedules of a task. Having a picture representing each bite sized step of a larger task can help students comprehend expectations. The Garden Strategies cards can help.
- For non-verbal students, having choice boards available with pictures or video of garden task options can help students communicate preferences and have autonomy over their own task schedule in the garden. Students can point to what they’d like to do next or build a schedule at the beginning of the session using the choice board.
- Clarity of expectations can increase accessibility for those with autism. Having schedules that include quantity to be planted or picked (example: We will pick 20 tomatoes), or a time that an activity will be engaged for (We will pick tomatoes for 3 minutes) can help students feel secure and reduce anxiety.
- To visually represent quantities, you can build a schedule board out of Velcro. For example, if you plan to pick 10 tomatoes with a student, you can Velcro ten pictures of tomatoes to laminated cardstock. As each tomato is picked, a picture can be taken from the board. Alternatively, you can use cardboard to make ten small boxes in your harvesting crate to give the student a natural visual that when each box has a tomato in it, tomato harvesting is done.
- For students who have trouble understanding time, visual clocks can help clarify. Visual clocks use contrasting colors to signify the passage of time. Sand timers also work well. Using a picture of a visual clock next to a picture or description of a task on a schedule or checklist can further help students create a mental map around their time in the garden.



May We Suggest...

A place to start (especially beginner teachers)	Module 2: Our Food System — From Farm to Table
For when you have many crops to harvest	Module 1: Winning Us Over Module 2: Our Food Systems Module 9: The Value Within Our Food
For a rainy day	Module 1: Winning Us Over Module 6: Animals in Agriculture
For a small group	Module 3: How to Feed a Plant
For a large group	Module 7: Heating Up
For a group of all first-time students	Module 1: Winning Us Over Module 2: Our Food Systems Module 3: How to Feed a Plant
For a new teacher or a substitute teacher	Module 1: Winning Us Over
For limited prep time	Module 5: Make It Last Module 8: Mental Health and Urban Agriculture
When you need a longer, more in-depth lesson with nuance	Module 7: Heating Up Module 9: The Value Within Our Food Module 8: Mental Health and Urban Agriculture
For participants interested in social justice	Module 4: Food Desert to Food Oasis

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Module 1 - Winning Us Over - Food Marketing and Food Choice
Students will investigate strategies that advertisers use to impact our food choices. We will explore the relationship between profit and advertising, and whether this relationship can affect consumer nutritional choices. Finally, students will use what they've learned to create their own advertisement for a specific food sourced from the garden.

- Activity #1: Brand Recognition
- Activity #2: Investigating the Ad Dollar
- Activity #3: Strategy Sleuths
- Activity #4: Create Your Own Ad

Module 2 - Our Food System - From Farm to Table
Students will learn about the steps involved in taking a food product from farm to plate. We will explore how our food systems distribute wealth. Lastly, we will play a food web activity that illustrates how all steps along the food chain are connected.

- Activity #1: Fair Share Card Sort
- Activity #2: The Food Chain
- Activity #3: The Journey
- Optional Activity #4: The Food Chain of Justice & George Washington Carver
- Activity #5: The Food Web

Module 3 - How to Feed a Plant - What Our Crops Need to Grow
Students will explore the major climates of the world, and what crops grow best in each climate. Students will learn the basic needs of a plant by building a hydroponic growing column and building their own soil. Lastly, the interactions of plants in a garden will be explored through a three sisters garden tour and companion planting card game.

- Activity #1: Crops Around the World
- Activity #2: Hydroponic Growing Column
- Activity #3: Healthy Soil = Healthy Food
- Optional Activity #4: Three Sisters Garden Tour
- Optional Activity #5: Companion Planting Game

Module 4 - Food Desert to Food Oasis - Food Security and Urban Farming
Students explore what influences food choice, including geography, marketing, policy, and culture. Students will plan a menu based on the constraints of two scenarios and will explore food access in three neighborhoods in Madison, WI. To end the lesson, urban agriculture will be explored as a solution to food access barriers.

- Activity #1: Food Choice
- Activity #2: Building a Healthy Meal

- Activity #3: Mapping Food Security
- Activity #4: Community Thriving through Urban Agriculture

Module 5 - Make it Last - Sustainable Agriculture and Agroecology
Students learn how sustainable agriculture is related to human thriving by exploring Maslow's Hierarchy of Needs and relating these human needs to community, economy, and environment. A card game is used to explore the sustainability of different foods and their production processes. Students create a menu for a sustainable meal to summarize the lesson.

- Activity #1: Thriving Together
- Activity #2: Sustainable? You Decide!
- Activity #3: Garden Connection: Nature + Farming = Agroecology
- Activity #4: Sustainable Meals

Module 6 - Animals in Agriculture
Students explore the effect of culture, policy, and economy on meat consumption in the United States. We then explore the effect of the industrial meat industry on the economy, community, and environment. Ecological animal husbandry is addressed at the end of the lesson.

- Activity #1 - Animals, Nutrition, and Culture
- Activity #2 - The Meatrix
- Activity #3 - Meat Effect
- Garden Connection: Insects: The Gardener's Secret
- Activity #4 - Farmers and their Animals

Module 7 - Heating Up - Why A Changing Climate Matters to You
Students explore the difference between weather and climate, how greenhouse gasses drive climate change, and the relationship between agriculture, our food, and climate.

- Activity #1: What is Climate? Evaluating Your Closet
- Activity #2: What is Climate Change? Meeting the Greenhouse Gasses; A Game
- Activity #3: No Rain, No Gain – How a changing climate is stressing our farms.
- Activity #4: Is your food warming the planet?

Module 8 – Mental Health and Urban Agriculture
Students will learn about how emotions relate to nature. Students will also explore mindfulness techniques and how mental health is impacted by nature. Lastly, students will learn about healing gardens and plants.

- Activity #1: Nonviolent Communication
- Activity #2: Mindfulness in the Garden

- Activity #3: Healing Garden
- Activity #4: Healing Garden Matching Game

Module 9 – The Value Within Our Food
Students will explore the global burden of food loss and waste and how it interrelates with the food supply chain. Students will also brainstorm preventative solutions of all scales along each step of the food supply chain to maximize food yields and minimize food waste. Students will discover the hidden resources that are discarded as waste and will engage in critical thinking regarding the essential inputs required for food production as well as the extent of loss from food waste.

- Activity #1: Food Waste vs. Food Loss
- Activity #2: Discovering the True Costs
- Activity #3: Messaging the Value
- Optional Activity #4: Exploration of the Plate

Materials

For ease of use, materials that are needed for **more than three lessons** have been included in the *master list* below, and hence eliminated from individual module material lists. We suggest you keep an accessible container on hand that includes, at a minimum, all the master list materials for use with each module. Complete material lists are included at the beginning of each lesson plan.

Master List:
- Scissors (multiple; at least 1 pair for every 3 students)
- Whiteboard and markers (or large sheet of paper and markers)
- Regular pens or pencils
- Blank notebook paper
- Colored markers
- Blank white paper
- Post-It notes
- Magnets

Additional Module 1 Materials:
- Module 1 Teacher Print Kit
- Module 1 Student Handouts
- Magazines (at least one per two students)

Optional:
- Array of packaged foods (Activity #1)
- Supplies listed on Kitchen Essentials, as well as access to the Nutrition Basics, and Recipe Cards (from Bonus Card Deck)

Additional Module 2 Materials:

- Module 2 Teacher Print Kit
- Module 2 Student Handouts

Optional:

- 4 clear jars (Activity #1)
- 200 pennies (Activity #1)
- One set of supplies from Kitchen Essentials (from Bonus Deck to each student group) (Optional Activity #4)
- Recipe Cards (from Bonus Card Deck) (Optional Activity #4)
- Packaging options (Optional Activity #4)
  - Quart or gallon size zip-lock bags
  - Pint or Quart size jars
- Sticky mailing labels (Optional Activity #4)
- Colored Sharpies (Optional Activity #4)
- Technology to show a YouTube video OR printed Teacher Print Kit (Activity #4)

Additional Module 3 Materials:

- Module 3 Teacher Print Kit
- Module 3 Student Handouts
- Tape
- String
- Empty 2-liter soda bottles with caps (1 per student Activity #1 + 4 for Activity #3)
- Cotton material (an old T-shirt works well)
- Potting soil
- Scoop for the soil
- Large mixing bowl
- Access to water
- Thick nail and hammer OR awl OR utility knife OR drill (something to poke a hole in a bottle cap with)
- A small plant or seedling for each student (herbs, like basil, work well here)
- 4 coffee filters
- Liquid measuring cup
- Dry measuring cup
- 1.5 C Sand
- 1.5 C Clay (in dry, powdery form, such as from a potter's shop or craft store)
- 1.5 C Silt
- Permanent Marker

Optional:

- Mature Three Sisters Garden for observation
- Four magnets for posting cards on the whiteboard.

Additional Module 4 Materials:

- Module 4 Teacher Print Kit

- Module 4 Student Handouts

Optional:

- Technology to show a YouTube Video

Additional Module 5 Materials:

- Module 5 Teacher Print Kit
- Module 5 Student Handouts
- Two colors of string
- Magnets (#) or tape
- Garden in any stage of growth

Additional Module 6 Materials:

- Module 6 Teacher Print Kit
- Module 6 Student Handouts
- Technology with internet access to watch a video
- Tape (or about 40 magnets)
- String

Additional Module 7 Materials:

- Module 7 Teacher Print Kit
- Module 7 Student Handouts
- Open area for a physical activity
- 2 pieces of string (~1 foot and ~7.5 feet)
    - Note: You can do this activity without string; it serves as an aid to draw a large circle for the game
- Chalk for paved spaces **or** stakes and string for grassy/field spaces
- Small bag with “What are Humans doing?” written on it (optional)
- 12 dodgeballs OR newspaper and masking tape
- Two thermometers (for taking air temperature outside)
- A clear bowl, jar, or vase and something to cover it (plastic wrap or a dark t-shirt)
- Four large pieces of paper
- Tape

Optional:

- Technology to play a YouTube video

Additional Module 8 Materials:

- Module 8 Teacher Print Kit
- Module 8 Student Handouts
- Outside environment or garden

Additional Module 9 Materials:

- Module 9 Teacher Print Kit
- Module 9 Student Handouts

- Tape OR 24 magnets
- 5 clear jars OR cups
- Set of multicolor pompom balls

Optional:

- Projector and technology to play a video
- Poster boards

Where to get help / support:

Likely you will want or need additional information and support for your program. We list useful references at the end of each module that were used to develop the *Food Up!* content. Additionally, we have created a reference database of related and relevant curricula, sorted by the main topic. This catalog is research-based and includes publicly available high school food curriculum searchable by topic and by organization. You can access the research database online here: https://thelandproject.org/additional-resources/

About the Authors

The *Food Up!* curriculum was developed by a team of scholars and practitioners in Wisconsin, USA. They include Shelbi Jentz, Valerie Stull (PhD), Olive Dyrbye-Wright, Dejah Broaster, and Allison Errath, with support from Michael Bell (PhD) and the School for Urban Agriculture at the University of Wisconsin-Madison. The team brings extensive experience in agriculture, research, pedagogy, and nonprofit work to this project. We hope that *Food Up!* can be used to expand urban agriculture education to wider audiences who may not enroll in more formal programs. Moreover, we hope that the topics included here can introduce participants to the interconnectedness between farming, economics, wellbeing, and human health. We welcome feedback and hope that educators from all backgrounds can use (and modify) this curriculum as it suits their needs.

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Module 1: Winning Us Over – Food Marketing & Food Choice

Goals and Objectives:

Students will gain an understanding as to how advertisements and marketing impact food choice, particularly as they relate to processed and fresh foods. Students will also explore motives, given that profits routinely drive what foods companies advertise most and what marketing strategies they apply to influence our choices. Students will be encouraged to think critically about their own dietary choices considering these realities. To help students apply their knowledge, this lesson concludes with a group activity whereby groups will create their own advertisement for healthy fresh food.

Time: 1 hour 5 minutes

Optional additional activities: 40 minutes

Materials:

☐ Module 1 Teacher Print Kit
☐ Module 1 Student Handouts
☐ Scissors
☐ Magazines (at least one per two students)
☐ Whiteboard and markers (or large sheet of paper and markers)
☐ Pens or pencils

Optional:
☐ Array of packaged foods (Activity #1)
☐ Blank notebook paper (Activity #3)
☐ Colored markers (Activity #3 and Optional Activity #4)
☐ Blank white paper (Optional Activity #4)
☐ Supplies listed on Kitchen Essentials Card (from Bonus Card Deck)
☐ Nutrition Basics & Recipe Cards (from Bonus Card Deck)

Teacher Background:

In 2012, $4.6 billion was spent on advertisements for fast food. Yet less than 4% of that, ($116 million) went to advertising fruits and vegetables.[1] Companies are motivated to sell processed foods, as it is often more profitable than fresh foods. Unfortunately, the foods that make companies the most money are often the least healthy. Research shows a strong association between increased viewing of advertisements for unhealthy foods and rates of obesity in children. Children under eight years old do not discern the persuasive nature of advertisements and therefore are likely to view their claims as true. Children in the United States see an average of 4,787 television advertisements for food and beverages each year and are influenced by the celebrities, cartoon characters, and bright colors that advertisers employ.[2]

Opening Discussion:

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

- *What do you love to eat?*
- *What influences your choices of food when you go to a grocery store?*
- *Who influences our food choices? Is it only family and friends? Are there people we don't know influencing us?*

Activity #1: Brand Recognition

Time: 10 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Includes: Brand Recognition Answer Key (page 3)
- ☐ Student Handouts (print 1 copy per 2 students)
    - ☐ Includes: Brand Recognition Image Cards that should be cut out (pages 2-5)
- ☐ Scissors

Prep: Cut out the Brand Recognition Image Cards from the Student Handouts

Lesson:

1. Hand out brand recognition cards to groups of 2-3 students. Give students two minutes to identify as many brands as they can. Have students sort cards into unrecognized and recognized brands.

2. Discuss:
    - *Where do you see these brands and how often?*
    - *How do you think branding affects your food choices?*
    - *Which brand was the easiest to recognize? Why?*

Activity #2: Investigating the Ad Dollar

Time: 15 minutes

Materials:

☐ Teacher Print Kit
☐ Student Handouts (print 1 copy per 2 students)
  ☐ Includes: Investigating the Ad Dollar (pages 6-9), which can also be projected if desired

Optional:
☐ Projector

Teacher Background (Optional)

Read this short article from the American Psychological Association: The Impact of Food Advertising on Childhood Obesity

Lesson:

1. Show the students the first two slides under Activity #2 in the Teacher Print Kit. Then discuss:
   - *What categories of food do advertisers spend the most on? What category do they spend the least on?*
   - *Why do you think advertisers spend more on the foods that they do?*
   - *How do you think food spending affects our choices in food?*
   - *How do you think advertising affects our health?*

2. Next, observe the third slide under Activity #2 in the Teacher Print Kit as a group and consider:
   - *Why do you think advertisers spend money on children?*

   Example:
   Children do not have a "media filter." Establishing brand loyalty at a young age increases profits for companies throughout that child's lifetime.

Activity #3: Strategy Sleuths

Time: 30-40 minutes

Materials:

- ☐ Magazines (have 1-3 magazines per 2 students) or food packages
- ☐ Whiteboard and markers (or large sheet of paper)
- ☐ Blank notebook paper (optional for students to use)
- ☐ Pens or pencils

Optional:

- ☐ Strategy Sleuths Discussion Questions from the Teacher Print Kit or Student Handouts

Lesson:

1. Show the group a representative ad from one of the magazines. Discuss the below questions together. (Note: these questions are also included at the end of the Teacher Print Kit to be shown as a visual aid if desired.)

    - *Who is this ad intended for? What strategies are the advertisers using to appeal to their audience? How effective do you think the ad is in selling the product? Why?* Write the list on the whiteboard. Try to come up with a list of 20 simple strategies.
        - Examples: Celebrity endorsement, positive information, giveaways, emotional appeal, narrative, humor, brand recognition

2. Next, have students break into pairs, and hand out 1-3 magazines to each pair. Ask each group to pick out a food advertisement from their magazine.

3. Have students think about, draw out, or write out the answers to the above discussion questions for their newly selected ads. You can post the questions on the board, project them, or hand out printed copies (see the Strategy Sleuths page 10 in both the Student Handouts and the Teacher Print Kit).

4. Next, ask each pair to present their findings to the class. If you'd like, each group can also ask the rest of the class to come up with more strategies that the advertiser used.

5. Optional: You may want to end this lesson by reflecting on how advertisement strategies are intended to incentivize people to buy things or adopt certain behaviors. Ask the groups to reflect on the overall impact that such strategies may be having on consumers, farmers, and businesses.

Connecting to the Garden

Time: variable, 15+ minutes

Materials:

Optional:
☐ Recipe Cards (from Bonus Card Deck)
☐ Nutrition Basics Cards (from Bonus Card Deck)

Please Note: Optional Activity #4 (“Create Your Own Ad!”) outlined below connects directly to your work in the garden through this short “Connecting to the Garden” exercise. Before beginning Activity #4, consider taking a walk through the garden with students and doing the following:

1. Point out crops that are ready for harvest—students may use these in their marketing campaigns in Activity #4. Use the **Recipe Cards** to help students brainstorm a few ideas of how they might combine ingredients in the garden to make them more marketable. Use the **Nutrition Basics Cards** to point out beneficial aspects of produce in the garden that students can use in their advertisements. You might follow the below script.

    - *Food advertising may seem distant from farming or gardening itself, but it isn’t. How food is produced, harvested, and processed is influenced by business decision making, including marketing.*

2. As you walk the garden, consider these questions with students:

    - *Which products might be harder to market? What can you do, as an advertiser or marketer, to make them more appealing?*

      Example: Winter squash is not very appealing eaten raw. We might **process** foods like squash to make them ready to eat by roasting or pureeing them, for example.

      Example: A tomato with bulges or splits may not be appealing to a customer. We could **process** this tomato into a more marketable product like salsa, or we could start an **ad campaign** that celebrates “ugly” produce.

      Example: Tomatoes stay good for only a few days after harvest, making them hard to market. We might process them into a **shelf stable** spaghetti sauce so we can sell to people in the winter as well as the summer, doubling our time in the market!

- *If you were an advertiser working for a processor, what foods might you focus on advertising? If you worked for a farmer, which would you focus on?*

  Example: Watermelons are appealing right off the vine. They don't need any processing to be appealing, and are a fairly easy, low-cost crop to grow. If you worked for a farmer, you might advertise melons. If you worked for the processor, you might advertise the squash, as more of the money will be put into processing before arriving at the consumer's table.

Optional Activity #4

Time: 40 minutes

Materials:

☐ Blank Paper
☐ Markers

Optional:
☐ Nutrition Basics Cards (from Bonus Card Deck)
☐ Recipe Cards (from Bonus Card Deck)
☐ Supplies listed on Kitchen Essentials Card (from Bonus Card Deck) if you decide to cook or make any recipes

Lesson:

1. Have students break into groups of 2-4. Ask each group to harvest (or identify) one healthy food from the garden that they would like to advertise. Students should think about how they could market this crop. Would they process it by cooking, drying, or using it in a recipe? Would they package it in a unique way? What language might they use to describe the food? Note: If time and resources allow, students can look at the Recipe Cards as inspiration for their own new creation. Feel free to help them conceptualize and discuss their ideas, or even cook up their creation for everyone to taste!

2. Next, help each group determine the TYPE of ad they will create (ex. print, TV, radio, billboard, package, etc.), their target audience, and at least five STRATEGIES they will use from Activity #3 above to make their advertisement effective.

3. Give students time to create their advertisement. They can look at the Nutrition Basics Cards to help spark ideas on the value(s) of their product. They will need markers and paper for print ads, or they might write a script for a radio ad, etc.

4. Lastly, have each group present their advertisement to the rest of the class. After the brief presentation, discuss together the target audience for the ad, its effectiveness, and the strategies applied in each. [Optional: Ask the class to vote for the most effective and creative advertisement.]

Closing Discussion:

You may wish to help the students connect the dots in this lesson using a brief closing comment, such as the one below.

- *There are many factors that influence our decisions as to what foods go into our body. Two of these factors are marketing and advertising. Often, the foods that make companies the most profit are also those highest in unhealthy ingredients and subjected to extensive processing. We can honor our bodies and our health by being aware of the messages and advertisements we see. We should aim to listen to and be most influenced by credible sources (evidence-based) and people who have our health and wellbeing in mind.*

Lastly, discuss the following:

- *Who decides what you eat?*
- *Could we design a system where companies are incentivized to increase health? How would advertising change?*
- *How does knowing how money affects what is advertised change how you see advertisements?*
- *What power do you have to influence others' eating habits?*

References:

Teacher Background:

1. Harris et al., 2013. Fast Food Facts: Measuring Progress in Nutrition and Marketing to Children and Teens. Report from the Yale Rudd Center for Food Policy and Obesity.
2. The American Psychological Association, 2010. The Impact of Food Advertising on Childhood Obesity.

Activity 1:

Adapted from Lesson 11: *Marketing Under the Influence* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020)

Activity 2:

Adapted from *The Media Does Not Have My Mind* from Soul Fire Farm

Activity 3:

Adapted from Lesson 11: *Marketing Under the Influence* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020)

WINNING US OVER: FOOD MARKETING AND FOOD CHOICE

Module 1
Teacher Print Kit

Instructions: Print one copy of this document as a reference *for the Teacher.* You can print double- or single-sided. Additionally, print the Student Handouts for Module 1.

Food Up!

Optional Teacher Background Reading

The Impact of Food Advertising on Childhood Obesity
The American Psychological Association

"The childhood obesity epidemic is a serious public health problem that increases morbidity, mortality, and has substantial long term economic and social costs. The rates of obesity in America's children and youth have almost tripled in the last quarter century. Approximately 20% of our youth are now overweight with obesity rates in preschool age children increasing at alarming speed. According to the Centers for Disease Control and Prevention, the prevalence of obesity has more than doubled among children ages 2 to 5 (5.0% to 12.4%) and ages 6 to 11 (6.5% to 17.0%). In teens ages 12 to 19, prevalence rates have tripled (5.0% to 17.6%). Obesity in childhood places children and youth at risk for becoming obese as adults and associated poor health such as diabetes, cardiovascular disease, and some forms of cancer. Prevention efforts must focus on reducing excess weight gain as children grow up.

Today's children, ages 8 to 18, consume multiple types of media (often simultaneously) and spend more time (44.5 hours per week) in front of computer, television, and game screens than any other activity in their lives except sleeping. Research has found strong associations between increases in advertising for non-nutritious foods and rates of childhood obesity."

Optional Teacher Background Continued...

“Most children under age 6 cannot distinguish between programming and advertising and children under age 8 do not understand the persuasive intent of advertising. Advertising directed at children this young is by its very nature exploitative. Children have a remarkable ability to recall content from the ads to which they have been exposed. Product preference has been shown to occur with as little as a single commercial exposure and to strengthen with repeated exposures. Product preferences affect children's product purchase requests and these requests influence parents' purchasing decisions.”

References:

1. The American Psychological Association, 2010. The Impact of Food Advertising on Childhood Obesity

Activity #1: Brand Recognition

Answer Key for Teachers

A. Gatorade
B. Pepsi
C. Mountain Dew
D. Starbucks
E. Kit Kat
F. Gerber
G. McDonalds
H. Subway
I. Johnsonville Sausages
J. KFC
K. Organic Valley
L. Kraft
M. Heinz
N. Green Giant
O. Up and Up
P. Great Value
Q. Market Pantry
R. Kwik Trip
S. Roundys
T. Aldis

Activity #1: Brand Recognition Images

Logos A-H

A	B	C	D
E	F	G	H

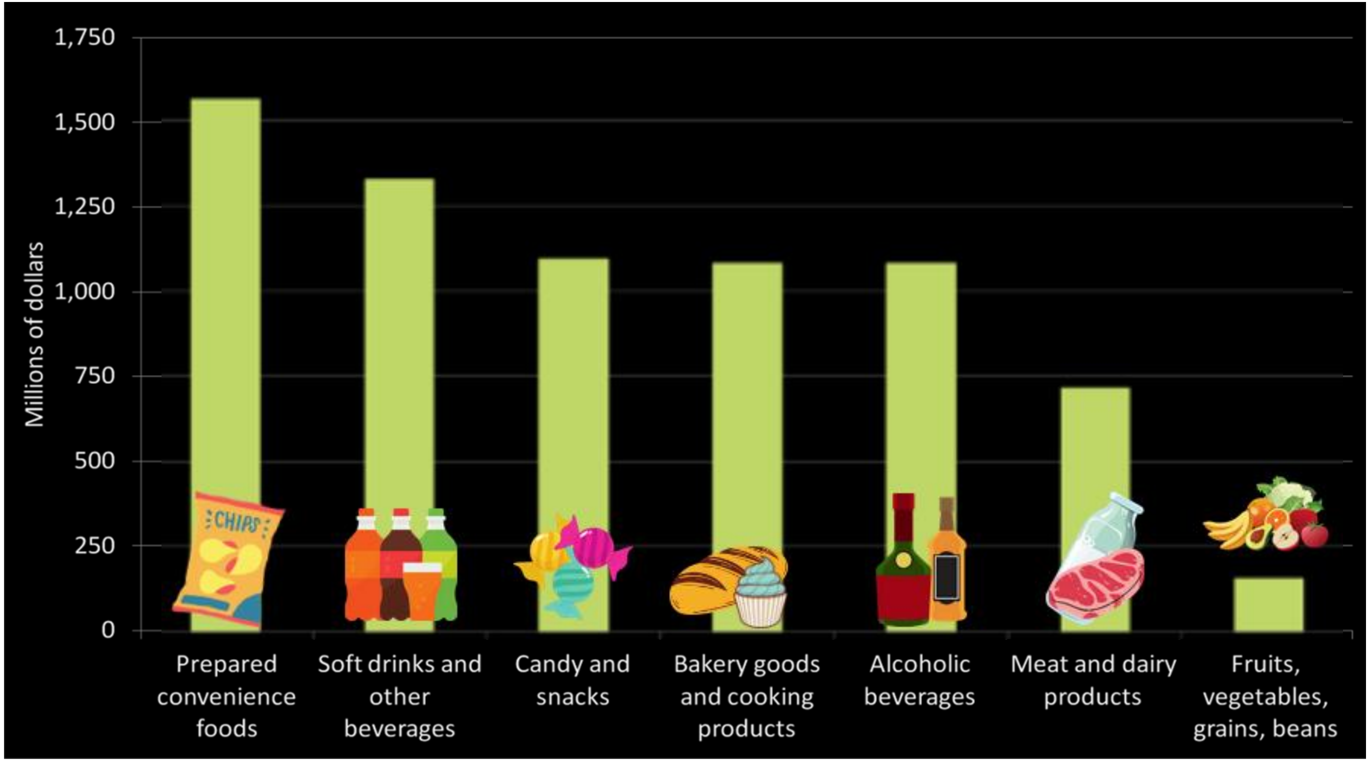
I	J	K	L
Heinz M	N	O	P
Q	R	S	T

Activity #2: Investigating the Ad Dollar

Show your students the following graphics as you would through this activity.

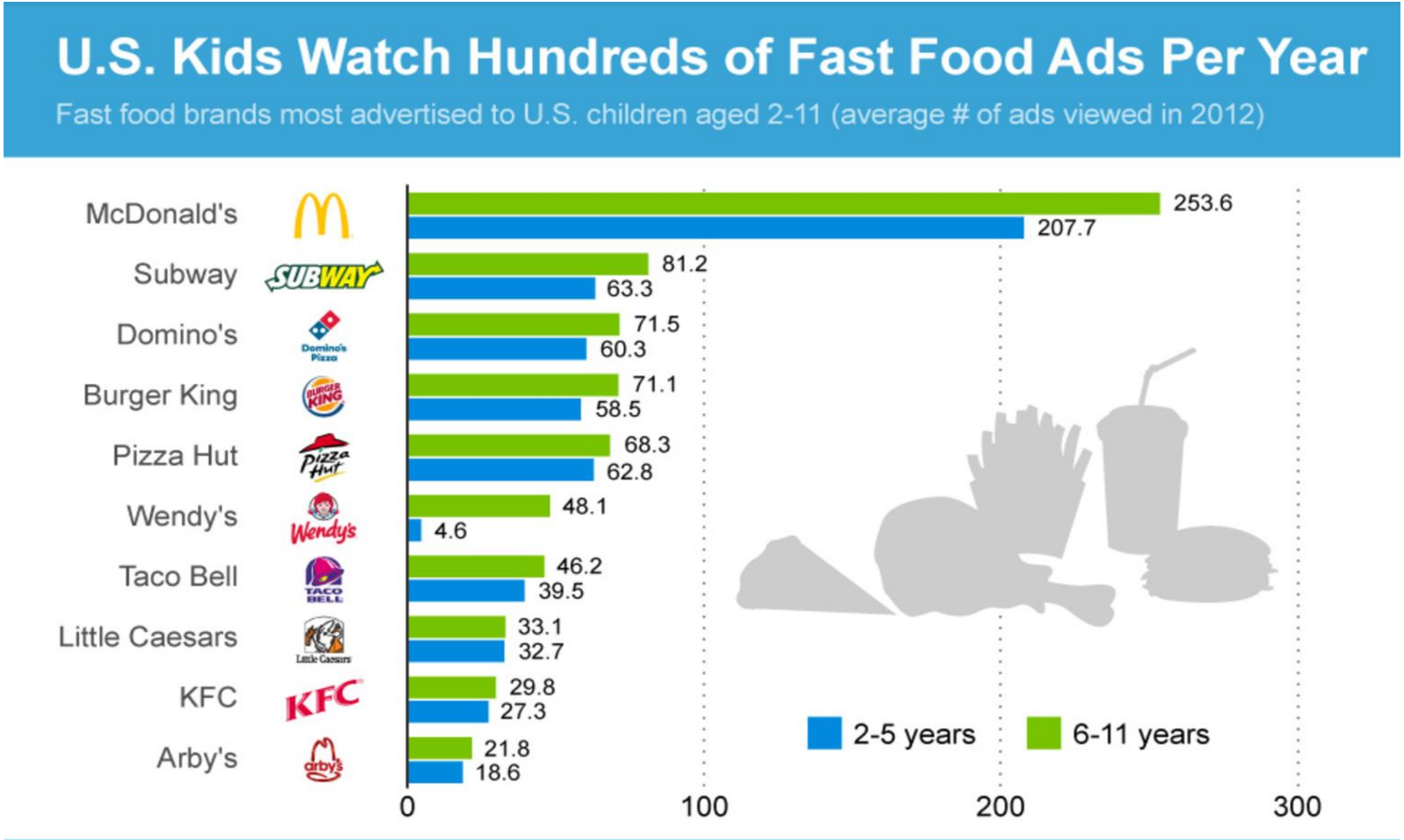
1. US Food Advertising Spending
2. Fast Food Advertising Graphic
3. Hours of Fast-Food Ads Per Year Watched by Children

US Food Advertising Spending



Annual spending by U.S. food and beverage manufacturers on advertising in 1997 (the last year industry-wide data were openly available); Source: Gallo A. Food Advertising in the United States. In: America’s Eating Habits Changes and Consequences. USDA Economic Research Service; 1999:173-180. Image Adapted from Foodspan.

Source: Yale Rudd Center for Food Policy & Obesity, as shown in *The Media Does Not Have My Mind* by Soul Fire Farm



Source: Nielsen, Yale Rudd Center for Food Policy, as shown in *The Media Does Not Have My Mind* by Soul Fire Farm

Activity #3: Strategy Sleuths

Discussion Questions:

- Who is this ad intended for?

- What strategies are the advertisers using to appeal to their audience?

- How effective do you think the ad is in selling the product?

Winning Us Over: Food Marketing and Food Choice

Module 1
Student Handouts

Instructions: It is easiest to print this document **double-sided**. Print 1 copy for every 2 students in your class. Individually cut out the Brand Recognition Images from pages 2-5 into card decks. Each student group should get 1 deck (including images A-T).

Food Up!

Food Up!

Activity #1: Brand Recognition Image Cards

Logos A-H

A

B

C

D

E

F

G

H

J

K

L

M

N

O

P

Q

R

S

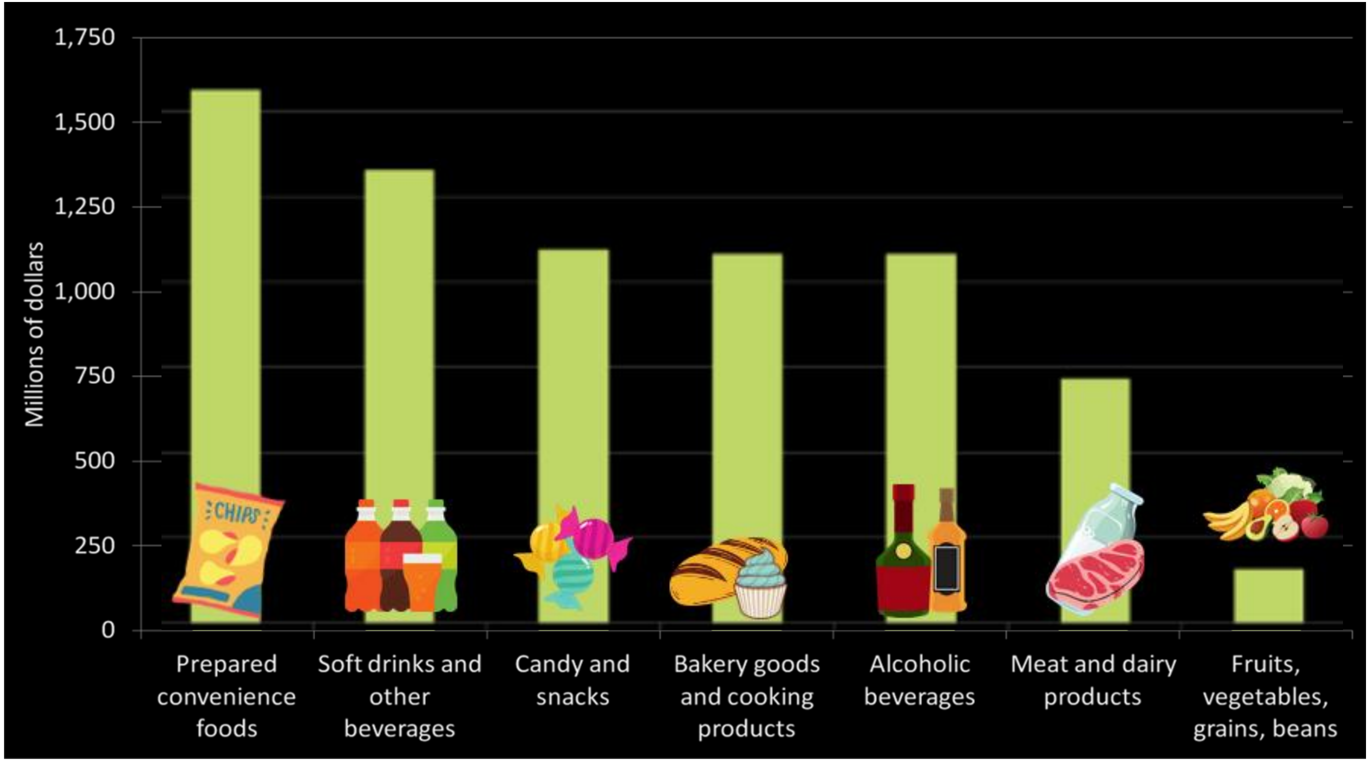
T

Activity #2: Investigating the Ad Dollar

View the following graphics as you work through this activity.

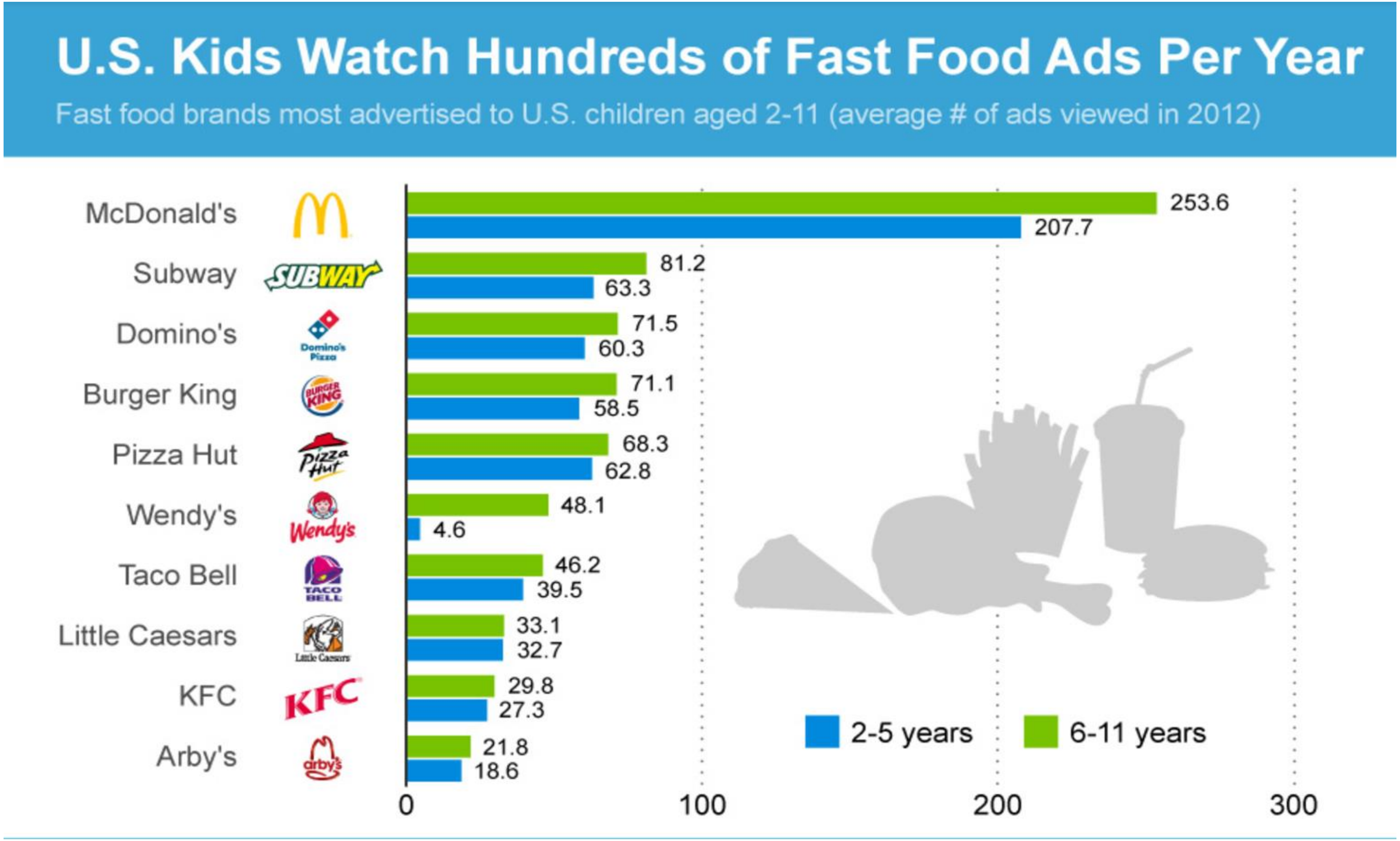
1. US Food Advertising Spending
2. Fast Food Advertising Graphic
3. Hours of Fast-Food Ads Per Year Watched by Children

US Food Advertising Spending



Annual spending by U.S. food and beverage manufacturers on advertising in 1997 (the last year industry-wide data were openly available); Source: Gallo A. Food Advertising in the United States. In: America's Eating Habits Changes and Consequences. USDA Economic Research Service; 1999:173-180. Image Adapted from Foodspan.

Source: Yale Rudd Center for Food Policy & Obesity, as shown in *The Media Does Not Have My Mind* by Soul Fire Farm



Source: Nielsen, Yale Rudd Center for Food Policy, as shown in *The Media Does Not Have My Mind* by Soul Fire Farm

Activity #3: Strategy Sleuths

Discussion Questions:

- Who is this ad intended for?

- What strategies are the advertisers using to appeal to their audience?

- How effective do you think the ad is in selling the product?

Module 2: Our Food System—from Farm to Table

Goals and Objectives:

Students will explore the steps involved in moving food from the farm to the table, as well as the role of money in the process. Students will be introduced to the broader impacts of our food system on human health, the environment, and the economy. During this lesson, students will investigate the relationship between the capital distribution across the food chain and the nutritional value of products by comparing the farmer's share of retail prices for a variety of products and setting up a mock food chain to illustrate where money is allocated along the journey from farm to table.

Time: 1 hour

Optional additional activities: 1 hour

Materials:

☐ Module 2 Teacher Print Kit
☐ Module 2 Student Handouts
☐ Scissors
☐ Whiteboard and markers (or large sheet of paper and markers)
☐ Post-It Notes

Optional:
☐ 4 clear jars (Activity #1)
☐ 200 pennies (Activity #1)
☐ One set of supplies from the Kitchen Essentials card for each student group from Bonus Card Deck (Optional Activity #4)
- ☐ Recipe Cards (from Bonus Card Deck) (Optional Activity #4)
- ☐ Packaging options (Optional Activity #4)
  - ☐ Quart or gallon size zip-lock bags
  - ☐ Pint or Quart size jars

☐ Sticky labels (Optional Activity #4)
☐ Blank paper (Optional Activity #4)
☐ Colored sharpies, markers, crayons, colored pencils (Optional Activity #4)
☐ Technology to show YouTube video OR printed Teacher Print Kit (Activity #4)

Teacher Background:

Our food chain is complex. Students may not realize that the majority of each dollar spent on food funds all of the steps that happen between the farm and to their plate. However, of the $1.2 trillion spent on food in the United States in 2017, only 7.8% or $94 billion went to gross income for farmers.[1] From this income, farmers earn a salary, but must also cover expenses related to their land, seeds, inputs, equipment, and more.

There are benefits to having a complex food system. A system with infrastructure to support food production, processing, transportation, wholesale trade, retail, and food services can offer a wide variety of food choices. In this way, corn can be grown, harvested, and processed into a variety of products, from cereal to soda to fuel, and a banana can be acquired almost everywhere in the United States at any time of the year. Foods can be processed and packaged to increase shelf-life and accessibility.

However, there are major downsides to this complex system as well. As capitalism drives decision-making across the value chain and processing becomes more common, companies are incentivized to sell delicious, convenient, and highly processed foods than whole, fresh, and often perishable foods. Consumers pay the price with diet-related complications. Incentives to market and sell processed foods—from government subsidies to profit trends—outpace those of healthier, whole foods.

Additionally, there are many food monopolies that create strain on local economies and workers. An estimated 93% of soda is produced by just three companies: Coca Cola Company, PepsiCo, and Keurig Dr. Pepper. Moreover, 73% of breakfast cereal is produced by only three companies: General Mills, Kellogg Company, and Post Holdings.[2] These market-dominating companies wield exorbitant power, with the ability to set retail prices, prices for producer's raw ingredients, and even worker wages.

An alternative paradigm involves situations where consumers have a personal relationship with food producers and vendors. By buying directly from local farmers, consumers are able to distribute their dollars in a way that supports the local economy. Buying locally often means buying foods with less packaging, fewer food miles, limited processing, and more nutrients. It can also connect consumers to farmers, communities, and to the environment. It should be noted that local producers often struggle to produce food as cheaply as large companies, posing a barrier for low-income consumers.

Many of the benefits of buying locally are amplified when urban agriculture is put to use. Food miles, a unit of measurement of the fuel used to transport food from producer to consumer, are often further decreased. The constraints of urban farming encourage human power over large, fossil fuel-dependent equipment during production. The greenspaces that farms create also keep cities cooler, facilitate natural rainwater drainage, and attract pollinators. Urban agriculture also offers natural community building and mental health benefits, providing a space where people can connect around growing and sharing food. Urban farms can play a key role in making healthy, culturally desirable, and affordable food available in underserved neighborhoods.[3]

Opening Discussion:

Use the questions below to kickstart this lesson with a conversation about food choice. Push your students to interrogate their own decisions about food, or those made by people who prepare food for them. Then, consider sharing the introduction paragraph below to set the stage for this module.

- *What are the reasons that you might buy a frozen pizza at the store rather than make it yourself?*
    - Plausible responses:
        - Convenience
        - Sometimes cheaper
        - You don’t need to buy many different ingredients.
        - You don’t need to cook.
- *Can you think of some of the companies and workers you might be paying to produce your frozen pizza for you?*
    - *Is there anyone we’ve forgotten* (perhaps farm workers, truck drivers, people who stock grocery stores, supply chain managers / logistics experts)?
- *Do you eat any foods that likely were produced and transported by very few people? Which foods might have a lot of people involved?*
    - Consider: frozen, highly processed foods coming from far away versus locally produced, raw or unpackaged foods

There are many people involved in shaping the food we eat. Almost all our food starts out on a farm. Where it goes between the farm and the table, however, depends on what form the food will take on your plate, and where the food comes from. Some foods are simple, with not a lot of steps between the farm and the table, like an ear of fresh sweet corn. Others require a complicated chain of events, such as soda. Both these products come from corn, but the processes they go through along the food chain are very different. These processes have an impact on your health, on our world’s wealth distribution, on our planet, and more. Today we are going to start to explore the impact our food chain has on people and our planet.

Activity #1: Fair Share Card Sort

Time: 15 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Includes: Food Dollar Infographic (page 1)
    - ☐ Includes: Where Does Your Dollar Go? (page 2)
- ☐ Student Handouts (one copy per group of 3-4 students)
    - ☐ Includes: Fair Share Card Sort (pages 2-3)
- ☐ Scissors
- ☐ White board (or large paper) and markers
- ☐ post-It notes

Optional Materials:

- ☐ 4 clear jars
- ☐ 200 pennies

Prep:

- Cut out Fair Share Cards from the Student Handouts and sort them into decks. You'll need 1 deck for every 3-4 students.
- Study the Food Dollar Infographic on page 1 of the Teacher Print Kit to give yourself a richer background to teach from.

Lesson:

1. Create two timelines by drawing two long horizontal lines on the white board or paper. Write "Carrots above one line and "Soda" above the other. Write "Farm" on one end of the lines, and "Table" on the other. Your chart will look as follows:

Carrots

Farm ———————————————— Table

Soda

Farm ———————————————— Table

2. As a large group, have students brainstorm the steps involved in getting carrots all the way from the seed to the dinner table. Have the students (or the teacher) write ideas on post-it notes and stick them along the carrot timeline on the board.

[For example: Step #1 plant carrot seeds on the farm. Step #2 - harvest carrots from the field and wash them…]

- Repeat this process for soda.

3. Once your board is nicely populated with sticky notes, take some time to discuss the following:
    - *What steps are involved in soda production that are not involved in carrot production?* Add these steps to the timeline if you'd like.
    - *How much do you think the workers in each of these steps get paid? Do you think each step is valued in the same way?*
    - *Do you think the steps involved after the product leaves the farm impact how much the farmer is ultimately paid for a product? Why?*
    - *If a pound of carrots and a can of soda were each sold for $1, do you think the farmer would get more of that dollar for the carrots or the soda? Why?*
    - *On average, farmers get about 47 cents for every one dollar spent on carrots at the store. Farmers get about 5 cents for every dollar spent on soda at the store.*

4. **Optional:** Economic Illustration (If you do not have the materials or do not wish to do this illustration, skip to step #4 below):
    - Use 200 pennies, the "Where Does Your Dollar Go?" Teacher Print Kit (page 2), and four jars to illustrate. With post-its or paper laying in front of the jars, label your jars according to the following:
        - Carrots, Farmer, $.47
        - Carrots, Others
        - Soda, Farmer, $.05
        - Soda, Others
    - *Ask the students to calculate how many pennies go into the "Others" Jars as a group. Then discuss:*
        - *Who else gets some of that money? Why might the farmer's share be larger for carrots than it is for soda?*

5. Separate students into groups of 3-5 and pass out a Fair Share Card Sort deck to each group with the *images face up*.
    - Ask students to do their best to order cards from largest farm share (largest percentage of retail value allocated to the farmer) to smallest farm share solely based on the images. Remind students not to look at the back of the cards yet!
    - Discuss: *Look at the card you think will give the smallest share of money to the farmer. Why do you think this will have a small share?*
    - Ask students to flip their cards over in place. They can re-order the cards if they would like. Discuss: *Think about the production chain of these products. Which products have the largest share of money going to the farmer? Which has the smallest? What do the items with the smallest farmer share have in common? What do the items with the largest farmer share have in common?*

Activity #2: The Food Chain

Time: 10 minutes

Materials:

- ☐ White board and markers
- ☐ Completed post-Its from Activity #1
- ☐ Teacher Print Kit
  - ☐ Includes: Food Production Chain Teacher Cards (pages 4-7)
- ☐ Student Handouts (print 1 copy per 2 students)
  - ☐ Includes: Food Chain infographic (page 4)

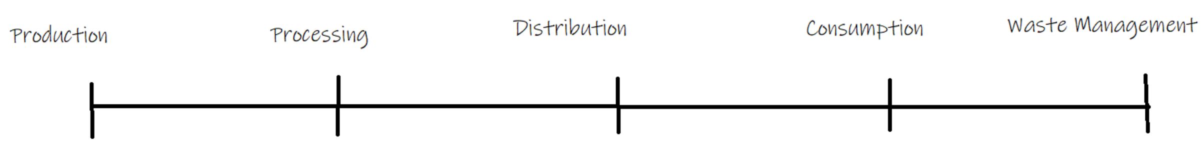
Optional:

☐ Scissors

Prep: Cut out Food Production Chain Teacher Cards (optional)

Lesson:

1. Display the food chain infographic (from Teacher Print Kit, page 4). Write a horizontal line on the board and write each of the steps listed in the infographic on the timeline, like so:



2. Use the Food Production Chain Teacher Cards (from Teacher Print Kit, pages 5-8) to define each step of the food chain timeline and give ideas of what each step represents.

3. One by one, move the soda and carrot post-It notes from Activity #1 to the new timeline. Read each Post-it and ask the group where it should be moved to on the new timeline. Discuss:
   - *Can we think of even more steps to the soda and carrot production chain?* You may choose to add these steps to the timeline.
   - *Do they all fit in these categories?* Share with students that many of the steps involved in getting products from farm to table don't fit into neat categories and that's okay.

Activity #3: The Journey

Time: 15 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Includes: The Journey Answer Key (page 8)
- ☐ Student Handouts
    - ☐ Includes: The Journey Card Decks (pages 5-10)
- ☐ Scissors

Prep:

- Cut out the Journey Card Decks (print 1 of each deck for every 3 students)

- We suggest printing the three decks on different colored paper, so they don't get mixed up!

Lesson:

1. Shuffle card decks and pass out a copy of each of the three decks to each student group (3 students per group).

2. Ask each group to order cards for each product: Carrot, soda, and cheese.

3. When students are done ordering the cards, discuss:
    - *What steps are missing from the decks?*
    - *Where does the most work happen for each product? Are the answers different for each product? Why?*
    - *How does the answer to the last question affect who is paid most for this product?*
    - *How does the answer to this question affect the health of the product?*
    - *What foods could you eat that don't involve parts of the food chain we learned about?*

        Ideas:
        - Fresh, unprocessed foods avoid processing.
        - Food made at home avoids food service.
        - Farmers market foods avoid processor, distributor, food service.

Connecting to the Garden

We've explored how the food production and processing steps between farm and table impact what percent of each dollar spent a farmer receives for her work.

One brilliant figure in American history, George Washington Carver, fought against the oppression of black farmers by capturing more of the agricultural dollar from crops they often grew. He developed over 100 value-added products for the sweet potato, and over 300 for the peanut. As such, southern black farmers were better equipped to sell their crops—in new forms— at markets. For example, they could sell peanuts processed as glue or plastic, rather than raw peanuts.

Today in the garden, we will do the same as Carver did. We will look at the raw ingredients in our field and find a new use for them. Through innovation and creative marketing, we will capture more of the food dollar for farmers.

Optional Activity #4: The Food Chain of Justice & George Washington Carver

Time: 1 hour

Materials:

- ☐ Student Handouts
    - ☐ Includes: Food Dollar Infographic (page 11)
    - ☐ Includes: Value Added Product Examples (page 12)
- ☐ Material listed on Kitchen Essentials Card (from Bonus Card Deck)
- ☐ Basic Ingredients (from Bonus Card Deck)
- ☐ Packaging options (at least one of the below available for each group of 3-5)
    - ☐ Quart or gallon size zip-lock bag
    - ☐ Pint or Quart size jar
- ☐ Sticky labels
- ☐ Paper
- ☐ Colored sharpies, markers, crayons, colored pencils
- ☐ White board and markers
- ☐ Technology to show a video, **and/or** printed copy of the Teacher Background: George Washington Carver, A Short Biography (page 10-12 in Teacher Print Kit)

Prep:

Be sure to print 1 copy of the Student Handouts for each group of 3-5 students. This lesson must take place in a garden that has fresh, harvestable produce available. Set out "stations" for each group of 3-5 students. Each station should have:

- Materials listed on Kitchen Essentials and Basic Ingredients cards (from Bonus Card Deck) packing options (jar, Ziplock bags, or both), sticky labels, colored sharpies, and paper.

- **NOTE:** If you do not have a few of these items, it is okay. Just ensure that the groups have at least one container, kitchen equipment, and something to write with.

Lesson:

1. Display or pass out copies of the Food Dollar Infographic from the Student Handouts (page 11).

2. Discuss the following:
    a. *Does anything surprise you?*
    b. *If you were a farmer, what strategies could you use to keep more of the retail value of your produce?* Teacher ideas for discussion:
        - Sell to a great marketer who will get a good price for your product and pass on some of that value to you.
        - Sell direct to consumers at a farmer's market to eliminate the need for many services that are necessary between farm and restaurant or grocery store.
        - Find a way to process your product into something more valuable than the product itself. Example: Instead of selling wheat, sell noodles made of wheat. Buy a share of a noodle factory, or partner with other farmers to create a noodle factory.

3. Next, introduce the story of George Washington Carver.
    a. Use the YouTube video (link also available on page 10 of Teacher Print Kit) or read/summarize points from pages 11-12 of the Teacher Print Kit. Be sure to emphasize Carver's use of value-added products to bring more money to black farmers. Show students the "Value-Added Product Examples" PDF (Student Handouts, page 12).
    b. Ask students: *What might be the benefits of selling value added products vs. raw materials?*

4. Separate the class into groups of 3-5. Explain to the group that they will oversee profits from farm to retail. Challenge groups to start with a few raw ingredients from the garden and brainstorm how to add value to the product.

5. Write on the board or paper:
    a. Production
    b. Processing
    c. Packaging
    d. Advertising

6. Explain that each group will work together to harvest their raw ingredients, process the ingredients into a value-added product, package their ingredients in an attractive way, and create an advertisement to maximize profits. Give students a time limit to create their project (40-60 minutes). Encourage them to divide and conquer within their group after they come up with a plan.

7. **Optional:** Put out the Recipe Cards, Nutrition Basics, and Food Facts cards (from Bonus Card deck) to give students ideas on how to add value to items in the garden. (For example, they could process tomatoes into Pico de Gallo, etc.)

Encourage students to use the information on the cards in their marketing campaigns.

8. Give students a 10-minute and 5-minute warning before time is up. When the time is up, have each group present their project, including the product, packaging, and marketing campaign. Have each group explain how their strategies will increase profit. Allow other groups to ask questions about the strategies used.

9. Finally, as a group discuss the following:
    a. *If you were to create a project in your community to increase the wealth that stays with the people in your community, what might you create? Consider: What do people in your community need? Convenience? Health?*
    b. *What products do your community members buy a lot of, but most or all the wealth from that product goes to people outside of your community? Could you create that product locally? Why or why not? Is there an alternative product that people might eat if it was produced locally?*
    c. *What raw materials are locally available in abundance? What value added products can be made from these materials?*
    d. *Today, you had limited resources to advertise your product. How might your packaging and advertising change if you had a larger budget?*
        - *How might the marketing and advertising resources of larger companies affect the competitiveness of smaller, local food companies?*
        - *How can communities work together to make sure local companies have a share of the food market?*

Activity #5: The Food Web

Time: 20 minutes

Materials:

- ☐ Ball of string
- ☐ Student Handouts
    - ☐ Includes: Food Web Card Set (pages 13-16)
- ☐ Scissors

Prep: Cut out Food Web cards. We recommend printing the cards double-sided.

Lesson:

1. Ask all students to sit in a circle, handing out the Food Web cards one by one to each student. Read the word and definition on the back of the card to the group before handing it to each student. Pass out all the cards. Students can have more than 1 card, but not more than 3.

2. Have students place their cards with the picture side up on the ground in front of them for everyone to see.

3. Give one student the ball of string. Ask that student to read one of their cards, then, while keeping hold of the end of the string, toss the ball of string to another student. Ask the second student to read one of their cards as well.

    - Now, work with the group to come up with one way (or more) that these two cards are connected. Note: *All cards are connected!* Encourage students to be creative and think of connections that aren't obvious.
        - Example: Fish are connected to fertilizers because it is harder for fish to live in areas where fertilizer has seeped into rivers/waterways. (This is because excess nutrients in water from agricultural runoff can cause eutrophication and reduce oxygen in the water, killing fish and other organisms.)
        - Example: Chickens are connected to pathogens because chickens can be killed off by disease.
        - Example: Pathogens are connected to supermarkets because if pathogens are present in foods that make it on to supermarket shelves, consumers might get sick.

4. Repeat step 4 until all CARDS held by all students are connected. Students will create a web by holding on to a portion of the string before they pass the ball of string to the next student. Once all cards are part of the web, the group can stop or continue to make connections based on time available.

5. Next, ask the students to reflect on what they see in front of them. *What does this "web" of connected cards look like? What does it remind you of?*

6. Now, present the students with scenarios. For each scenario, have students pull on the string if they think one of their cards will be impacted by the scenario. Ask a few volunteers to explain why they are pulling on the string for each scenario.
   - Scenario Ideas for Teachers (Note: Feel free to make up your own, have students come up with scenarios as well!)
     - A series of extremely dry seasons leads to drought across North America, India, and Africa.
     - Economic changes lead to a dramatic decrease in the price of major crops.
     - A conflict between two countries causes a major shortage in fertilizer available globally.
     - Many truck drivers quit their jobs at the same time.
     - Due to very high unemployment, wages for farm workers and food service positions decrease.
     - There is a large worker strike at a packing plant.
     - Gas and oil prices go up dramatically in a short period of time.
     - An unforeseen plant disease decreases soybean crop across the globe.
     - New regulation states that fruit and vegetable quantities required by law in all public-school lunches will double in the next year.
     - A local well is polluted by excess manure and synthetic fertilizers spread on nearby fields and becomes undrinkable (unsafe)
     - A massive oil spill leads to a "dead zone" in the ocean near California.

   - Students should feel the string being pulled during most or all scenarios, even if their card(s) are not directly impacted by the scenario. This is a great opportunity to reflect on how interconnected our food system is. If students did not feel the string being pulled, discuss as a group to find connections they may not have thought of.

Closing Discussion:

There are numerous steps required to move food from the farm to our plates. These steps allow us to eat foods that we wouldn't otherwise have access to throughout the year. Whether we are eating foods out of season, buying products shipped in from faraway places, or consuming ready-to-eat meals that we wouldn't have time to make ourselves, the modern food system makes this possible. With more convenient choices available and easy access to highly processed, cheap foods, many people are susceptible to poor diets.

By supporting the current food system and value chain as it stands, physical health and the health of our economy can suffer if we aren't careful. When choosing value-added foods, it is important to consider how the food will drive your health and contribute to your community's wealth. If strategic, we can use the power of the food chain to benefit our well-being.

End with a discussion of the following:

- *If you were to open a food business, what part of the food chain would you most like to engage in? If your goal was to maximize your personal profits, would this change? How might you work with friends or other community members to optimize and streamline your work across the food chain?*

- *Do you think that the way money is distributed in our food system is usually fair? Why or why not?*

- *What foods would you eat to ensure your money is going where you want it to go? Why? Where would you shop?*

References:

Teacher Background:

1. Canning, P. 2021. Where Do Americans' Food Dollars Go?. USDA. Food Economics Division, Economic Research Service (ERS) in Research and Science.
2. Lakhana, N., Uteuova, A., and Chang, A. 2021. Revealed: the true extent of America's food monopolies and who pays the price. The Guardian.
3. Dewey, S. 2021. The Power of Urban Agriculture in Transforming a Community. Conservation Law Foundation Blog.

Activity 1:

Information taken from the National Farmers' Union (2022). Title: The Farmer's Share.

Activity 2:

Infographic taken from the Centers for Disease Control and Prevention (2013). Image Title: The Food Production Chain - How Food Gets Contaminated.

Food chain steps taken from Center for Integrated Agricultural Systems at the University of Wisconsin-Madison *Toward a Sustainable Agriculture* curriculum: Module I Section B: The Big Picture, Systems.

Activity 3:

Adapted from Lesson 1: *Activity: Supply Chain Journey* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020)

Optional Activity 4:

Carver biography information taken from:

- Britannica online. George Washington Carver.
- Missouri Encyclopedia online. Georgo Washington Carver (1865–1943).
- Biography.com video. George Washington Carver "The Plant Doctor" Revolutionized Farming Industry | Biography

Value added information taken from:

- Lakhana, N., Uteuova, A., and Chang, A. 2021. Revealed: the true extent of America's food monopolies and who pays the price. The Guardian.
- Canning, P. 2021. Where Do Americans' Food Dollars Go?. USDA. Food Economics Division, Economic Research Service (ERS) in Research and Science.

Activity 5:

Adapted from Lesson 1: *Activity: Exploring Connections* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020)

Our Food System—From Farm to Table

Module 2
Teacher Print Kit

Instructions: Print one copy of this document as a reference *for the Teacher.* It is easiest to print **double-sided, on the short-edge.** Additionally, print the Student Handouts for Module 2.

Food Up!

Activity #1 and Activity #4 : Food Dollar Infographic

It will be helpful to look over this infographic before teaching Activity #1, as it gives context to why some foods have a larger farmer share of the retail dollar than others.

When students imagine themselves as farmers in Activity #4, they will use the following infographic to come up with original ways to keep more of the retail dollar in their pocket. Encourage your students to imagine value added products that allow them to create something more valuable out of a low value field crop.

Image illustrates how much of the average dollar spent on food in the United States goes to each part of the food supply chain. Notice that farmers and ranchers only get 7.6 cents of the average food dollar. Source: US Department of Agriculture 2019

Activity #1: Where Does Your Dollar Go?
Optional Discussion Activity

CARROTS

SODA

Calculate how much money participants along the food chain, besides farmers, receive from a dollar spent for both carrots and soda.

Who else gets some of this money?
Why might the farmer's share be larger for carrots than it is for soda?

ACTIVITY #2: FOOD CHAIN INFOGRAPHIC

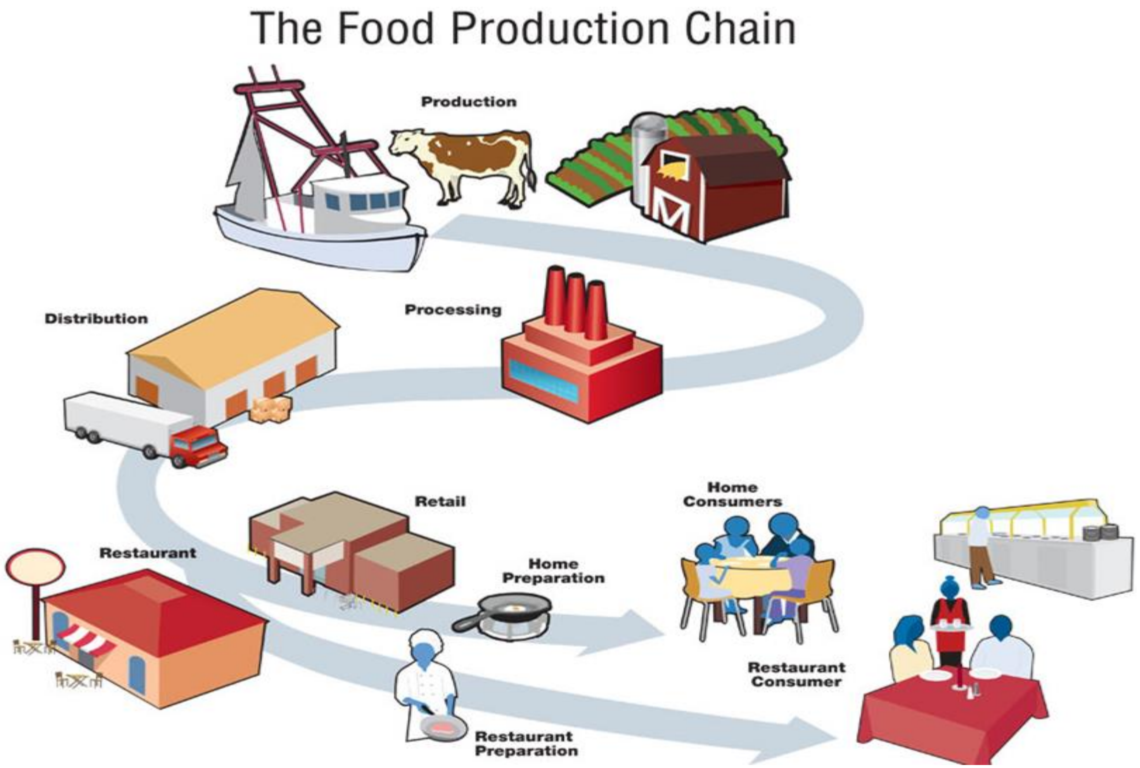


Image Source: Centers for Disease Control and Prevention, 2013 (https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/figure_food_production.html).

Activity #2: Food Production Chain Teacher Cards

Production: How the Food is grown

Distribution: How the product moved from the farm to the eater

Processing: Changing the crop into what is eaten

Consumption: The use of the product by the end consumer

Distribution

- Trucking
- Marketing and Advertising
- People who build trucks, planes
- Energy workers
- Highway builders
- Food hubs

Production

- Tractor Manufacturers
- Fertilizer manufacturers
- Well diggers
- Farmers
- Construction workers
- Natural gas, petroleum, electricity, solar power manufacturers

Consumption

- Restaurants
- Grocery stores
- Farmers Markets
- Home

Processing

- Honey and maple syrup bottling
- Washing and bagging/banding/boxing produce
- Butchering
- Canning
- Processing Corn into Corn Syrup and Corn Flakes
- Freezing
- Plastic Production for packaging
- Cooking food in our kitchens and restaurants

Waste Management

Collection, transport, treatment, and disposal of waste






Waste Management

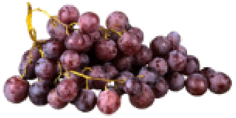
- Sewage after human consumption
- Compost of food scraps
- Trash/Landfill
- Recycling of packaging
- Management of manure
    - Spreading on fields
    - Storing in pits
    - Leaking into waterways

Activity #3: The Journey Answer Key

Note to teacher: Steps bolded below have variable positions in the food value chain.

Cheese	Soda	Carrots
1. Corn and soy are harvested from the field for animal feed 2. Calves are born; cows do not produce milk until a baby calf is born **3. Milking equipment, including pumps and tanks, are manufactured (this fits anywhere before step four)** 4. Cows are milked. 5. Milk is pasteurized to kill bacteria 6. Milk truck comes to transport milk to the cheese plant 7. Cultures are added to the milk, and whey is squeezed out of the milk 8. Cheese is packed in wax or plastic 9. Cheese is graded by the USDA 10. Cheese is retailed in the grocery store 11. Macaroni and cheese is enjoyed on your dinner table **12. Manure is spread on fields (can be moved to the beginning or the end)**	**1. Glass bottles or cans are recycled or sent to the landfill** **2. Soda cans are made from recycled aluminum** 3. Corn, cane, or beets are planted 4. Corn, cane, or beets are harvested 5. Corn, cane, or beets are washed, packed, and transported to syrup factory 6. Sugar syrup is manufactured **7. Flavor development and testing is done in the lab** 8. Water is filtered 9. Water and syrup are combined and sent through a carbonator 10. Soda is canned or bottled **11. Marketers design labels, magazine ads, and television ads** 12. Soda is distributed to grocery stores, restaurants, event venues, and vending machines	1. Carrots are bred for seeds that have good harvests, are resistant to disease, and have great flavor 2. Potash is mined to make potassium rich fertilizer 3. Tractor plants carrot seeds in rows 4. Carrots are harvested by a tractor or by hand 5. Carrots are washed and graded 6. Carrots are transported from the farm to their destination 7. Carrots are sold at the farmers market 8. Plastic bags are manufactured for frozen carrot packaging 9. Carrots are chopped and flash frozen in a factory 10. Carrots are canned in a factory 11. Carrots are shipped to a distributor 12. Grocery stores order carrots from distributor

Activity #4: Value Added Product Examples

Milk 	Cheese 
Wheat 	Pasta 
  Carrots, Onion, Parsley 	Canned Soup 
Sugar Beets 	Fruit Snacks 
Grapes 	Grape Juice 

Activity #4: George Washington Carver

You may choose to watch this biography to get context on George Washington Carver, or show the video in class:
https://www.youtube.com/watch?v=sdz8XTNttdc

Activity #4: Teacher Background: George Washing Carver, A Short Biography

George Washington Carver (~1861 - 1943) was an agricultural chemist and agronomist passionate about the success of black farmers in the south in the early years after the Civil War.

During the Civil War, infant George and his mother Mary were kidnapped. Their owner, Moses Carver, hired a neighbor to find them. The neighbor found baby George, but never found George’s mother. George and his brother were adopted after the war by his former owners Moses and Susan Carver. George was not accepted into schools in the area due the color of his skin, so Susan taught George and his brother to read and write as children.

George left the Carvers at age eleven to further pursue education. He earned his high school education, and later his Bachelor of Science in Agricultural Science from Iowa State University in 1892. In 1896, he was hired as Director of Agricultural Research at Tuskegee University under Booker T. Washington.

(continued on next page…)

Activity #4: Teacher Background: George Washing Carver, A Short Biography

Carver grew familiar with the south's dependence on cotton. As an agronomist, he saw the toll that cotton was taking on the soils, as cotton is a heavy feeder of nutrients. He encouraged the use of peanuts and other legumes to fertilize the soil and ensure sustainability of the soil on black land in the south. In an effort to bring more value to the crops that black farmers were growing, Carver invented over 100 value added products for the sweet potato, and over 300 for the peanut. Due in large part to his efforts, in the fifty years after Carver's start at Tuskegee, peanuts went from an unrecognized crop to one of the top six leading crops in the south. His inventions for the use of peanuts included milk, flour, ink, plastic, wood stain, linoleum, medicinals, and cosmetics.

In the face of severe oppression toward black share croppers in the post-slavery south, Carver dedicated his life to the economic advancement of black farmers in the south. Despite job offers from those such as Henry Ford and Thomas Edison, Carver never left Tuskegee due to a deep dedication to the black southern farmer. When he died, he left his life savings to found the George Washington Carver Institute for Agriculture at Tuskegee to continue his work.

Our Food System: From Farm to Table

Module 2
Student Handouts

Instructions: It is easiest to print this document **double-sided, on the short-edge**. Print 1 copy for every 3 students in your class. Individually cut out the Fair Share cards from pages 2-5 into card decks.

Food Up!

Activity #1: Fair share Card Sort: Front (One Deck Per 3 students)

Bacon 	Steak 	Bread 	Carrots 
Cereal 	Tomatoes 	Eggs 	Organic Stone Ground Flour 
Ham 	Lettuce 	Milk 	Bagel 
Potatoes 	Soda 		

Activity #1: Fair Share Card Sort: Back

 $3.99 **53%** $2.11	 $3.99 **4%** $.17	 $10.49 **19%** 1.98	 $6.49 **16%** $1.06
 $3.49 **17%** $.59	 $2.19 **49%** $1.07	 $2.99 **14%** $.43	 $4.99 **2%** $.12
 $.80 **1%** $.01	 $3.79 **40%** $1.52	 $2.99 **6%** $.19	 $12.28 **7%** $1.06
Retail **Percent of Retail for Farmer** Farm Share	Retail **Percent of Retail for Farmer** Farm Share	 $.99 **8%** $.08	 $6.99 **19%** $1.32

ACTIVITY #2: FOOD CHAIN INFOGRAPHIC

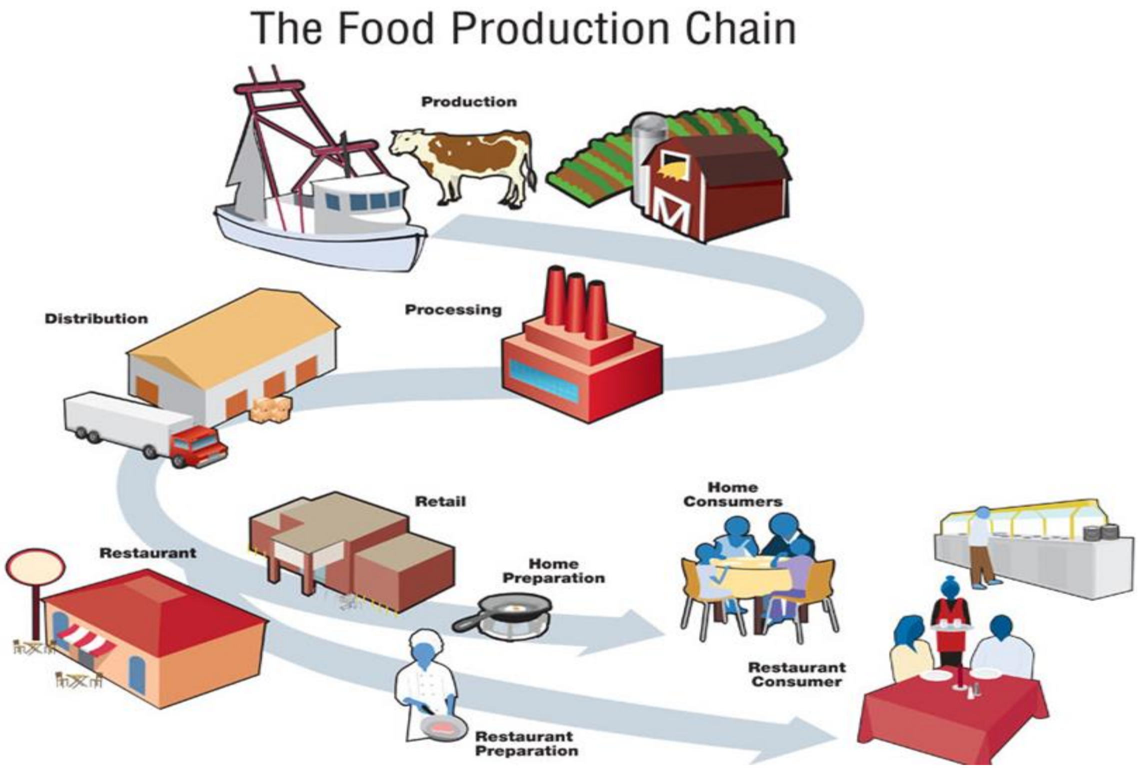


Image Source: Centers for Disease Control and Prevention, 2013 (https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/figure_food_production.html).

Activity #3: The Journey – Cheese

USDA Organic

Activity #3: The Journey - Cheese

Cheese is graded by the USDA.	Cheese is retailed in the grocery store.	Macaroni and cheese is enjoyed on your dinner table.	Manure is spread on fields.
Milk is pasteurized to kill bacteria	Milk truck comes to transport milk to the cheese plant	Cultures are added to the milk, and whey is squeezed out of the milk	Cheese is packed in wax or plastic.
Corn and soy are harvested from the field for feed.	Calves are born. Cows do not produce milk until a baby calf is born.	Cows are milked.	Milking equipment, including pumps and tanks, are manufactured.

Activity #3: The Journey – Soda

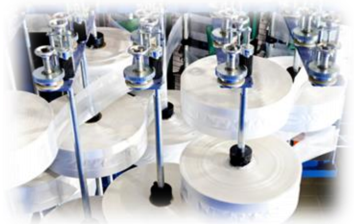
Activity #3: The Journey – Soda (Back)

Soda cans are made from recycled aluminum	Corn, cane, or beets are planted	Corn, cane, or beets are harvested	Corn, cane, or beets are washed, packed, and transported to syrup factory
Sugar syrup is manufactured	Flavor development and testing is done in the lab	Water is filtered	Water and syrup are combined and sent through a carbonator
Soda is canned or bottled	Marketers design labels, magazine ads, and television ads	Soda is distributed to grocery stores, restaurants, event venues, and vending machines	Glass bottles or cans are recycled or sent to the landfill

Activity #3: The Journey – Carrots











Activity #3: The Journey - Carrots (Back)

Carrots are bred for seeds that have good harvests, are resistant to disease, and have great flavor.	Potash is mined to make potassium rich fertilizer.	Tractor plants carrot seeds in rows.	Carrots are sold at the farmers market.
Carrots are harvested by a tractor or by hand.	Carrots are washed and graded.	Carrots are transported from the farm to their destination.	Plastic bags are manufactured for frozen carrot packaging.
Carrots are chopped and flash frozen in a factory.	Carrots are canned in a factory.	Carrots are shipped to a distributor.	Grocery stores order carrots from distributor.

Activity #4: Food Dollar Infographic

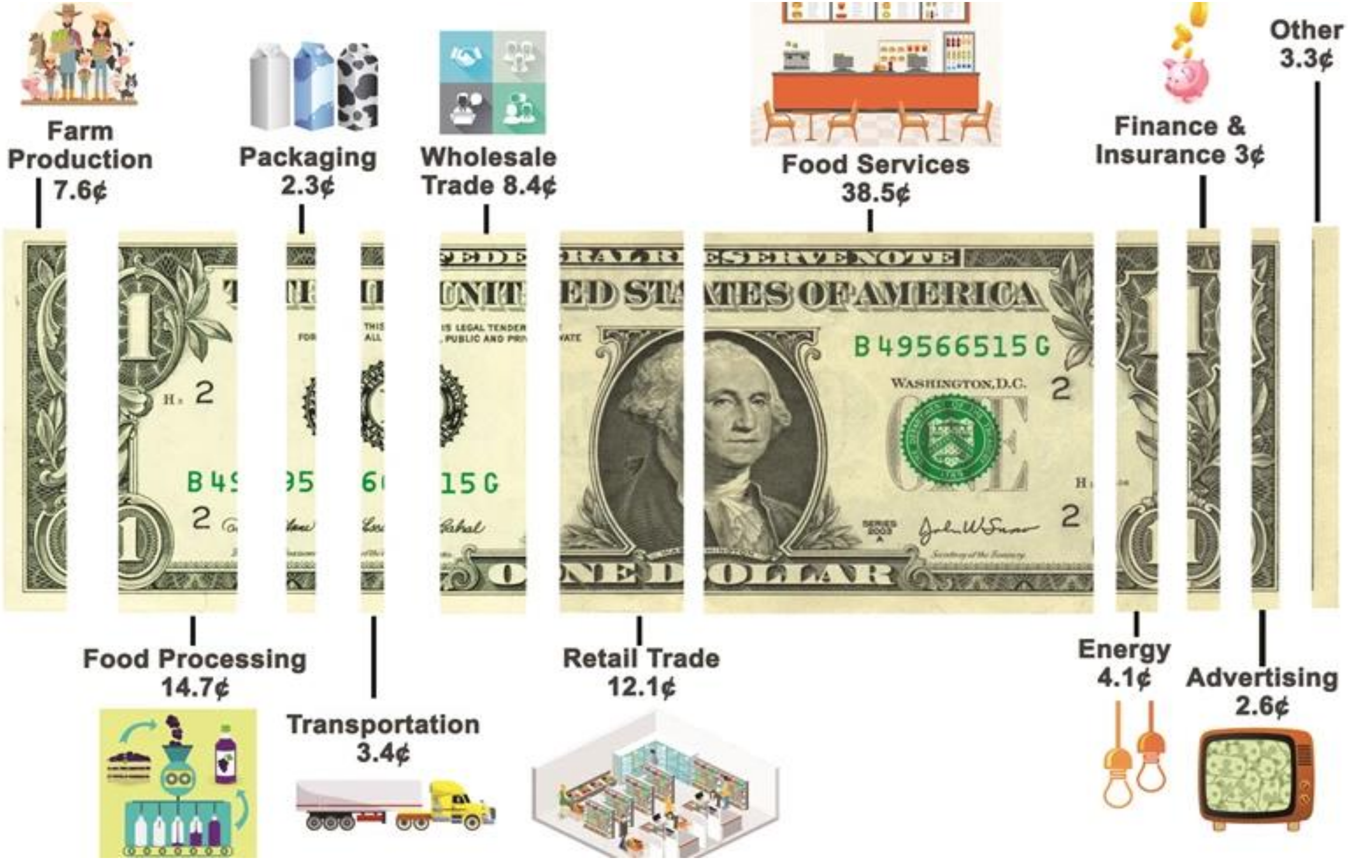
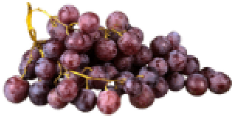


Image illustrates how much of the average dollar spent on food in the United States goes to each part of the food supply chain. Notice that farmers and ranchers only get 7.6 cents of the average food dollar. Source: US Department of Agriculture 2019

Activity #4: Value Added Product Examples

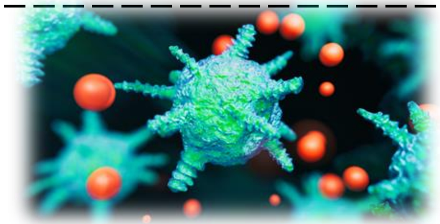
Milk 	→	Cheese 
Wheat 	→	Pasta 
  Carrots, Onion, Parsley 	→	Canned Soup 
Sugar Beets 	→	Fruit Snacks 
Grapes 	→	Grape Juice 

Activity #5: The Food Web Cards #1

Cow

Climate

Compost



Pathogen

Chicken

Soil

Fish

Crop

Water

Activity #5: The Food Web Cards (Back)

Compost Needs: Air, plant material for decomposing Provides: Soil and plant nutrition	**Climate** (Weather patterns over long period of time) Needs: Sunlight, water, limited greenhouse gas pollution Provides: Rain and temperatures necessary for crops. Crops provide food for humans and animals.	**Cow** Needs: Food, water, humane living conditions Provides: Dairy, meat, manure as plant fertilizer
Soil Needs: Nutrition, microorganisms, plant roots to prevent erosion Provides: Access to nutrition for plants	**Chicken** Needs: Food, water, humane living conditions Provides: Eggs, meat, manure as plant fertilizer	**Pathogen** Needs: Often need water, heat, and food Provides: Causes disease in humans, plants, and animals
Fish Need: Safe water environment Provide: Food for humans, Support of marine environments	**Crop** Needs: Sunlight, carbon dioxide, water, soil, nutrients Provides: Food, Soil nutrition, oxygen	**Water** Needs: Safety from pollution from animal waste and fertilizers Provides: Hydration for animals and plants, environment for marine life. Helps to stabilize temperatures in ecosystems.

Activity #5: The Food Web Cards (#2)

Activity #5: The Food Web Cards (Back)

Supermarket Needs: Customer base, building, energy, workers Provides: Market for farms and other food industries, access to healthy food	**Government** Needs: Citizen engagement, money Provides: Food safety regulations, money for farms during hard times, food security assistance	**Food Citizen** Needs: Access to healthy food Provides: Advocacy for healthy food, money for food
Truck Driver Needs: Fuel, truck, well maintained roads, wages Provides: Access to a variety of foods year round from many locations	**Food Service Worker** Needs: Safe working conditions, good wages Provides: Easy access to food for customers	**Corner Store** Needs: Customer base, money, building, energy, workers Provides: Often convenient access to food
Pesticide Needs: Manufacturer, equipment to apply the pesticide Provides: Protection to plants from harmful weeds of insects. Also often causes pollution to the air, soil, and waterways	**Chemical Fertilizer** Needs: Manufacturer, equipment for application, raw materials Provides: Nutrition for soil and plants, can contaminate waterways	**Farm Worker** Needs: Safe work environment, fair wages Provides: Labor to grow food for people and agricultural animals

Module 3: How to Feed a Plant: What our Food Needs to Grow

Goals and Objectives:

What is required to grow healthy food? How does one “feed a plant”? What type of environment—soil, temperature, precipitation—is optimal for crops? Why does this matter?

In this lesson, students will explore the necessary elements for plant growth and consider how each relates to photosynthesis, energy storage, and energy transfer in crops. Students will gain a basic understanding of how environmental factors, such as climate zones, influence plants and crops across the globe. Using a hands-on hydroponic activity, students will have an opportunity to think specifically about the importance of water. In Activity #3, soil type and texture will also be addressed, helping students make connections between soil health, agriculture, and human health.

Students will also be introduced to the concept of *companion planting*, demonstrated via a tour of a *Three Sisters* Garden (where squash, beans, and corn are planted together). The lesson ends with a card game that will help students further consider how plants work synergistically to support one another through companion planting.

Time: 1 hour 10 minutes

Optional additional activities: 35 minutes

Materials:

☐ Module 3 Teacher Print Kit
☐ Module 3 Student Handouts
☐ Whiteboard OR large paper and markers
☐ Tape and string
☐ Empty 2-liter soda bottles with caps (1 per student Activity #1, 4 for Activity #3)
☐ Cotton material (an old T-shirt works well)
☐ Thick nail and hammer OR utility knife (something to poke a hole in a bottle cap with)
☐ Scissors (1 pair for every 3 students)
☐ A small plant or seedling for each student (herbs, like basil, work well here)
☐ 4 coffee filters
☐ Potting Soil and scoop for the soil
☐ Large mixing bowl
☐ Access to water
☐ Liquid measuring cup
☐ Dry 1 cup measuring cup
☐ 1.5 C Sand
☐ 1.5 Clay (in dry, powdery form, such as from a potter’s shop or craft store)
☐ 1.5 C Silt
☐ Permanent marker
☐ 8 jars or cups (large enough to fit a measured cup)

Optional:

- ☐ Mature Three Sisters Garden for observation
- ☐ Four magnets for posting cards on the whiteboard

Teacher Background:

Soil, nutrients, water, air, and sunlight are all necessary for plant growth and energy creation via photosynthesis. Nutrients are provided through organic matter in the soil and are absorbed through plant roots as a solute in water. Photosynthesis, the plant process that converts carbon dioxide in the air into storable energy in the form of glucose, requires both sunlight and chlorophyll. Nutrients and water are used to move the glucose and to store it for use in plant growth and setting fruit. It is important for students to grasp the basic components of photosynthesis as they consider what factors impact food production.

Temperature, precipitation rates, and soil characteristics vary dramatically across the globe. Variations in both climate and local ecosystems impact the types of crops that thrive across regions. In this lesson, we will explore five major world climates: polar, temperate, Mediterranean, arid, and tropical. We will use ideal growing condition information for a variety of crops to help students match the crop to the appropriate climate. This will help students explore how nutrients, water, air, and sunlight conditions vary, and how these changes are reflected by farming different foods. As they consider the broader food system, understanding regional and climatic differences will help students come to terms with both limitations and opportunities in agriculture.

Another key aspect of this lesson is helping students understand soil as the foundation of any garden or agriculture system. With your help, they will recognize that soil both provides nutrients and facilitates water availability to crops. A useful way to think about soil is in the context of agricultural practices. Careful management of nutrients and organic matter can enhance *soil fertility*, which is the ability of soil to supply nutrients for plant growth.[1] Over-taxing soils through continuous planting of the same crops, removing organic matter, over-fertilizing, compacting, or frequent soil tillage can deplete soil fertility. Building up soil organic matter (SOM), derived from all the plant or animal materials found in soil at various stages of decay, is one key way to enhance fertility by providing nutrients to plants in forms that are available for uptake. It also creates a favorable environment for soil organisms to live. Overall, SOM plays a sizeable role in the physical, chemical, and biological properties of soil, including soil structure, moisture-holding capacity, biodiversity, and nutrient availability.[2]

The often-overlooked physical structure of soil certainly impacts soil quality and is a concept your students should become familiar with. Soil structure—the arrangement of individual soil particles with one another—manifests in infinite arrangements across soil types and is determined by the level of aggregation.[3] SOM is crucial for the development and maintenance of optimal soil structure for plant growth.

Soil structure governs soil porosity, air and water content, permeability, tilth, and aggregate stability. When SOM declines, soil productivity and crop yields will suffer. Thus, ensuring there is plenty of organic matter in the garden is an important consideration for all farmers. Granular soil structure is desirable for plant growth because it provides both small and large pores that facilitate water movement and root growth. Pore space, formed by the position of aggregates, regulates the amount of air and water in the soil, the permeability of soil to water, and the ability of roots to grow easily.[3]

This basic background information on soil should help you discuss its importance with your students. Please see the Garden Strategies cards (in the Bonus Card Deck) on **Soil Organic Matter**, **Compost**, and **Mulching** for more information on how to apply these principles to your garden.

In the last section of this lesson, students will learn about companion planting, or grouping plants in the garden that work well together. We will consider how plants help one another by providing shade or trellising, fixing nitrogen, regulating water evaporation, and/or luring or repelling pests. These synergistic relationships are a natural way to improve crop growth and promote soil fertility.

We will explore the example of the Three Sisters Garden, an ancient Native American growing strategy that pairs the nitrogen-fixing power of pole beans, the trellising power of corn, and the shade, weed, and pest protection of squash. Many tribes interplanted this trio because the crops thrived together, much like inseparable sisters.

Opening Discussion:

Start this lesson with a group discussion on the basics of plant growth. Aim to link the principles discussed to food production whenever possible.

First, encourage students to brainstorm: *What do plants need to thrive?*

Write ideas on the board.

Examples: Soil, Water, Sunlight, Heat, Nutrients, Air, Carbon Dioxide

- *Why do some crops grow in certain places, but not others?*
- *Do we ever try to force crops to grow in places they are not well-suited for?*
- *How does what grows in our local area impact our diets? Has this changed throughout history?*
    - You might use this opportunity to reflect on how processing and increased transportation has widened our diet choices outside of our immediate climate area. Until modern times, diets were limited to what could be grown in the climate around us.

Activity #1: Crops Around the World

Time: 15 minutes

Materials:

☐ Whiteboard OR large paper and markers
☐ Teacher Print Kit
  ☐ Includes: Module 3 Teacher Cards: Soil and Nutrients, Water, Sunlight, Air (pages 2-3)
  ☐ Includes: Plant Climate Map Answer Key (page 1)
☐ Student Handouts
  ☐ Includes:
  - Plant Elements (page 2)
  - Climate Map (page 4)
  - Climate Key (page 5)
  - Climate Plant Cards (pages 6-7)
☐ 18 magnets (if using whiteboard) or tape
☐ Tape
☐ String
☐ Scissors

Prep:

☐ Cut 9 strings into approximately 2-foot-long pieces
☐ Cut out 9 Climate Plant Cards and the 4 Plant Elements

Lesson:

1. Post pictures of soil and nutrients, water, sunlight, and air on the board or paper using tape or magnets. Ask students why each of these elements are needed and write the reasons in a list under each picture. Use the Teacher Cards (Teacher Print Kit pages 3-4) to help facilitate discussion.

2. Ask students, *how could each of these elements be different in different regions of the world?*
   a. Examples:
      - Soil can be sand, loam, or clay.
      - Rainfall rate or annual volume can be different.
      - Sunlight duration and intensity varies in different parts of the globe.

- The world has areas of vastly different temperature patterns.

3. Post the Climate Map and Climate Key on the board. (Student Handouts pages 4-5). Pass out tape and string to each student.

    a. Read aloud the definitions of each climate zone and go over the key on the chart.

    b. Ask for a student volunteer to hand out all the Plant Cards (Students Handouts pages 6-7), reading the growing information on the back of the card aloud as they hand out the cards. (Students can share a card if there are more than 9 students or have more than one card if the group is less than 9 students.)

    c. Ask students to come up one by one and stick their card to the board around the outside of the climate map. Then, ask students to use their strings, along with magnets and tape, to link the card to an area of the world they think would provide the ideal growing conditions for their plant. If you'd like, the group can discuss whether they agree with each post as it happens and why.

    d. Use the climate map answer key together to assess whether the group got the growing regions correct!

End this Activity by helping students make a personal connection to food. Discuss:

- *What climate zone is your family from? What crops grow in this region? Do your family food traditions mirror the foods that are grown in your family's area or origin?*
- *Pick a country and think of a meal that you associate with that country. Do the foods match the region not only in culinary terms, but in botanical terms as well?*
- *It is possible to buy or find crops in regions where they do not typically grow. Why is this the case? What are the pros and cons of moving food around in this way?*

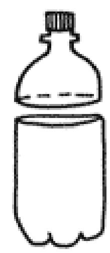
Activity #2: Hydroponic Growing Column

Time: 40 minutes

Materials:

- ☐ Empty 2-liter soda bottle with bottle cap (1 per student)
- ☐ Cotton material (an old T-shirt works well)
- ☐ Potting Soil
- ☐ Scop for the soil
- ☐ Large mixing bowl
- ☐ Access to water
- ☐ Thick nail and hammer (something to poke a hole in a bottle cap with)
- ☐ Scissors (at least 1 per every 3 students)
- ☐ A small plant or seedling for each student (herbs, like basil work well here)
- ☐ Student Handouts
    - ☐ Includes: Hydroponic Growing (page 8) (you may want to print 1 per group of 3 students for ease of reference)

Prep



1. Poke or drill about a 1 cm hole in the bottle caps with a nail, awl, or drill. Alternatively, make an X in each cap with a utility knife.

2. Mark a line on each bottle where the plastic should be cut with a permanent marker. Bottles should be cut about an inch below where the top stops tapering.

3. Cut or tear cotton material into approximately 1” wide, 5” long strips.

4. Fill the bowl with water.

Lesson:

1. Post the sunlight, water, air, and soil and nutrients pictures from Activity #1 on the board again. Explain that we will be making a ‘mini climate’ with everything necessary for a plant to grow.

2. Pass one of the below out to each student:
    - Bottle with cap
    - Cotton strip
    - Scissors (can be shared with other students)

3. Ask students to:
    - Remove the label from their bottle.
    - Cut around the circumference of the bottle at the mark (see Image A)
    - Saturate the cotton strip by dipping it in the water bowl.
    - Thread the cotton strip (wick) through the cap (about halfway).
    - Fill the bottom of the bottle with about 2” of water.
    - Flip the top of the bottle over and rest it inside of the bottom part of the bottle.
    - Hold the cotton strip straight up while scooping potting soil into the top of the bottle (this ensures that the water will wick from the bottom of the bottle into the soil at the top).
    - Plant the plant in the soil so that the root is completely covered in soil.
    - Lightly water the plant.

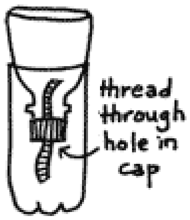


Image A

4. Ask students: *How will you ensure that your plant gets all the elements it needs to grow?* They can look at the pictures posted on the board to brainstorm.

5. When all the students are done planting, ask them to come up with ways they could change the climate for their plant. Ask: *How could we make this plant’s environment:*
    - …*more tropical?*
        - Examples:
            - Increase humidity by putting another bottle top over the plant to keep water evaporation inside
            - Put the plant in a sunny window.
    - …*more arid?*
        - Examples:
            - Use sand as soil so that the soil holds less water.
            - Let the bottom chamber go dry for a time.
    - …*more polar?*
        - Examples
            - Keep the planter outside during the cold season.

Discussion:

- *People often alter the growing environment to produce foods we love in new places or at different times of the year. Think of a few ways that you could have tomatoes longer than the regular growing season in the temperate Midwest.*
    - Start seeds indoors in a window.
    - Place plants in a greenhouse so they won't freeze in the late fall.
- *Plants put their energy generated from photosynthesis into their fruits. Photosynthesis requires a lot of sunlight and water. What is one way you could change a plant's environment to increase fruiting?*
    - Examples:
        - Increase sunlight by reducing structures and large plants around plants that require full sunlight.
        - Add a sprinkler to a garden plot to ensure regular access to water.

Activity #3: Healthy Soil = Healthy Food

Time: 15 minutes

Materials:

- ☐ 4 empty soda bottles with cap
- ☐ 4 coffee filters
- ☐ Liquid measuring cup
- ☐ Dry 1 cup measuring cup
- ☐ 1.5 C Sand
- ☐ 1.5 C Clay (in dry, powdery form, such as from potter's shop or craft store
- ☐ Scissors
- ☐ Permanent marker
- ☐ 8 jars or cups (large enough to fit a measured cup)
- ☐ Thick nail and hammer OR awl OR utility knife OR drill (something to poke a hole in a bottle cap with)

Prep:

1. Drill or punch 1 cm holes in each bottle cap.
2. Prepare the bottles as if you were making a planter above, but leave out the soil, cotton strip, and plant.
3. Put a coffee filter in the top chamber of each bottle.
4. Label the bottles:
   a. Sand
   b. Silt
   c. Clay
   d. Loam
5. Fill each cup with a measured cup of water.
6. Fill 1 cup with a cup of sand, one with a cup of silt, and another with a cup of clay.
7. Set out each bottle system next to the corresponding cup of soil type on a table.

Lesson:

Soils hold plant nutrients and water, both necessary ingredients in the process of making energy, or photosynthesis. Roots break through the soil and act as vessels to soak up the nutrients and water in the soil and bring them to the plant. Roots can grow deep into the soil and act to anchor the plant in the ground.

The only way that nutrients can be carried through a root is if they are dissolved in water. Different kinds of soils hold different amounts of water and can make it easier or harder for roots to get to that water. Though plants range widely in soil preference, most garden plants like about 50% pore space in the soil. Pore space is the gap in-between soil particles where water and air are suspended and available to roots. These pores allow nutrients from organic matter—a key source of nutrients— in the soil to be released to plants. Let's look at different textures of soil and see how they behave when it rains.

1. Pass around the cups of sand, silt, and clay. Ask students:
   - *Which soil particles are the smallest? The largest*?
     i. Answer: Sand is largest, clay is smallest
   - *Which soil do you think will be hardest for roots to push through?*
     i. Answer: Clay is the hardest because pores are small, and particles are tightly compact.
   - *Which soil do you think will hold water best? Which will drain best?*

Now, let's do an experiment to see if we were right…

2. Once all three soils are returned to the table, ask three students to come to the front and add their soils to the top chamber of the bottle.

3. Next, ask the three students to pour a cup of water over their soil at the same time. Ask all students to notice which soil holds water, and which drains the fastest. After water has drained, pass around the wet samples in the tops of the soda bottles. Give the students an opportunity to observe the consistency of each soil with their eyes and to assess it with their hands. You may want to explain the following:
   - *Clay is great for holding onto water and nutrients; however, the soil particles are so small that they easily clump together when wet. This can make it hard for roots to push into and through the soil. Additionally, there are little pores for air and water. Poor drainage and lack of oxygen to the plants' roots are risks of clay soil.*

   - *Sandy soils are easy for plants to root in. However, the water and nutrients drain quickly from the sand, so many types of plants would die of lack of water. Notice that silt may hold water better than sand, but pure silt lacks pore space for water and oxygen.*

   - *Many soils have a combination of clay, silt, and sand, which together creates proper drainage and pore space. 40% sand, 40% silt, and 20% clay makes a soil type called loam.*

4. As a group, mix a cup of loam using the ratios above (this doesn't need to be exact), and have a student measure out 1 cup of it into the last with a coffee filter and pour a cup of water through it. Pass the sample around to be observed.
    - *How does the loam compare in water retention and drainage to the rest of the soils?*

    - *When you touch the loam, does it seem to hold more or less pore space than the rest of the soil types?*
        i. The combination of particle sizes in loam creates a structure that supports more pore space for water and air.

5. Organic Matter Discussion:
    - *Soil is more than just sand, clay, or silt. Plants also require organic matter to get the nutrients that they need to flourish. Nutrient-rich soil organic matter (SOM) is derived from all the plant or animal materials found in soil at various stages of decay. As these materials break down in the soil, nutrients become available to the plant. Often growers will add nutrients to their soil with compost, manure, or a manufactured chemical fertilizer to increase soil fertility. Ensuring nutrient availability to crops ensures that our food is abundant and nutritious.*

    - *We learned that nutrients in the soil must be absorbed in water so the roots can deliver them to the plants.* Discuss: *Do nutrients for humans need to be dissolved in water before we take them in?*
        i. Answer: Humans are a bit more adaptable in this way. Humans can take in dry food, but just like plants, our nutrients must be dissolved in water to be taken to our cells. We mix dry food with water in our digestive system if the food itself does not come with water! Plants do not have this capability. If there is no water available when the plant takes in its nutrients, no nutrients will be taken in.

6. *We can help to add and maintain nutrients in our soil in many ways. Farmers and gardeners will use nitrogen fixing plants, or plants that take nitrogen from the air and "fix" it into the soil, to add nitrogen to soils. We can also use many types of decomposed organic material to make compost. Adding this nutrient rich compost to the soil increases the soil's fertility.* (Learn more in the Bonus Cards on **Soil Organic Matter**, **Compost**, and **Mulching**).

7. Optional: Students can take compost from the garden and mix it with the loam created earlier to make an ideal vegetable growing soil.

- Discuss: *What about this soil we have made makes it ideal for many different plants?*

- *What is something you could do today to increase soil fertility in our garden?*
    i. Examples: Add scraps to the compost pile, incorporate compost into the soil, turn the compost pile to speed decomposition.

Connecting to the Garden

Note: This section requires a Three Sisters system actively growing in your garden or farm. If you would like to discuss companion planting but do not have the Three Sisters established, you can show pictures of this setup using the Three Sisters Graphic on page 9 of the Student Handouts.

Plants and food crops need different amounts of sunlight, water, and nutrients to survive and thrive. They are also impacted by what is growing around them. Think about how a densely packed forest may not have very many plants growing on the floor beneath the trees, whereas an open prairie is likely heavily populated with grass. This is due in part to the availability of light (and water) in these contexts.

Today we will look at how plants and food crops can be synergistic—or cooperate to produce a combined effect greater than the sum of their separate effects and support each other's growth. In agriculture, we call this intentional strategy 'companion planting.'

Let's look at a mature Three Sister Garden to observe the ways that plants work together. We will then play a Companion Planting Card Game to explore the ways that all plants work together to support one another's growing conditions in the garden.

Optional Activity #4: Three Sisters Garden Tour

Time: 5 minutes

Materials:

☐ Mature Three Sisters Garden consisting of squash, corn, and pole beans planted together

Optional:
☐ Student Handouts
- ☐ Three Sisters Graphic (page 9)
- ☐ Legends of the Three Sisters (pages 10-11)

Introduction:

Our food traditions are often deeply rooted in the people and places where they originated. Long oral and written histories in a variety of cultures give wisdom to following generations about how to grow and serve food that is good for the body and appropriate for the growing conditions of the area. Often foods that worked well in a certain area were integrated into cultural and spiritual traditions. One great example of a traditional companion planting garden is the Three Sisters Garden. This garden consists of corn, squash, and pole beans. This garden combination stems from an array of Native American and Indigenous cultures. Let's explore how the Three Sisters are adapted to one another for gardening and eating, and how they've been integrated into cultures.

Lesson:

1. Three Sisters in the Garden
   - Pole beans have a partnership with bacteria in the soil allowing them to take nitrogen from the air and put it into the soil, making the nitrogen available to other plants that need it. This can be a huge help to plants that need high amounts of nitrogen to grow, such as corn.
   - *What do you think corn does for beans to help them grow?*
     i. Answer: Corn provides a trellis for beans, keeping beans off the ground and decreasing the risk of rotting. A trellis also helps the bean plant produce a heavier harvest. As the beans grow through the tangle of squash vines and wind their way up the corn stalks into the sunlight, they also serve to hold the sisters close together.

- *Pay attention to the texture of the stem on squash. What do you think the squash does for its "sisters"?*
    i. The prickly stem and leaves on the squash are thought to help keep pests away from the garden, as raccoons and other pests may not like stepping on them.

- *Look at the broad squash leaves. How do you think the shade of the squash leaf on the group affects evaporation? What about weed control?*
    i. The squash serves as a living mulch, with the shade of the broad squash leaf at ground level helping to keep moisture in the soil (reducing evaporation) and blocking out the sun to control weeds.

2. Three Sisters for Nourishing our Body:
    - *A meal composed of the crops produced by the Three Sisters provides a complete meal for optimal human health. Corn and squash provide slow-release carbohydrates, while beans provide protein. The sisters are better together than when they are apart, as corn and beans provide complimentary amino acids that eliminate the need for meat, and the trio provides many micronutrients required so that humans can thrive.*

3. Three Sisters in Native American Cultures
    - *The Three Sisters are known as the 'Sustainers of Life' among the Oneida People. The botanical and nutritional partnership among these three plants have made them celebrated in many Native American cultures. We will now hear versions of the Legend of the Three Sisters.*
    - Ask two student volunteers to read the two Legends of the Three Sisters included on pages 11 and 12 of the Student Handouts.

Closing Discussion:

We've learned what our food crops need to grow, how they can work together, and some of what we can do to change their growing environments to help bring the food we want to our local climate. We've learned where different plants grow best and why, and how that influences diet choices culture around the world and throughout history.

As you go on with your day, think about a tradition that you want to start!

- What crops can grow in your local climate that also support the health of your family?
- Which of these crops do you love to eat, and how can you combine these foods to make a delicious new tradition?
- How could you better care for your soil to help these crops grow?

References

Teacher Background:

1. Plaster, E.J. (1991). *Soil Science and Management* (2nd Edition). Albany, N.Y: Delmar Pub.
2. Overstreet, L.F. and DeJong-Hughes, J. (2009). The Importance of Soil Organic Matter in Cropping Systems of the Northern Great Plains. *University of Minnesota Extension.*
3. Kohnke, H. and Franzmeier, D.P. (1994). *Soil Science Simplified* (4th Edition). Prospect Heights, Ill: Waveland Pr Inc.

Activity #1

Climate Map borrowed from Internet Geography (2015). Climate Zones.
Climate Zone Definitions taken from CK-12 lesson plans (2016). Chapter 2, Part 7 World Climates.

Activity # 2

Adapted from Bottle Biology and the Wisconsin Fast Plants Program: Build a TerrAqua Investigation Column *(option 1)*.

Activity #3

Basic background information borrowed from Kids Gardening.org: Soil Texture and Composition lesson.

Activity #4

Three Sisters Legends taken word for word from Northeastern State University, Three Sisters Legends.
Nutritional Background borrowed from the Oneida Nation: The Interworking of the Three Sisters.

How to Feed a Plant: What a Plant Needs to Grow

Module 3
Teacher Print Kit

Instructions: Print one copy of this document as a reference *for the Teacher.* It is easiest to print this document **double-sided, on the short-edge.** Additionally, print the Student Handouts for Module 3.

Food Up!

Activity #1: Plant Climate map answer key

Crop	Climate
Corn	Temperate
Wheat	Temperate
Pineapple	Tropical
Banana	Tropical
Watermelon	Arid
Date	Arid
Kale	Polar
Highbush Cranberries	Polar
Grapes	Mediterranean

Activity #1: Teacher Cards – Front

Nutrients & Soil

Water

Sunlight

Air

Activity #1: Teacher Cards – Back

Water

Water is used to carry nutrients from the soil to other parts of the plant. It is used to create energy during photosynthesis, and to store energy in fruits and leaves.

Soil and Nutrients

Plants need nitrogen, potassium, and phosphorous to transport nutrients, create energy through photosynthesis, and store energy. These nutrients are available in the soil and are taken up through the root of a plant.

Soil also stores water to be taken up by roots. A plant strongly rooted in the soil is less susceptible to being pulled up by strong winds.

Air

Air provides oxygen, hydrogen, and carbon. These elements are used to store energy from the sun. The sun’s energy is transformed into glucose in a plants’ leaves during photosynthesis.

Humidity in the air can help store heat from the sun, making the environment easier for plants to grow in.

Sunlight

Sunlight provides the energy necessary to transform elements in the air into glucose energy through photosynthesis. It also provides the heat that plants need to facilitate water movement (and hence nutrient movement) in a plant.

How to Feed a Plant: What a Plant Needs to Grow

Module 3
Student Handouts

Instructions: It is easiest to print this document **double-sided, on short-edge**. Print 1 copy for every 2 students in your class.

Food Up!

Food Up!

Activity #1: Plant Elements

Nutrients & Soil

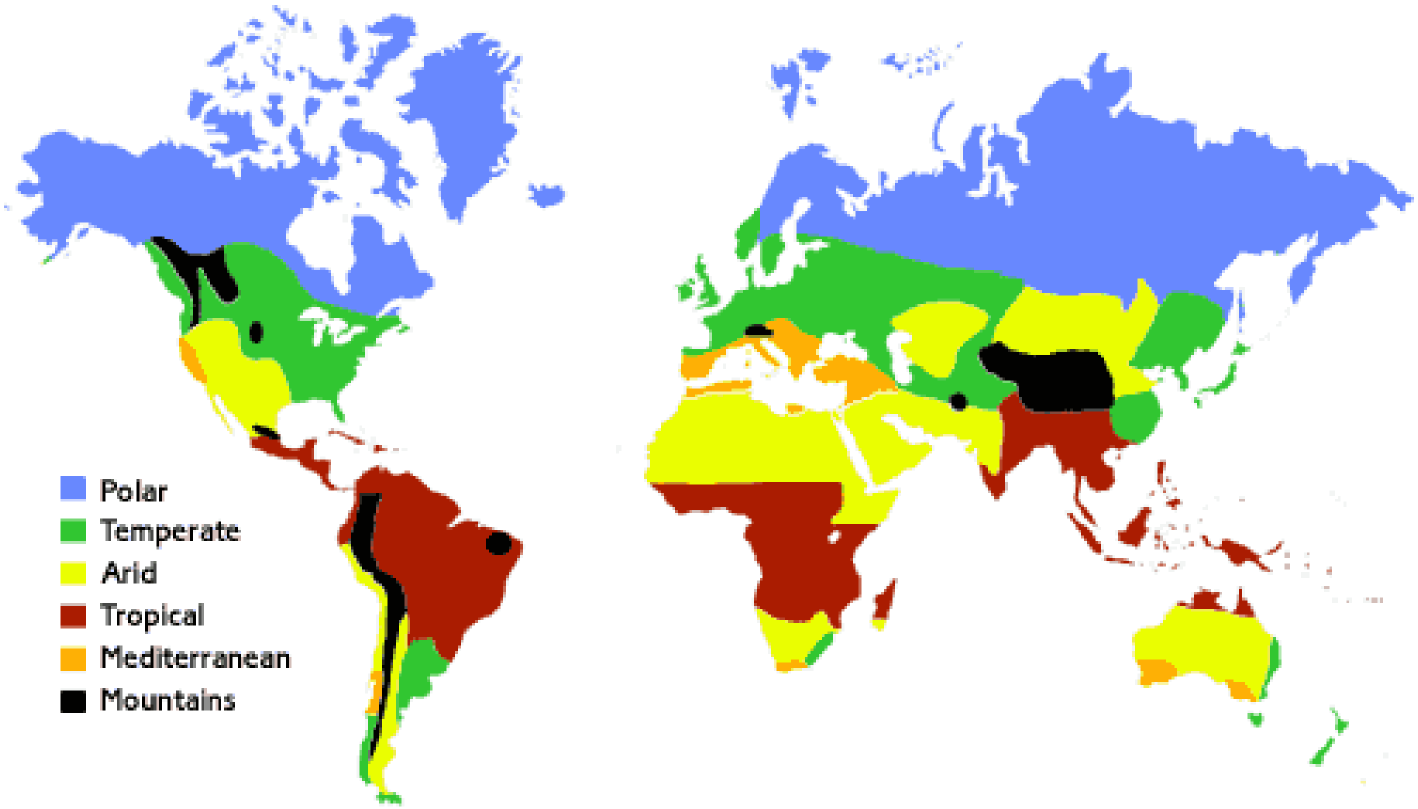
Water

Sunlight

Air

Food Up!

Activity #1: Climate Map



Map taken from: http://www.geography.learnontheinternet.co.uk/topics/climatezones.html

	Summer	Winter	Summer	Winter
Polar				

Polar climates are found near the North and South Poles. They also occur on high mountains at lower latitudes. The summers are very cool, and the winters are frigid. Precipitation is very low because it’s so cold.

Temperate

Temperate climates have moderate temperatures. They vary in how much rain they get and when the rain falls. Rainfall can be sporadic.

Arid

Arid climates are dry and receive very little rainfall. They also have high rates of evaporation. This makes them even drier. Most, but not all, arid climates are near the Equator and have hot weather.

Tropical

Tropical climates are found around the equator. As you'd expect, these climates have warm temperatures year round. Tropical wet climates occur at or very near the equator. They have high rainfall year round. **Tropical rainforests** grow in this type of climate.

Mediterranean

Mediterranean climates are found on the western coasts of continents (ex: California). Temps are mild and rainfall is moderate. Most of the rain falls in the winter, and summers are dry. To make it through the dry summers, short woody plants are common.

KEY:

Frigid **Temperature** Hot

Heavy **Rainfall** Dry

Activity #1: Climate Plant cards: Front

Activity #1: Plant climate cards: Back

Corn

Corn needs well distributed rainfall in sunny, moderately warm weather. It takes from 60 to 100 days to grow from seed to harvest.

Wheat

Wheat needs moderately warm weather with rain from time to time. It takes about 4 months to grow from seed to harvest.

Pineapple

Pineapple plants live for 2-3 years, but die if temperatures dip below 28degrees Fahrenheit.
They require lots of water, humidity, and heat.

Bananas

Bananas grow on trees that live for about six years. They require consistent heat and heavy rainfall.

Watermelon

Watermelon can withstand long droughts and extreme heat.

Dates

Dates can withstand long droughts and extreme heat.

Kale

Kale requires low to moderate rains and is frost tolerant.

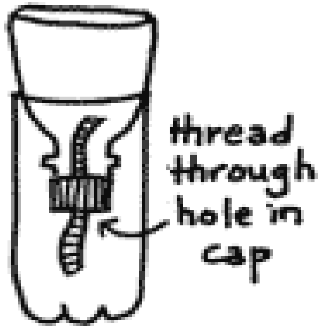
Highbush Cranberries

Highbush cranberries are sweetest picked right after a frost.

Grapes

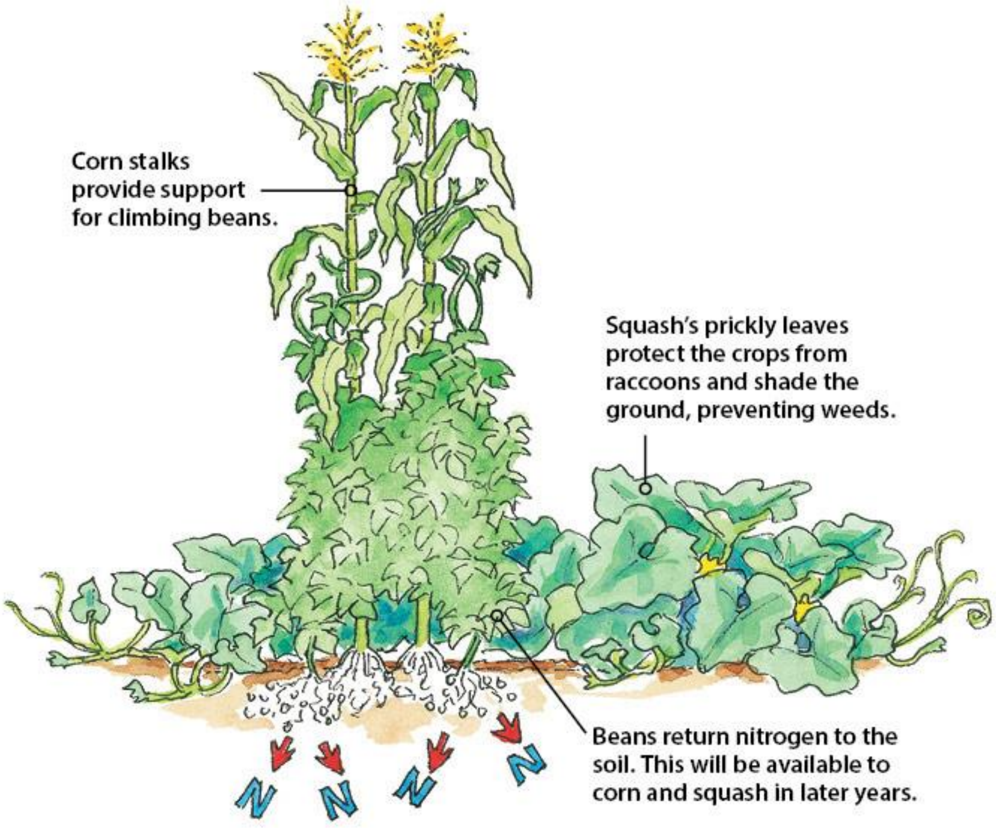
Grape vines have woody stems to help them survive a season of drought, but require moderate rainfall and heat during the summer when grapes are fruiting.

Activity #2: Hydroponic Growing



1. Remove the label from the bottle
2. Cut around the circumference of the bottle at the mark
3. Saturate the wick by dipping it in the water bowl
4. Thread the wick through the cap (about halfway)
5. Fill the bottom of the bottle with about 2” of water.
6. Flip the top of the bottle over and rest it inside of the bottom part of the bottle.
7. Hold the cotton strip straight up while scooping potting soil into the top of the bottle (this ensures that the water will wick from the bottom of the bottle into the soil at the top)
8. Plant the plant in the soil so that the root is completely covered in soil.
9. Lightly water the plant

Activity #4: Three Sisters Graphic



Activity #4: Legend of the Three Sisters 1

There once was a family of a mother, father and three sisters. The parents worked hard at providing for the family, but constantly had to beg the daughters for help. They also had to continually stop them form arguing and fighting. The three sisters were different from each others and also unique in their own way. The eldest was tall and slender with long, silky, shiny hair, the youngest was small but muscular and attractive, and the middle sister was average in height and looks but was beautiful in her giving nature. For whatever reason, although they loved one another as sisters, they would disagree on any little thing and be distracted from doing any work because of these quarrels. The parents tried and tried to get the sisters to help in the garden and help with the chores. When working together they would always fight and when they were apart they would complain about the eachother. The work wasn't getting done and the parents were worried that if it kept up, they wouldn't make it through another winter. When it came planting, work had to be done, but the sisters continued to fight instead work. The parents needed help, and it was given to them, but not as they imagined. As the sisters argued in the field, they were transformed into three plants. The first a long, tall plant with silk tassel-like hair, the second a broad-leafed plant low to the ground, and the third a medium-height plant with gentle vines. The plants—or the three sisters—were corn, squash, and beans.

Activity #4: Legend of the Three Sisters 2

This is the Iroquois Legend of the Three Sisters. It was said that the Earth began when “Sky Woman,” who lived in the upper world, peered through a hole in the sky and fell through to an endless sea. The animals saw her coming, so they took the soil from the bottom of the sea and spread it onto the back of a giant turtle to provide a safe place for her to land. This “Turtle Island” is now what we call North America.

Sky woman had become pregnant before she fell. When she landed, she gave birth to a daughter. When the daughter grew into a young woman, she also became pregnant. She died while giving birth to twin boys. Sky Woman buried her daughter in the “new Earth.” From her grave grew three sacred plants—corn, beans, and squash. These plants provided food for her sons, and later, for all of humanity. These special gifts ensured the survival of the Iroquois people.

Food Up!
URBAN AG CURRICULUM

Module 4: Food Desert to Food Oasis, Food Security and Urban Farming

Goals and Objectives:

During this lesson, students will identify environmental circumstances that influence their own dietary choices and food access. They will examine the components of a healthy meal through a neighborhood food security lens. Students will also identify the geographic and socioeconomic characteristics of a neighborhood that contribute to and are reflected in its calculated food security status. Lastly, students will examine how urban agriculture can lead to community food security and resilience.

Time: 1 hour, 20 minutes

Optional additional activities: 15 minutes

Materials:

☐ Module 4 Teacher Print Kit
☐ Module 4 Student Handouts
☐ Whiteboard and markers (or large sheet of paper and markers)
☐ Sticky notes and pen
☐ Colored markers (black or blue pens are okay)
☐ Blank paper

Optional:
☐ Technology to show a YouTube video

Teacher Background:

Despite an abundance of nutritious food available in the United States, hunger and nutritional inadequacy persist in this country. A prevalent myth is that some of this hunger is due to laziness. It is to the contrary as a legacy of economic, social, health, and cultural inequalities contribute to widespread nutritional challenges—both under and overnutrition—closely related to food security and food insecurity.

We all have different food choices available to us based on our circumstances and opportunities. These circumstances include how far we are from food outlets, such as grocery stores and farmers markets, whether we have access to reliable transportation, and whether our income is sufficient to meet our need for healthy food. Health status can also impact what foods we can eat and easily digest. Additionally, global pressures, market forces, and policy can impact our availability and access to food. All these factors impact our *food security*, defined by the USDA as “access by all people at all times to enough food for an active, healthy life.”[1] The United Nations’ Committee on World Food Security has a broader definition, clarifying that food security is a state in which "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life." [2]

Despite being one of the richest countries on the planet with a robust agriculture industry, an estimated 10.5% of U.S. households (13.8 million people) were food insecure at some point during 2020.[1] People facing food insecurity are often also experiencing poverty, as food insecurity does not exist in a vacuum. Many low-income people are affected by multiple, overlapping issues like lack of affordable housing, social isolation, economic/social disadvantage resulting from structural racism, chronic or acute health problems, high medical costs, and low wages. In sum, these issues are important social determinants of health, suggesting that efforts to improve food security must address root causes, not just food production. People across the US are working hard, and in creative ways, to address how food insecurity impacts health, economic productivity, and general wellbeing.

In this lesson, we explore the factors that drive food security and consider how urban agriculture might contribute to improved food security and neighborhood resilience by promoting nutrition, health, economic empowerment, community building, and environmental stewardship (Please see “The Benefits of Urban Agriculture” page 6 in the Teacher Print Kit for more information). Lastly, we discuss how urban agriculture lends to the Blue Zones Project’s eight principles of a long health*y* life. The Blue Zones was a National Geographic project that identified five regions of the world where people live the longest, and then studied the habits and culture in these areas. The project found 8 principles that all five areas shared. The principles include regular body movement, purpose, nutrition, and community building (Please see the Blue Zones, pages 7-9, in the Teacher Print Kit for more information).

Opening Discussion:

Start this lesson with an open discussion about food choices and external forces that might impact one's food security.

- *Are individuals responsible for their own food choices? Always? Can you think of examples where they are or are not in control?*

- *What does food security mean to you? What do you think it feels like to not be food secure?*
    - You may want to provide one of the definitions of food security from above to help your students here:
        - USDA: "access by all people at all times to enough food for an active, healthy life."[1]
        - The United Nations' Committee on World Food Security, food security is a state when "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life."[2]

Activity #1: Food choice

Time: 15 minutes

Materials:

☐ White board (or large paper) and markers
☐ Sticky notes and pen

Lesson:

1. Brainstorm with students: *What influences food choice?* Write each idea on a sticky note and post on the board or paper.
    - Steer students to cover the following: food and farm policy, budget and price, culture, taste, marketing, health, convenience, availability, religious beliefs.

2. Write two headings on the board: **My Choice** and **Chosen for Me**. As a group, sort the sticky notes into these two categories. You may have some sticky notes that land somewhere in the middle.

3. *Food choices happen in two steps. We are first presented with food options, and then we are able to choose. Our options are dependent on what is available in our location, what is within our budget, and what is reasonable to attain. We then must choose our food from these constraints.*
    - *What circumstances change our food options?*
        - Ideas: Whether we have a car, good public transportation, our income level, what kinds of food outlets are near us, etc.

4. Have each student choose 1 or 2 sticky notes from the “Chosen for Me” category on the board. Ask students to brainstorm ways these influences over food choice could be moved closer to the “My Choice” category. You might discuss:
        - Marketing: I can change what TV shows and magazines that I watch
        - Availability: I can work with my corner store to stock more healthy foods
        - Availability: I can grow a container garden on my porch
        - Culture: I can show my family a new recipe

ACTIVITY #2: BUILDING A HEALTHY MEAL

TIME: 20-25 minutes

MATERIALS:

☐ Student Handouts
  ☐ Includes: Healthy Eating Plate (page 1)
  ☐ Includes: Jadyn slide (page 2) and Amari slide (page 3)
  ☐ Includes: Food Security Pyramid (page 4)
☐ Blank paper
☐ Colored markers (non-colored pens will work)

LESSON:

1. Go over the Healthy Eating Plate included in the Student Handouts (page 1). Read aloud the categories with the group and define each.

2. Have each student draw their own plate on a piece of paper and draw one meal that is balanced and reflects the Healthy Eating Plate. It may be helpful to remind students that food categories can be combined into one dish. (For example, a soup might have rice, veggies, protein, and oil).

3. Ask students to share their meal ideas with the group. Have students explain how each category is covered on their plate.

4. Read aloud the food access stories of both Jadyn and Amari provided in the Student Handouts (pages 2-3).
   - Use the sorted post-it notes from Activity #1 to facilitate discussion about Jadyn and Amari's food choices.
     - Ask students to take turns pointing out one of the post-it notes, and sharing with the group how that note relates to Jadyn's story.
     - Repeat the above process for Amari's story.

   - *Which person would have an easier time creating the healthy meal you created on your plate? Why?*
   - *Take a look at the Food Security Pyramid on page 5 of both the Teacher Print Kit and Student Handouts. Do you think that Jadyn and Amari are experiencing different levels of food security? Why or why not*

Activity #3: Mapping Food Security

Time: 20 minutes

Materials:

- ☐ Student Handouts
  - ☐ Includes: Mapping Food Security (pages 5-7) (1 copy per group of 2-3 students)
  - ☐ Includes: Food Map Questions (page 8) (Optional: 1 copy per 1-3 students)
- ☐ Pens

Lesson:

1. According to the USDA, food security means “access by all people at all times to enough food for an active, healthy life”.[1] Food security is influenced by factors such as budget, transportation, and proximity to healthy food outlets. The opposite of food security is food **insecurity.**

   According to the US Department of Agriculture (USDA), “**Food-insecure** households are uncertain of having, or unable to acquire, at some time during the year, enough food to meet the needs of all their members because they had insufficient money or other resources for food: 10.5 percent (13.8 million) of U.S. households were food insecure at some time during 2020.”[3] Potential effects of food insecurity include less intake of fruit and vegetables, increased risk of obesity and diabetes, as well as increased anxiety and depression in children. Food insecurity can also affect children’s academic performance and affect behaviors negatively at school.[5]

2. Hand out neighborhood food maps and questions found in the Student Handouts (pages 6-9). Read the discussion questions aloud and allow students time to discuss or write their answers in small groups.

3. Discuss:
   - *For each neighborhood, where do you think most residents get their food from? Do you think this differs between people who have access to a car and those who don’t?*
   - *In which neighborhood do you think residents eat the healthiest food? Why?*

- *In which neighborhood do you think you would have the hardest time finding good food at an affordable price? Why?*
- *What are ways we could improve food security, and hence healthy eating, in all neighborhoods?*

  Ideas:

  - Increase participation in the SNAP program (food stamps)
  - Establish more urban gardens.
  - Bring communities together for more group meals.
  - Encourage schools to create a free breakfast program for all students.
  - Encourage convenience stores to stock healthy foods.
  - Attract good jobs to the area so that people can afford better food (this also encourages supermarkets to move into the neighborhood)
  - Establish farmers markets.

Connecting to the Garden

Time: 15+ minutes

Materials:

☐ Technology to show YouTube video

Lesson:

Urban Agriculture is one way that communities experiencing food insecurity can establish resilience. As a segway to the Urban Agriculture Activity, consider watching an example of an urban farmer creating community resilience in South Central Los Angeles with students.

1. Gangsta Gardener Ron Finley
    - TED X: (10:45) *Contains mild language
        - A guerilla gardener in South Central LA | Ron Finley
    - Game Changers: (5:11)
        - Ron Finley: Urban Gangsta Gardener in South Central LA | Game Changers

2. After the video, consider taking a tour of your own garden, and reflect on ways that the garden contributes to the health and wellbeing of the group. Discuss how the garden might better serve the community.

Activity #4: Community Thriving Through Urban Agriculture

Time: 15-20 minutes

Materials:

- ☐ Teacher Print Kit
  - ☐ Includes: The Benefits of Urban Agriculture (page 5)
  - ☐ Includes: Blue Zones Principles (pages 6-8)
- ☐ Student Handouts
  - ☐ Blue Zones Principles (page 9)
- ☐ White board or paper and markers

Lesson:

1. First, define urban agriculture for your students.
   - "Urban agriculture includes the cultivation, processing and distribution of agricultural products in urban and suburban areas."[4] Urban agriculture is often used as a way to bring jobs and access to healthy food to areas that are considered food deserts. It can look like many different activities, from community gardens that pour into potlucks, to hydroponic growing enterprises that provide jobs for neighborhood workers.

2. Next, use the urban agriculture slide in the Teacher Print Kit (page 6) to explain to students the benefits of urban agriculture.
   - Optional: Write on the board five categories of urban agriculture benefits as you talk about them:
     - Nutrition
     - Health
     - Economy
     - Community
     - Environment

   - Discuss: *How might urban farming change Jadyn's access to food from Activity #2: Building a Healthy Meal? What about Amani's?*

   - Brainstorm urban farming activities that might improve access to food for the neighborhoods we looked at in Activity #3.

3. Finally, introduce Blue Zones:
    - *The Blue Zones is a project by National Geographic that identified five regions of the world where people live the longest, and then studied the habits and culture in these areas in order to figure out why people lived so long in these places. The team found 8 principles that the areas shared:*
        - *Move Naturally*
        - *Purpose*
        - *Down Shift*
        - *80% Rule*
        - *Plant Slant*
        - *Right Tribe*
        - *Loved Ones First*
        - *Belong*

    - Use the Blue Zones Principles on pages 7-9 of the Teachers Print Kit to explain each of the Blue Zones principals to students.

    - As a group, go through all 8 Blue Zone categories one by one, and come up with ideas on how urban agriculture relates to each.

Closing Discussion:

End this lesson with a brief discussion on power and food choice.

- *What choices are within your power today to make healthier food choices?*
    - *Why is this important?*

- *What strategies are within your power to create more food choices for yourself and others in your neighborhood and wider community? In what other ways, besides healthy food availability, might these strategies make your community more resilient?*

References:

1. *Economic Research Service.* (2023, May). U.S. Department of Agriculture. https://www.ers.usda.gov/.
2. Food and Agriculture Organization. (2006, June). *Policy Brief Food Security* (Issue Brief no. 2). https://www.fao.org/fileadmin/templates/faoitaly/documents/pdf/pdf_Food_Security_Cocept_Note.pdf.
3. *Interactive Charts and Highlights.* U.S. Department of Agriculture, Economic Research Service. https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/interactive-charts-and-highlights/.
4. *Urban Agriculture.* U.S. Department of Agriculture. https://www.usda.gov/topics/urban.
5. (2020, June 26). *Unit 3: Consumers and Communities.* Johns Hopkins Bloomberg School of Public Health. https://www.foodspan.org/lesson-plans/unit-3-consumers-and-communities/

Activity 2:

Harvard T. H. Chan School of Public Health. (2023, January). *Healthy eating plate.* The Nutrition Source. https://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/

Activity 3:

Lesson plan adapted from Johns Hopkins Foodspan Lesson #14: The Hunger Gap: Unit 3: Consumers and Communities

Maps adapted from:

Wright, A. (2011, May 3). *Interactive Web Tool Maps Food Deserts, Provides Key Data.* U. S. Department of Agriculture. https://shorturl.at/fwDRX

Google Maps

Activity 4:

Adapted from Buettner, D. *Power 9.* Blue Zones. https://www.bluezones.com/2016/11/power-9/.

Adapted from Dewey, S. (2021, December 23). *The Power of Urban Agriculture in Transforming a Community.* Conservative Law Foundation. https://shorturl.at/eiyR2.

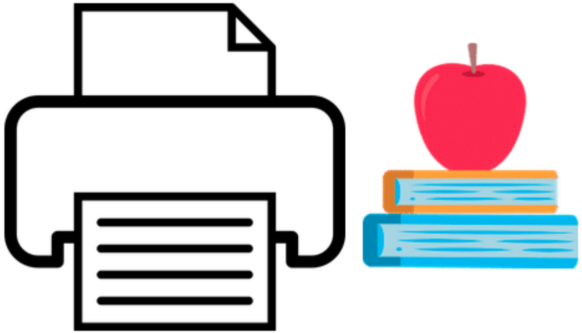
Garden Connection:

Finley, R. [WMX Presents]. (2015, December 16). *Ron Finley: Urban Gangsta Gardener in South Central LA.* [Video]. YouTube. https://youtu.be/7t-NbF77ceM

Finley, R. [TED]. (2013, March 6). *A guerilla gardener in South Central LA.* [Video]. YouTube. https://youtu.be/EzZzZ_qpZ4w

Food Desert to Food Oasis: Food Security and Urban Farming

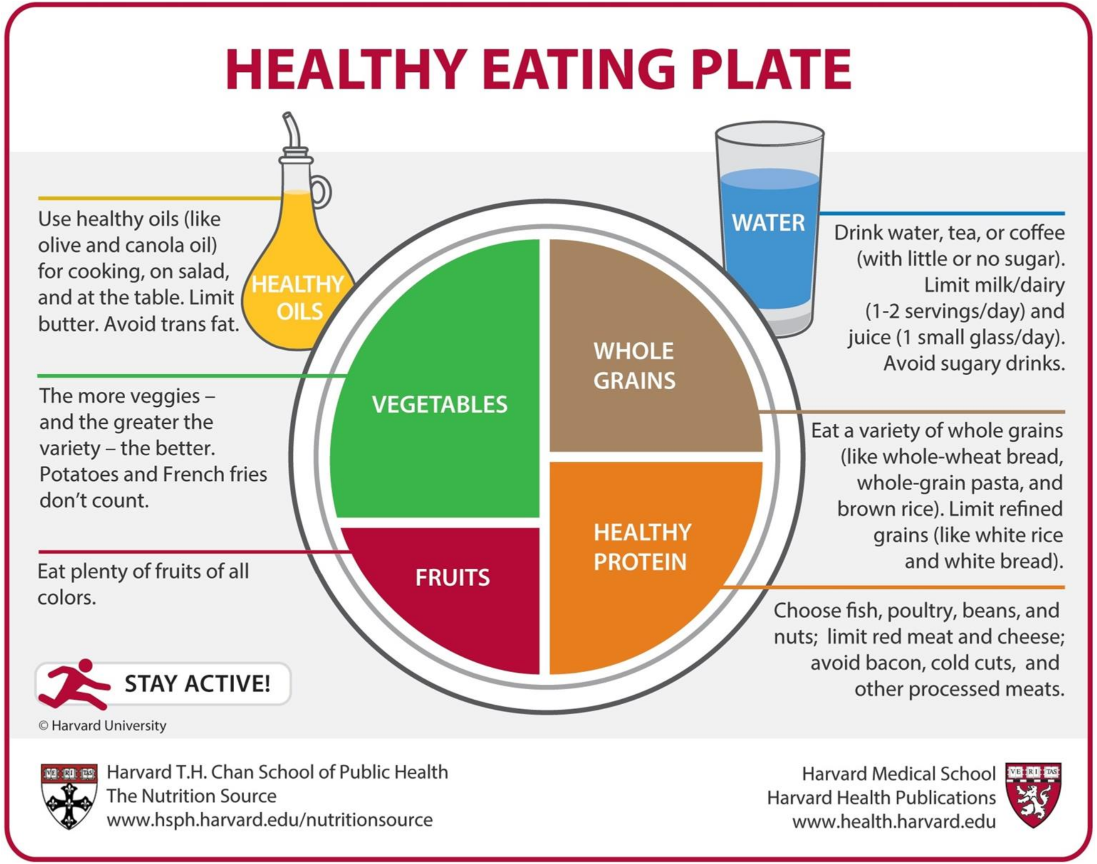
Module 4
Teacher Print Kit



Instructions: Print one copy of this document as a reference *for the Teacher.* You can print double- or single-sided. Additionally, print the Student Handouts for Module 1.

Food Up!

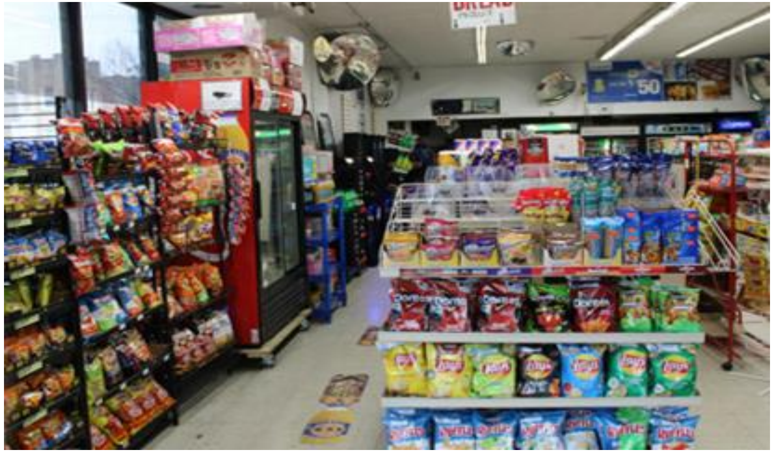
Activity #2


HEALTHY EATING PLATE
HEALTHY OILS
Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.
WATER
Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.
VEGETABLES
The more veggies – and the greater the variety – the better. Potatoes and French fries don't count.
WHOLE GRAINS
Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).
FRUITS
Eat plenty of fruits of all colors.
HEALTHY PROTEIN
Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.
STAY ACTIVE!
© Harvard University
Harvard T.H. Chan School of Public Health
The Nutrition Source
www.hsph.harvard.edu/nutritionsource
Harvard Medical School
Harvard Health Publications
www.health.harvard.edu

Activity #2

Jadyn

Jadyn passes by a convenience store on her way to and from school. She goes with her friends to the convenience store a couple times a week to get a snack before yearbook club. A small farmer's market is hosted in her neighborhood on Wednesdays from 2-5 pm during the summer and fall. The nearest grocery store is 1.5 miles away. Her family does not own a car, but Jadyn has a free student bus pass. Jaden's mom grows a container garden on their apartment's porch every year. Jaden's family receives SNAP (formerly known as food stamp) benefits. Jadyn's school has a backpack food program, and Jadyn is able to take a pre-packed backpack full of healthy food home for free once every two weeks. Jadyn's mom works two jobs, and Jadyn is very involved with extra curriculars at school, so their time available to cook is limited.



Activity #2

Amari

Amari lives in the suburbs, so his nearest grocery store is 3 miles away. His access to public transportation is very limited. Amari, his mom, and his dad all have their own cars. Amari helps his dad grow a garden every year in their backyard. Amari’s family is in the middle class, so they are able to afford most fresh produce and healthy food at the grocery store when they’d like it. Amari grew up with a family friend who regularly taught him to cook healthy food. Amari gets together with his neighbors once per month for a potluck.

Activity #2: Food Security Pyramid

Source: Adapted from the USDA Economic Research Service.

ACTIVITY #4: THE BENEFITS OF URBAN AGRICULTURE

Francey and the team at Mill City Grows are not alone in seeing a garden energize a neighborhood. Often led by and rooted in communities of color and immigrant and New American communities, urban gardens and farms bolster the well-being and resilience of our cities. Here's a look at the many benefits they provide:

Nutrition: Urban agriculture offers increased access to healthy, locally grown, and culturally appropriate food sources. Having space to grow and share food is especially important in disinvested and underserved neighborhoods, where finding affordable fruits and vegetables can be challenging. Plus, growing and eating food locally reduces the distance food travels to our plates – which is good for our climate and our health, as food loses nutritional value in transport.

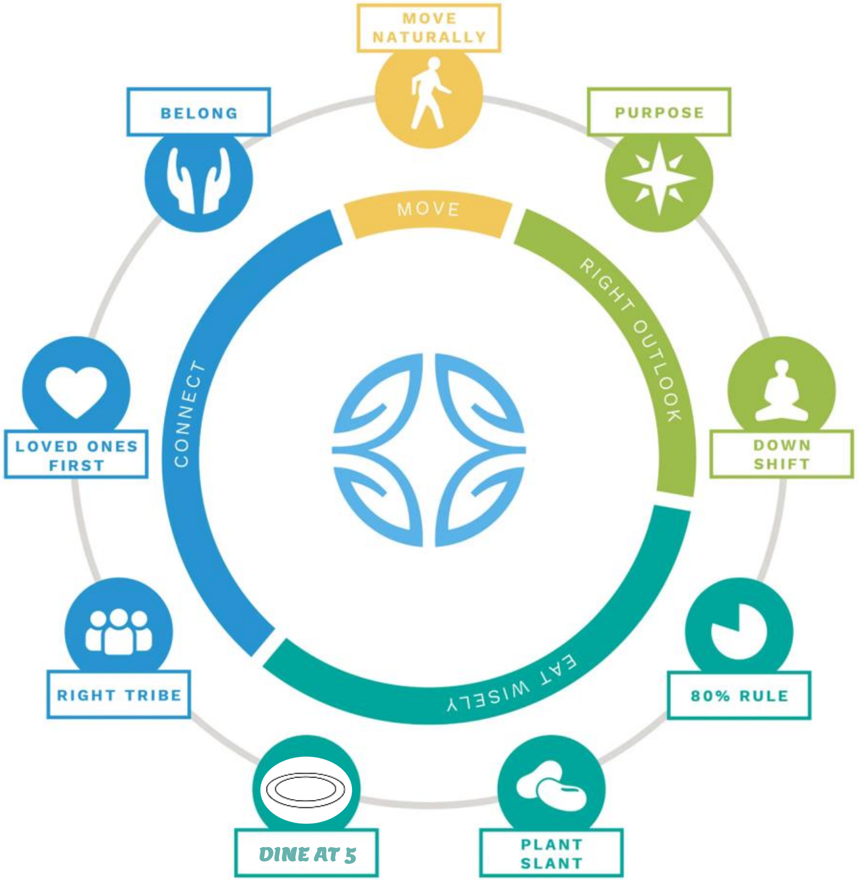
Health: While eating fresh food is beneficial in and of itself, the act of growing that food also boosts physical and mental health. Research shows that working with plants—and putting our hands in the dirt—provides outdoor physical activity, induces relaxation, and reduces stress, anxiety, blood pressure, and muscle tension.

Economy: Urban agriculture can provide a flexible source of income for gardeners and cut family food costs. Also, urban gardening and farming projects, like Mill City Grows, can often provide job training and jumpstart food entrepreneurship.

Community: Urban farming adds and preserves green space in cities, providing places for neighbors to come together, strengthen bonds, and build community cohesion. Urban agriculture connects people with the earth and the source of their food as well as with each other. What's more, urban farms offer critical opportunities for youth leadership, intergenerational collaboration, and cross-cultural learning.

Environment: Urban agriculture improves environmental health and climate resilience in the face of increasing storms and heat. Cultivated land absorbs rainfall, preventing stormwater from overloading sewer systems and polluting waterways. Also, by increasing vegetation and tree cover, farms and gardens attract pollinators like bees and keep city neighborhoods cooler, minimizing the health impacts of heat island effect.

Activity #4: Blue Zones Principles



ACTIVITY #4: BLUE ZONES PRINCIPLES

1. Move Naturally:
    - *The world's longest-lived people don't pump iron, run marathons or join gyms. Instead, they live in environments that constantly nudge them into moving without thinking about it. They grow gardens and don't have mechanical conveniences for house and yard work.*
2. Purpose:
    - *The Okinawans call it "Ikigai" and the Nicoyans call it "plan de vida;" for both it translates to "why I wake up in the morning." Knowing your sense of purpose is worth up to seven years of extra life expectancy*
3. Down Shift:
    - *Even people in the Blue Zones experience stress. Stress leads to chronic inflammation, associated with every major age-related disease. What the world's longest-lived people have that we don't are routines to shed that stress. Okinawans take a few moments each day to remember their ancestors, Adventists pray, Ikarians take a nap and Sardinians do happy hour.*
4. 80% Rule:
    - *"Hara hachi bu" – the Okinawan, 2500-year-old Confucian mantra said before meals reminds them to stop eating when their stomachs are 80 percent full. The 20% gap between not being hungry and feeling full could be the difference between losing weight or gaining it. People in the blue zones eat their smallest meal in the late afternoon or early evening and then they don't eat any more the rest of the day.*
5. Plant Slant:
    - *Beans, including fava, black, soy and lentils, are the cornerstone of most centenarian diets. Meat—mostly pork—is eaten on average only five times per month. Serving sizes are 3-4 oz., about the size of a deck of cards.*

ACTIVITY #4: BLUE ZONES PRINCIPLES

6. Wine @ 5:
   - *People in all blue zones (except Adventists) drink alcohol moderately and regularly. Moderate drinkers outlive non-drinkers. The trick is to drink 1-2 glasses per day (preferably Sardinian Cannonau wine), with friends and/or with food. And no, you can't save up all week and have 14 drinks on Saturday.*
7. Belong:
   - *The all but five of the 263 centenarians we interviewed belonged to some faith-based community. Denomination doesn't seem to matter. Research shows that attending faith-based services four times per month will add 4-14 years of life expectancy.*
8. Loved Ones First:
   - *Successful centenarians in the blue zones put their families first. This means keeping aging parents and grandparents nearby or in a home (It lowers disease and mortality rates of children in the home too). They commit to a life partner (which can add up to 3 years of life expectancy) and invest in their children with time and love (They'll be more likely to care for you when the time comes).*
9. Right Tribe:
   - *The world's longest-lived people chose – or were born into – social circles that supported healthy behaviors, Okinawans created "moais" – groups of five friends that committed to each other for life. Research from the Framingham Studies shows that smoking, obesity, happiness, and even loneliness are contagious. So, the social networks of long-lived people have favorably shaped their health behaviors.*

To make it to age 100, you would have to have won the genetic lottery. But most of us have the capacity to make it well into our early 90's and largely without chronic disease. As the Adventists demonstrate, the average person's life expectancy could increase by 10-12 years by adopting a Blue Zones lifestyle.

A note for teachers: Why the Healthy Eating Plate over MyPlate?

Linked here is context on why our team decided to teach from Harvard Medical School's Healthy Eating Plate, rather than the United States Department of Agriculture's MyPlate. In sum, the Healthy Eating Plate is based exclusively on the best available nutritional science. The USDA's nutrition resources are based not only on the interests of optimal human nutrition, but also the political and commercial interests of the food industry in the United States. For the purposes of this lesson, students will be considering optimal human nutrition when evaluating food security.

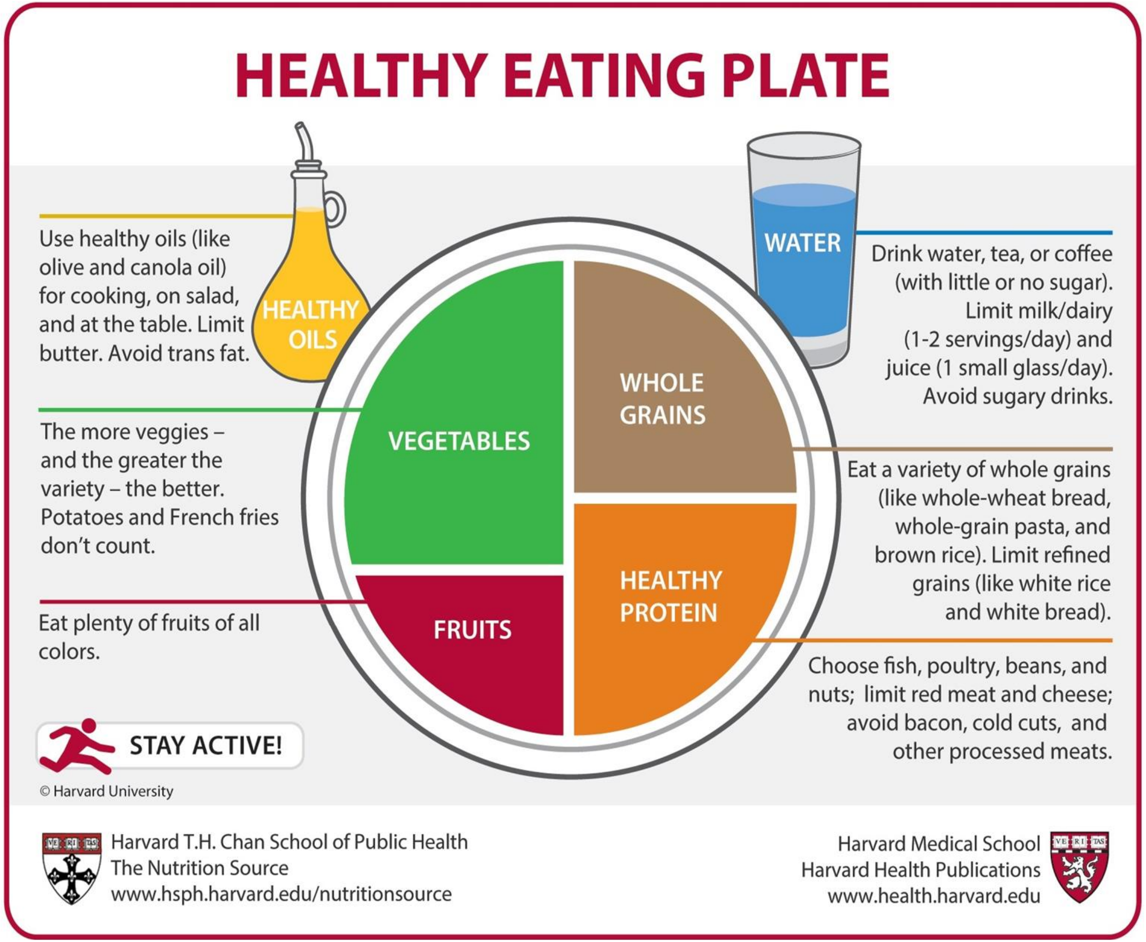
Food Desert to Food Oasis: Food Security and Urban Farming

Module 4
Student Handouts

Instructions: It is easiest to print this document **double-sided**. Print 1 copy for every 2 students in your class.

Food Up!

Activity #2


HEALTHY EATING PLATE
HEALTHY OILS
Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.
WATER
Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.
VEGETABLES
The more veggies – and the greater the variety – the better. Potatoes and French fries don't count.
WHOLE GRAINS
Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).
FRUITS
Eat plenty of fruits of all colors.
HEALTHY PROTEIN
Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.
STAY ACTIVE!
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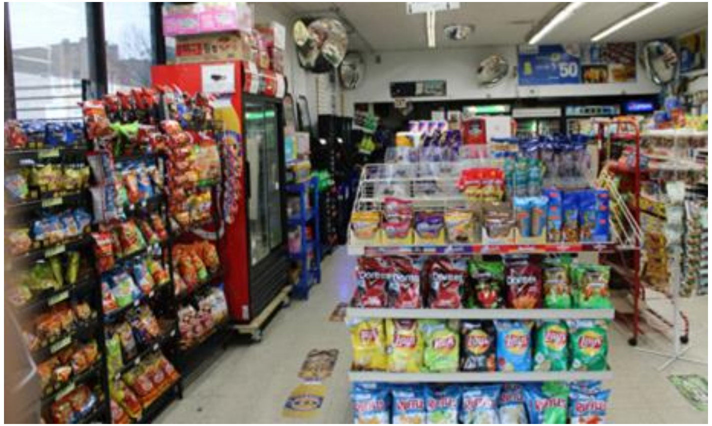
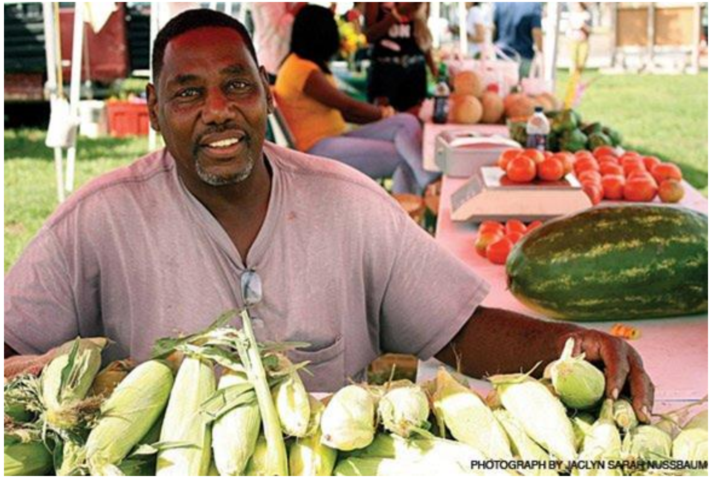
The Nutrition Source
www.hsph.harvard.edu/nutritionsource
Harvard Medical School
Harvard Health Publications
www.health.harvard.edu

Activity #2

Jadyn

Jadyn passes by a convenience store on her way to and from school. She goes with her friends to the convenience store a couple times a week to get a snack before yearbook club. A small farmer's market is hosted in her neighborhood on Wednesdays from 2-5 pm during the summer and fall. The nearest grocery store is 1.5 miles away. Her family does not own a car, but Jadyn has a free student bus pass. Jaden's mom grows a container garden on their apartment's porch every year. Jaden's family receives SNAP (formerly known as food stamp) benefits. Jadyn's school has a backpack food program, and Jadyn is able to take a pre-packed backpack full of healthy food home for free once every two weeks. Jadyn's mom works two jobs, and Jadyn is very involved with extra curriculars at school, so their time available to cook is limited.





Activity #2

Amari

Amari lives in the suburbs, so his nearest grocery store is 3 miles away. His access to public transportation is very limited. Amari, his mom, and his dad all have their own cars. Amari helps his dad grow a garden every year in their backyard. Amari's family is in the middle class, so they are able to afford most fresh produce and healthy food at the grocery store when they'd like it. Amari grew up with a family friend who regularly taught him to cook healthy food. Amari gets together with his neighbors once per month for a potluck.

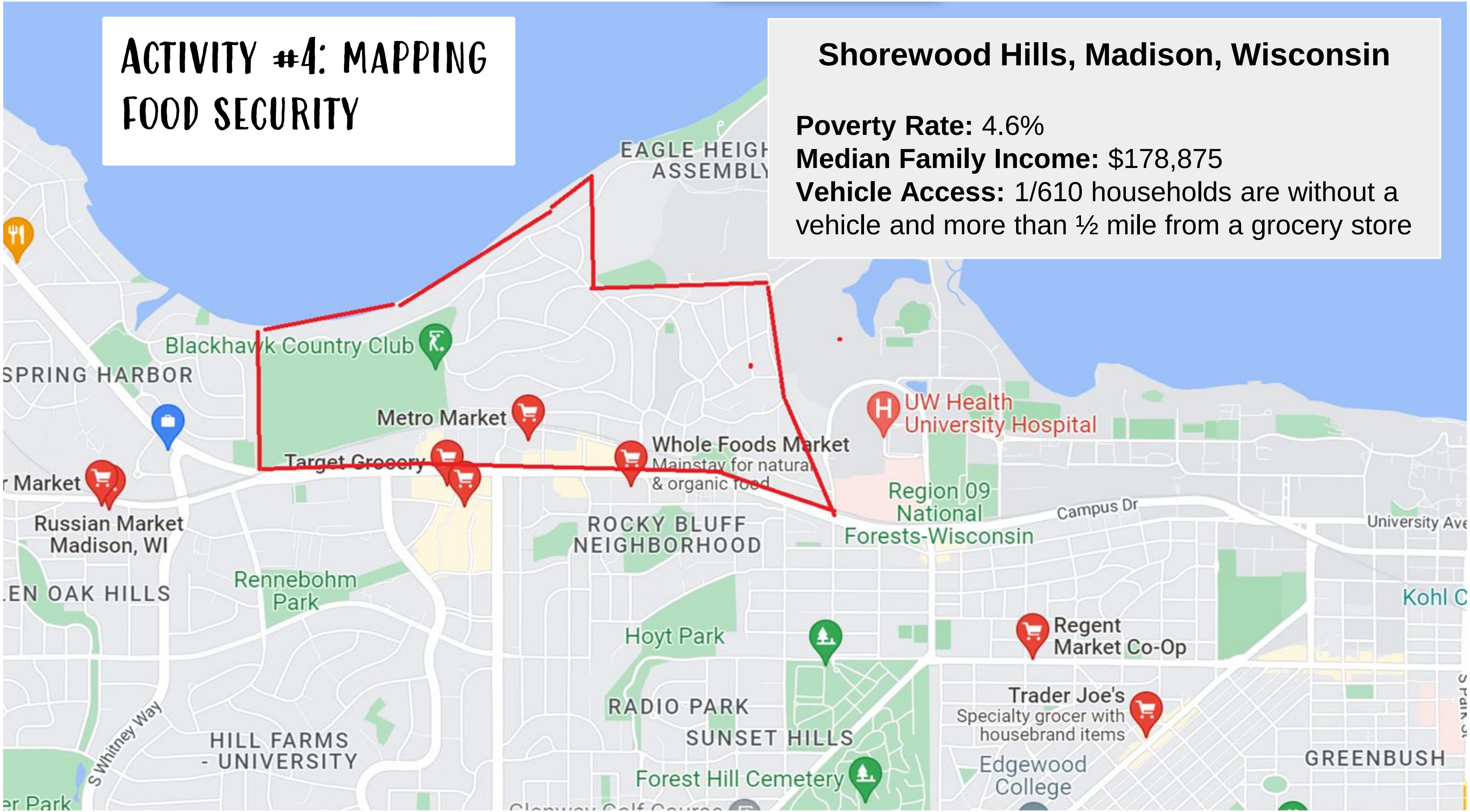
Activity #2: Food Security Pyramid

Source: Adapted from the USDA Economic Research Service.

Activity #4: Mapping Food Security

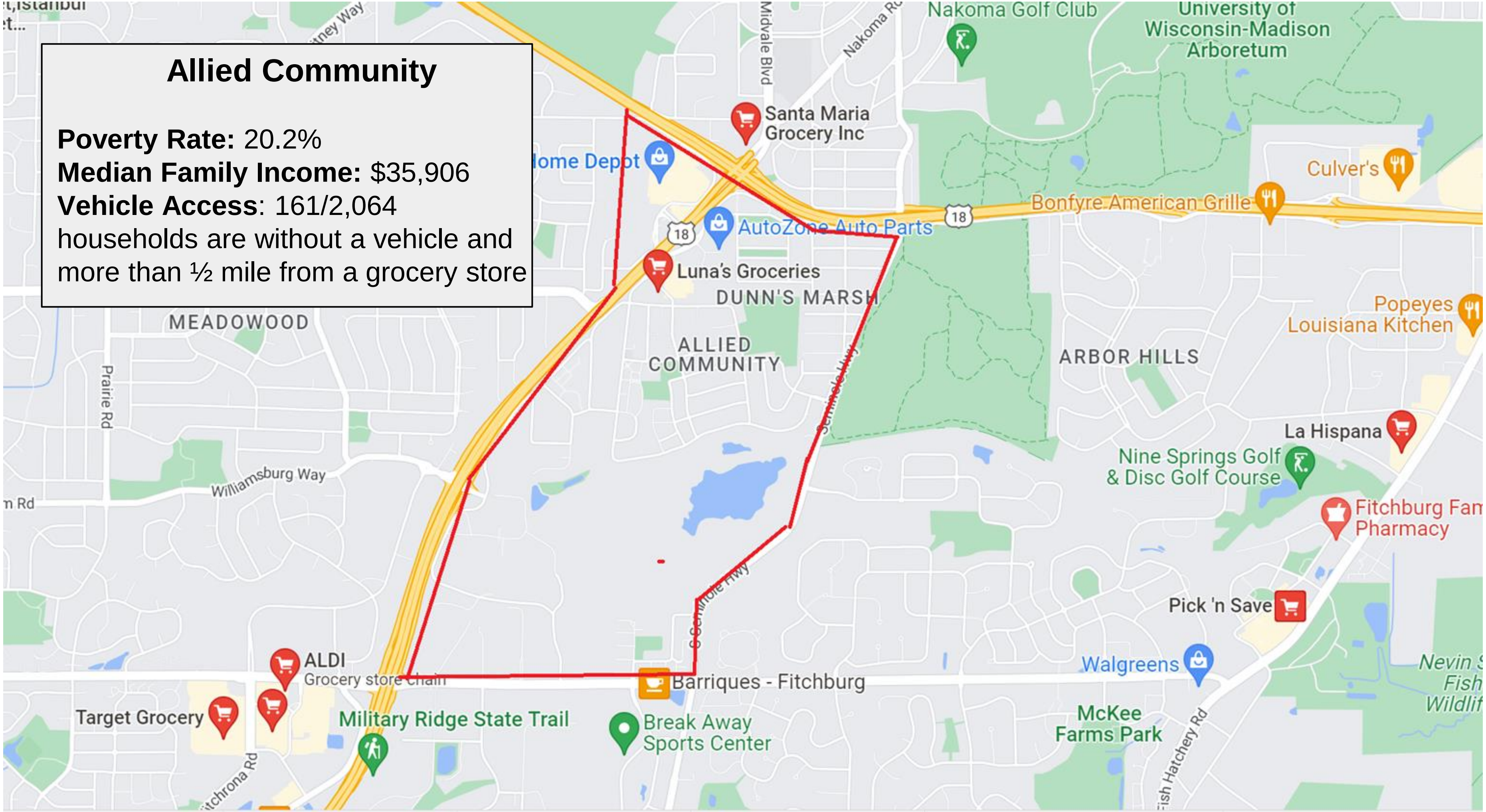
Shorewood Hills, Madison, Wisconsin

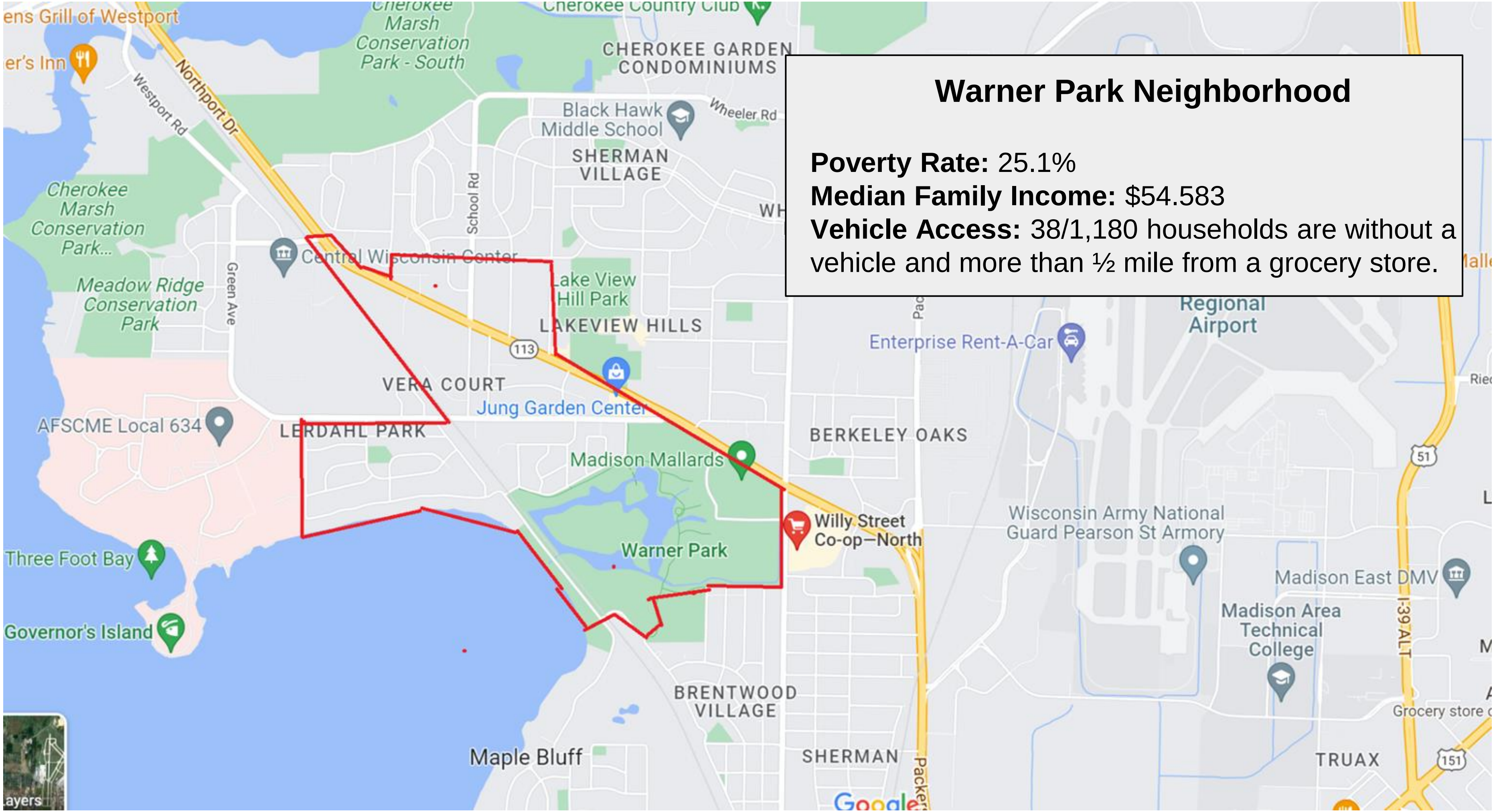
Poverty Rate: 4.6%
Median Family Income: $178,875
Vehicle Access: 1/610 households are without a vehicle and more than ½ mile from a grocery store



Allied Community

Poverty Rate: 20.2%
Median Family Income: $35,906
Vehicle Access: 161/2,064 households are without a vehicle and more than ½ mile from a grocery store





Warner Park Neighborhood

Poverty Rate: 25.1%
Median Family Income: $54.583
Vehicle Access: 38/1,180 households are without a vehicle and more than ½ mile from a grocery store.

Activity #3: Food Map Questions

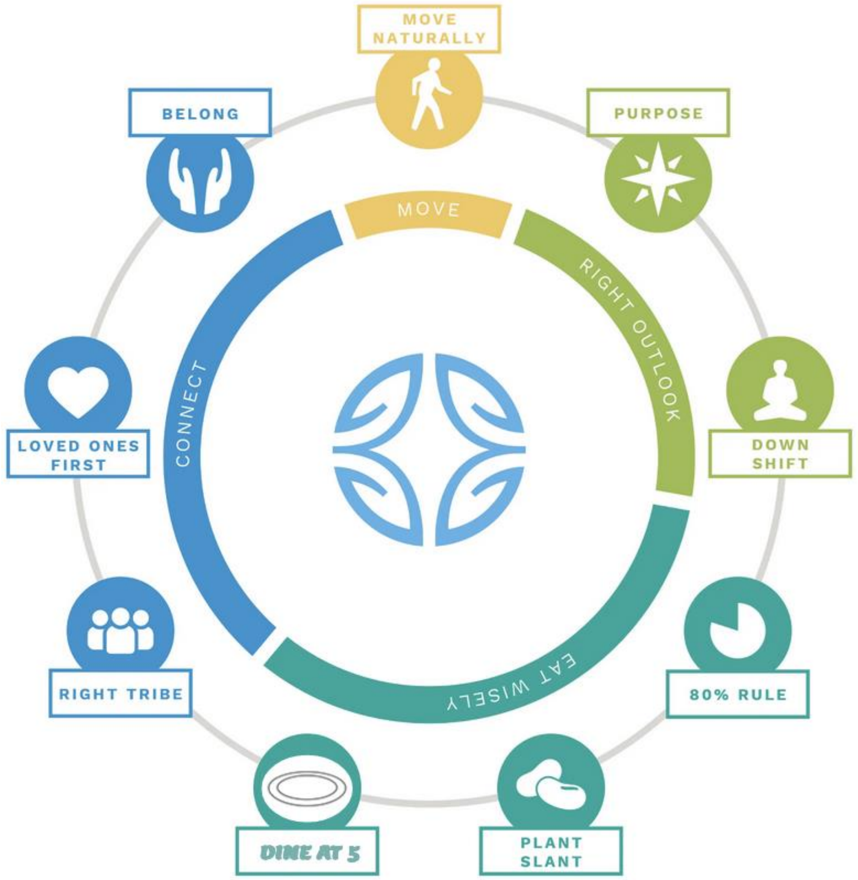
- *For each neighborhood, where do you think most residents get their food from? Do you think this differs among people who have access to a car and those who don't?*

- *In which neighborhood do you think residents eat the healthiest food? Why?*

- *In which neighborhood do you think you would have the hardest time finding good food at an affordable price? Why?*

- *What are ways we could improve food security, and hence healthy eating, in all neighborhoods?*

ACTIVITY #4: BLUE ZONES PRINCIPLES



Module 5: Make it Last – Sustainable Agriculture and Agroecology

Goals and Objectives:

Sustainability is a term applied across industries and academic disciplines/ But what does it mean in terms of farming? In this lesson, students will explore what makes a *system* sustainable and apply this definition of sustainability to agriculture. The commonly used framework, *Three Legs of Sustainability: Economy, Environment, and Community,* will be used to evaluate the sustainability of various crops as they move through processes in our modern food system. As an alternative to conventional, industrialized agriculture, students will learn how ecology and agriculture can be paired to create a more sustainable food system through *agroecology.* Four tenets of agroecology will be present: efficiency, self-sufficiency, diversity, and resilience. Students will then use the Healthy Eating Plate to design a nutritious *and* sustainable meal. The lesson ends with a brainstorming session on how students can take action in their own lives to create a more sustainable food system.

Time: 1 hour 15 minutes

Materials:

- ☐ Module 5 Teacher Print Kit
- ☐ Module 5 Student Handouts
- ☐ Scissors
- ☐ Magazines (at least one per two students)
- ☐ Whiteboard (or large sheet of paper)
- ☐ Pens, colored pencils, markers, or crayons
- ☐ Blank paper
- ☐ Two colors of string
- ☐ 38 magnets or tape
- ☐ Garden in any stage of growth

Teacher Background:

Definitions for sustainability and sustainable agriculture vary across sources, but generally sustainable systems have been described as those that can continue over a long period of time, due to the balance and longevity of three main components: the economy, the environment, and the community. Stewardship of the financial, environmental, and social aspects of any system is paramount to sustainability, given that humans are the actors driving, benefiting from, and shaping action. The United Nations Brundtland Commission defined sustainability as, “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (1987). Today, with more than 150 developing countries in the world seeking ways to meet their development needs in the face of climate change and developed nations continuing a trajectory of high per capita consumption, concrete efforts to ensure that current and future development does not negatively affect future generations is essential.[1]

Since 1950, we have seen global improvements in life expectancy, lower rates of poverty, and a decrease in child mortality. However, these gains have not been distributed equally, nor have they come without environmental costs. We have exploited the planet at an unprecedented rate, which has contributed to a system of unsustainability and our current climate and ecological crises. Agriculture is both suffering from and driving climate change today.

These three tenets of sustainability—economy, environment, and community—translate to agricultural systems as well. Sustainable agriculture relies on favorable economic outcomes that allow farmers to pay people fairly and provide consumers with access to healthy, affordable food; an environment that can regenerate and is not depleted (e.g., farming that protects the purity of soil, water, and air): and outcomes that benefit and sustain local communities in ways that create connection and partnerships. There are numerous examples of farming practices today that are unsustainable long term, such practices exploit natural resources and workers, rely on energy intensive inputs, and put profits above other concerns. Hence, efforts to better understand how sustainability can be achieved across contexts are needed. (Please see the first four slides of the Teacher Print Kit for more information on sustainability and sustainable agriculture).

Agroecology—the combination of ecology and agriculture to create agricultural systems that work with nature—offers an alternative farming paradigm. Agroecological systems are efficient, self-sufficient, diverse, and resilient.[2] Respectively, these systems use resources efficiently and have little waste, recycle resources such as water and organic matter on-farm, grow diverse crops (and animals) that support one another's growth, and are more resilient to adverse weather and disease. In addition, agroecological farm operations are often much smaller than industrial operations. This allows farmers to better serve and connect with their local customers, hence strengthening communities. Natural systems provided humans with food before we ever knew how to farm, and now we can learn from nature to farm more sustainably.

Opening Discussion:

Explore what existing ideas students have about sustainability. Students will consider the concept in more depth and define it in Activity #1.

- *What does it mean to be sustainable?*
- *What is needed to make something sustainable?*
- *What is sustainable agriculture?*
- *What is needed to make agriculture sustainable?*

Activity #1: Thriving Together

Time: 20 minutes

Materials:

☐ Teacher Print Kit
  ☐Includes: Defining Sustainability, Sustainable Agriculture, and Three Stool Legs of Sustainability (pages 1-3)
☐ Student Handouts
  ☐ Includes: Maslow's Hierarchy of Needs (page 2)
☐ Post-it notes
☐ Pens and markers
☐ White board or a large sheet of paper

Lesson:

1. Ask students to brainstorm the things that humans need to thrive. Write all ideas on post-it notes and post them on the board.

2. Display or pass out copies of Maslow's Hierarchy of Needs (page 2 in Student Handouts). Ask students to use the chart to come up with even more ideas on what humans need to thrive as you go through each level of the pyramid together. Write these additional ideas on post-its and post them on the board.

3. Write "sustainable" on the board and discuss:
   - *Based on our brainstorming session, would we like to add anything to our previous definition of sustainability in our Opening Discussion?*
   - Next, write "sustainable agriculture" on the board. *Would we like to add anything to our discussion about what is needed to make agriculture sustainable?*

4. Share the definitions of "sustainable" and "sustainable agriculture" with students from the Teacher Print Kit.

5. Introduce the Three Stool Legs of Sustainability to students. Write "Economy," "Environment," and "Community" at the top of the board, horizontally.

6. Take down the post-its with brainstormed ideas from the board and pass them back to students. Read them out loud as you pass them out.

7. Ask students to come up to the board and re-post their post-its under the leg of sustainability that they think their note relates most. Ask them to explain why they placed it where they did.

8. End with another discussion:
    - *Give an example of a sustainable project or process in your community. How does it support the community, economy, and environment?* (It does not need to be agriculture related!). *Is there anything that will make achieving sustainability in this project or process difficult? What systems are in place to ensure that the process will go on for a long time?*

        - Example: A new bike trail was built. It is environmentally sustainable as it reduces carbon emissions from cars. It helps the economy by reducing the need to purchase fossil fuels from companies not reinvesting in the local community. It allows citizens access to nature, recreation, and a shared communal activity at a low cost.
            - The bike trail's sustainability is threatened by the easy use of automobile roads in the city, along with low gas prices. Alternative easy access to transportation may bring about lack of long-term support of the trail's maintenance or expansion.
            - A system in place to ensure the sustainability of the bike trail is a "Helmet Deal" program in the city. When people use their bikes and show their helmets at local stores, they receive a small discount on goods and services.

    - *How are human well-being and sustainable agriculture tied together?*

        - Examples:
            - Humans need love and belonging. Both the economy and the community are bolstered in a sustainable way through farmer's markets and Community Supported Agriculture (CSA) when people make connections with their growers, and wealth is distributed equitably.

            - Humans have physiological needs like clean air and water. Responsible agriculture avoids contaminating water with eroded soil and excess fertilizer.

            - Humans have needs for esteem. When more people own their own local businesses and have creative power over what they offer, there is more pride in the community. Local businesses are very often a bolster to the local economy and serve to build community.

Activity #2: Sustainable? You Decide!

Time: 25 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Food Production Chain Teacher Cards (Cut out; pages 6-9)
    - ☐ Three Legs of Sustainability Cards (Cut out; page 10)
- ☐ Student Handouts
    - ☐ Food Chain infographic (page 3)
    - ☐ Sustainable? You Decide! Food Cards (pages 4-13)
- ☐ Two different colors of string
- ☐ White board or large paper
- ☐ 38 magnets or tape

Prep:

Cut Strings into pieces approximately 18” in length. You will need about 20 lengths of each color. Once color represents sustainable, the other unsustainable. If you wish to teach the optional section of step 7 in this activity, you will need 15 additional lengths of your sustainable color.

Lesson:

1. Display the *Food Chain Infographic*. Use the Food Production Chain Teacher cards in the Teacher Print Kit to give examples of what these steps of the food chain represent. (Note: These cards are the same as in Module 2: Food Chain). Post the five Food Production Chain Teacher cards horizontally along the top of the board.
    - Production
    - Processing
    - Distribution
    - Consumption
    - Waste Management

2. Post the Three Legs of Sustainability (Economy, Environment, and Community) horizontally along the bottom of the board.

3. Pass out *Sustainable? You Decide!* Food cards and read the notes out loud on the back of the cards as you pass them out. All cards should be passed out evenly among students.

4. Choose one color of string to represent sustainable practices, and the other to represent unsustainable practices.

5. Ask students to post their card, one at a time, along the top of the board with tape or magnets under a step of the food chain and tell the group an aspect of the food's production that fits under that link of the food value chain.

6. Next, ask the students to use a string to link the card to one of the *Three Legs of Sustainability* along the bottom of the board with either a "sustainable" string or an "unsustainable" string. Ask the student to explain one reason why they made the connection that they did.
   - Example: a student may post the tomato card under "Production", then use an "unsustainable" string to point the card to "Community." They might explain that because farm workers on tomato farms are often paid very low wages, the community suffers because workers are not able to make enough money to support good schools, local businesses, and infrastructure in their community.

7. End by noting as a group all the unsustainable strings that were used. For each unsustainable string, discuss a way or ways that the same connection could be made with a sustainable string.
   - Optional: As a visual, you may wish to replace the "unsustainable" strings with "sustainable" strings as you come up with sustainable alternatives to the processes on the cards.

Activity #3: Connecting to the Garden – Nature + Farming = Agroecology

Time: 10 minutes

Materials:

- ☐ Garden in any stage of growth
- ☐ Whiteboard (or a large sheet of paper) and markers

Lesson:

1. Agroecology aims to mimic the characteristics and qualities of natural ecosystems to sustainably increase farm productivity. Write the four pillars of agroecology (below) on the board. Go through each pillar with students, giving examples to enhance understanding.
   - **Efficiency:** Agroecology recycles and reuses resources whenever possible, just as natural systems continually recycle rainfall and organic matter.[3]
     a. Rain barrels use rainfall rather than irrigation from a well or from the city water system.
     b. Compost piles turn organic matter from the farm into soil fertilization for next season.

   - **Self-sufficiency:** Agroecology requires minimal inputs beyond what Nature already provides (sunlight, soil, water, and biodiversity).
     a. Greenhouses increase the ambient temperature for plants without the use of outside heat sources.
     b. Three sister gardens eliminate the need to buy materials for a trellis, since corn is used as a trellis.
     c. Some gardeners save seeds rather than buy seeds from suppliers.

   - **Diversity:** Agroecology makes use of many different species of plants and animals on the same farm, and benefits from their interactions.[3]
     a. Large squash leaves in a Three Sister Garden of corn, beans, and squash, serve to cover soil as a weed barrier and retain moisture in the soil.

   - **Resilience:** Agroecology can better withstand and recover from shocks like floods, hurricanes, and droughts.[3]
     a. Farms that use cover crops (crops planted during the off season to fix nitrogen and provide structure to soil) experience much less erosion of soil during flooding.

2. Take a short tour of the garden as a group, looking for examples in the garden of agroecology or agroecological principles being applied.

3. Discuss:
   - *What are ways that we could make our garden more in tune with natural ecosystems?*
   - *How do you think the process from farm to table is different in our garden than produce from the grocery store?*

Activity #4: Sustainable Meals

Time: 20 minutes

Materials:

☐ Student Handouts

☐ Includes: Healthy Eating Plate (page 14)

☐ Blank Paper

☐ Colored markers, crayons, or colored pencils

Lesson:

1. Optional: To begin, ask students to take the 3 minute "Find Your Foodprint" quiz at *https://foodprint.org/quiz/*.
   - *In addition to what we eat, our foodprint depends on other factors. What are some examples of these?*
     - Examples:
       - Whether our food is grown in season
       - Whether the animals we are eating were treated humanely
       - Growing practices like pesticide use and water use
       - Worker welfare, including safety and wages
       - Food waste management: buying only what we will eat, composting

2. Pass out one blank sheet of paper to each student, along with colored markers, crayons, or pencils.

3. *To conclude our time learning about sustainable agriculture, we will take time to create the most sustainable, delicious, and nutritious plate that we can think of. Start by drawing one of your favorite meals. It doesn't need to be sustainable or healthy to start! When you are done, share your meal drawing with a neighbor.*

4. Post the Healthy Eating Plate, and briefly go over the categories of a healthy meal according to the Plate. *How might you adapt your favorite meal to align with the Healthy Eating Plate more closely?*
    - Example:
        - If favorite meal is pizza
            - Use whole grain dough
            - Top with vegetables like peppers and tomatoes
            - Replace pepperoni with barbequed chicken
            - Use less cheese
            - Replace soda with iced tea
5. Help your students reflect on the Three Legs of Sustainability: Community, Environment, and Economy. Brainstorm three ways that you could source the ingredients for your meal in a sustainable way. Below are a few questions to start brainstorming:
    - *How can you reduce food miles?*
    - *How can you ensure fair wages for growers?*
    - *What agricultural practices would your farmer ideally use to grow your ingredients?*

6. Ask your students to gather into groups of 3-5. Ask each student to share their plate with the other students in their group. Ask students to share reasons why their meal fits the Healthy Eating Plate. Also, ask students to share their three ways to source their meal in a sustainable way.

Closing Discussion:

- *What is one way you could make your community, economy, or environment more sustainable by eating differently? You can refer to Sustainable? You Decide! Cards to spark ideas.*
    - Themes to keep in mind for learning discussion:
        - Worker and animal welfare
        - Limiting meat consumption to cut water and grain usage, along with lowering water and air pollution
        - Growing practices like water use, fertilizer, and pesticide usage
        - Packing
        - Food waste management
        - Seasonal and local food consumption
        - Gardening

For a supportive visual, post “Sustainable? You Decide!” Cards on the board to spark memory and conversation.

References:

Teacher Background:

1. UN. "Sustainability." Academic Impact. United Nations, 2022. https://www.un.org/en/academic-impact/sustainability.
2. What is Sustainability? From the University of Alberta, Office of Sustainability. https://www.mcgill.ca/sustainability/files/sustainability/what-is-sustainability.pdf
   Lesson draws from Maslow's Hierarchy of Needs. Graphic available from thought.co (2022).

Activity 1:

Adapted from *Toward a Sustainable Agriculture Curriculum for Highschool Students*, Module 1, Section A: What makes agriculture sustainable? The Center for Integrated Agricultural Systems at the University of Wisconsin-Madison.

Definition of Sustainability from John Ikerd, as quoted by Richard Duesterhaus in "Sustainability's Promise," Journal of Soil and Water Conservation (Jan.-Feb. 1990). See also: USDA, 2007. Sustainable Agriculture Definitions and Terms.

Activity 2:

Adapted from Foodprint.org. Foodprint Website. GRACE Communications Foundation, 2022.

Image for Food Chain Infographic from: The Centers for Disease Control and Prevention (CDC), 2022. The Food Production Chain. Food Safety.

Adapted from *Toward a Sustainable Agriculture Curriculum for Highschool Students*, Module 1, Section A: What makes agriculture sustainable? The Center for Integrated Agricultural Systems at the University of Wisconsin-Madison.

Activity 3:

3. Adapted from Lesson 6: *Turning Toward Sustainability* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020)

Activity 4:

Image from Student Handouts: Harvard University. "Healthy Eating Plate." The Nutrition Source. 2011.

Foodprint Quiz from: Find your Foodprint. Foodprint Website. GRACE Communications Foundation, 2022.

Make it Last: Sustainable Agriculture and Agroecology

Module 5
Teacher Print Kit

Instructions: Print one copy of this document as a reference *for the Teacher.* It is easiest to print this document **double-sided, on the short-edge.** Additionally, print the Student Handouts for Module 5.

Food Up!

Activity #1: Thriving Together — Defining Sustainability

"Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, we also need social and economic resources. Sustainability is not just environmentalism. Embedded in most definitions of sustainability we also find concerns for social equity and economic development." [1]

"Sustainability is the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity." [1]

Sustainability means the ability to continue over a period of time.[2]

Triple Bottom Line (Dalibozhko & Krakovetskaya, 2018)

1. What is Sustainability? From the University of Alberta, Office of Sustainability. https://www.mcgill.ca/sustainability/files/sustainability/what-is-sustainability.pdf
2. Cambridge Dictionary. https://dictionary.cambridge.org/us/dictionary/english/sustainable

Sustainable Agriculture

As it pertains to agriculture, John Ikerd describes sustainable farming systems as those that are "capable of maintaining their productivity and usefulness to society indefinitely. Such systems... must be resource-conserving, socially supportive, commercially competitive, and environmentally sound."

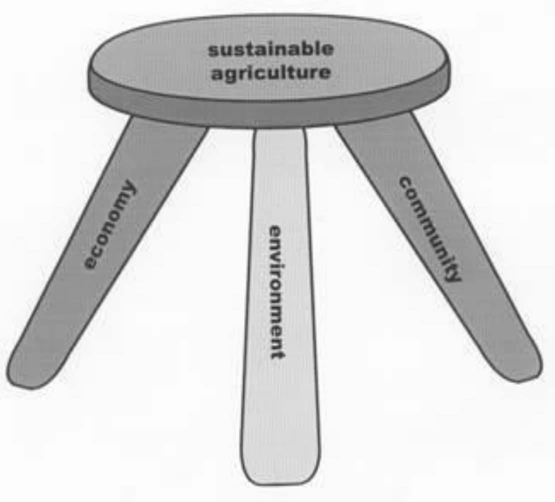
The 1990 United State’s Farm Bill defines sustainable agriculture as: “an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- Satisfy human food and fiber needs
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- Sustain the economic viability of farm operations
- enhance the quality of life for farmers and society as a whole.”

Source: John Ikerd, as quoted by Richard Duesterhaus in "Sustainability’s Promise," Journal of Soil and Water Conservation (Jan.-Feb. 1990).
See also: USDA, 2007. https://www.nal.usda.gov/legacy/afsic/sustainable-agriculture-definitions-and-terms

Three Legs of Sustainability

Economy: Sustainable agriculture is *economically sustainable*. Agriculture should provide a secure living to farm families and others employed in food production and processing. An economically sustainable approach also provides access to good food for all people.



Environment: Sustainable agriculture is *environmentally sound*. It preserves the quality of basic natural resources that the farms, businesses and the surrounding environment rely on, including soil, water, and air. Agriculture affects natural resources. Cooperating with natural resource systems instead of trying to overpower them can offer benefits to food production as well as the natural environment .

Community: Sustainable agriculture is good for families and communities. It promotes opportunities and cooperative relationships for family and community members. For example, a local food marketing system called community supported agriculture (CSA) offers opportunities for people to get into farming without major capital investment; provides work for family members, including children, on the farm; and creates direct partnerships with consumers in the community.

Source: Adapted from Toward a Sustainable Agriculture Curriculum for Highschool Students, Module 1, Section A from the Center for Integrated Agricultural Systems at the University of Wisconsin-Madison. (https://cias.wisc.edu/curriculum-new/module-i/module-i-section-a/#intro)

Activity #2: Sustainable? You Decide!

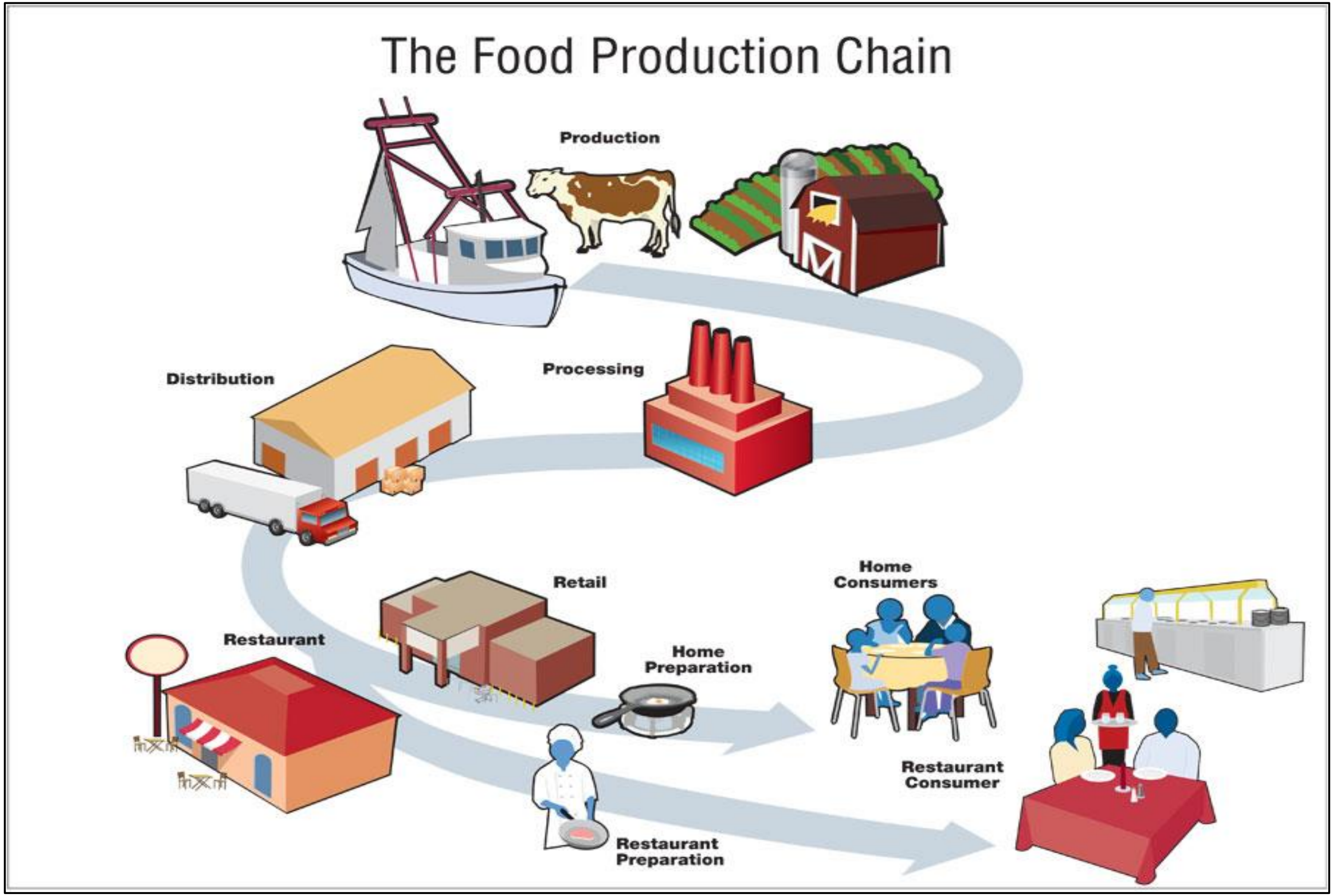


Image Source: CDC, 2022. The Food Production Chain. Food Safety, CDC. https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/figure_food_production.html

FOOD PRODUCTION CHAIN TEACHER CARDS

PRODUCTION: HOW THE FOOD IS GROWN

DISTRIBUTION: HOW THE PRODUCT MOVED FROM THE FARM TO THE EATER

PROCESSING: CHANGING THE CROP INTO WHAT IS EATEN

CONSUMPTION: THE USE OF THE PRODUCT BY THE END CONSUMER

Distribution

- Trucking
- Marketing and Advertising
- People who build trucks, planes
- Energy workers
- Highway builders
- Food hubs

Production

- Tractor Manufacturers
- Fertilizer manufacturers
- Well diggers
- Farmers
- Construction workers
- Natural gas, petroleum, electricity, solar power manufacturers

Consumption

- Restaurants
- Grocery stores
- Farmers Markets
- Home

Processing

- Honey and maple syrup bottling
- Washing and bagging/banding/boxing produce
- Butchering
- Canning
- Processing Corn into Corn Syrup and Corn Flakes
- Freezing
- Plastic Production for packaging
- Cooking food in our kitchens and restaurants

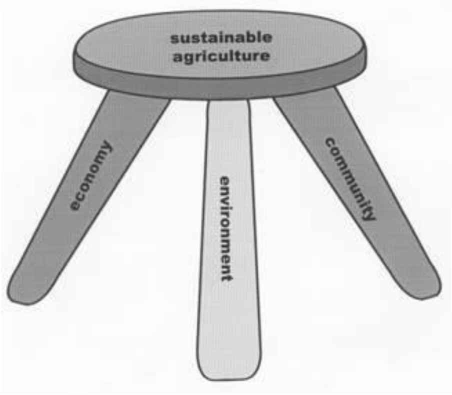
Waste Management

Collection, transport, treatment, and disposal of waste

Waste Management

- Sewage after human consumption
- Compost of food scraps
- Trash/Landfill
- Recycling of packaging
- Management of manure
    - Spreading on fields
    - Storing in pits
    - Leaking into waterways

The Three Legs of Sustainability



Economy

Environment

Community

Make it Last: Sustainable Agriculture and Agroecology

Module 5
Student Handouts

Instructions: It is easiest to print this document **double-sided, on the short-edge**. Print 1 copy for every 2 students in your class. Individually cut out the Brand Recognition Images from pages 2-5 into card decks. Each student group should get 1 deck (including images A-T).

Food Up!

Maslow’s Hierarchy of Needs

Image Source: Maslow's hierarchy of needs (Abraham Maslow) from Getty Images/Plateresca via https://www.thoughtco.com/maslows-hierarchy-of-needs-4582571

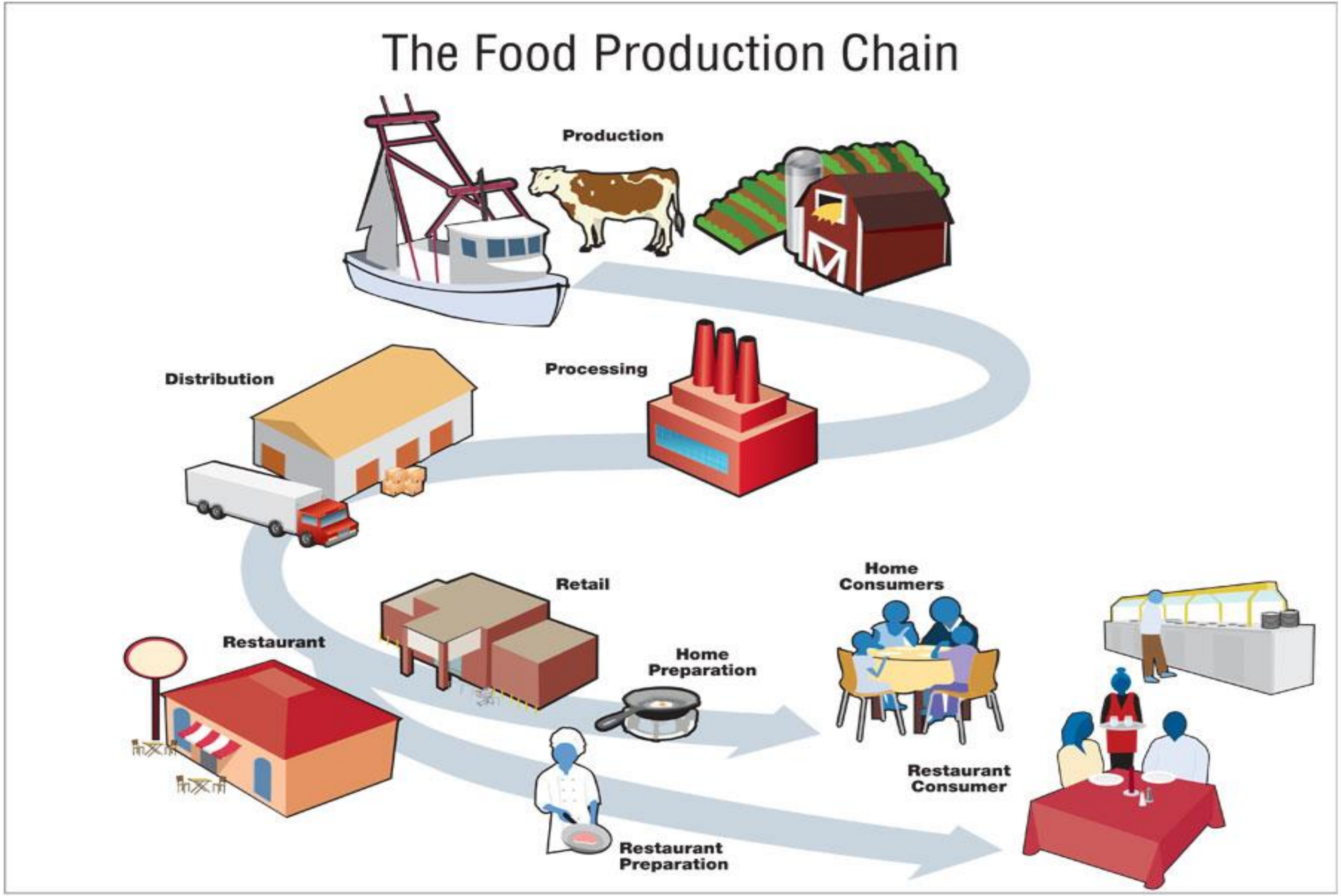


Image Source: CDC, 2022. The Food Production Chain. Food Safety, CDC. https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/figure_food_production.html

Sustainable? You Decide!

Sustainable? You Decide!

Tomatoes When grown industrially, tomato production relies heavily on insecticides, herbicides, and fungicides, landing them on the Environmental Working Group's Dirty Dozen list, a list of produce typically grown with the most pesticides. (Prod/Env,Comm/-)	**Soy Milk** The water footprint of soy milk is significantly less than cow milk. One glass of cow milk requires about 67 gallons water to produce, whereas one glass of soymilk requires about 18 gallons of water for production. (Prod/Env/+)	**Tea** Using loose leaf tea, rather than tea packaged into tea bags, can reduce the carbon footprint of the tea by up to 90%. (Cons / Env/ +)
Tomatoes Migrant tomato workers are some of the poorest and most abused workers in the country. Not only are they regularly exposed to high amounts of pesticides, but as recently as 2008 were paid 40 cents per bucket of tomatoes, resulting in annual wages of about \$6500.[2] (prod/Env,Ec,Comm/-)	**Soy** Much conventional (non-organic) soybean oil is extracted using hexane, a chemical that has been linked to negative neurological effects. This makes work dangerous for workers in the soy processing industry. (Proc/ Comm/-)	**Tea** Tea is used for gathering rituals around the world. It is used in many cultures on a daily basis for social purposes ranging from work breaks to spiritual rituals. (Cons / Comm / +)

Sustainable? You Decide!

Sustainable? You Decide!

Corn

The average Iowa cornfield produces enough calories to keep 14 people alive annually. However, most of our corn goes to ethanol and animal feed, so the same corn field ends up supporting the equivalent of only three people's dietary needs per year, mostly through corn syrup and animal products.[4] (Proc, Env, -)

Corn

Much of the 5.6 million pounds of nitrogen fertilizer applied to corn annually ends up in our rivers and lakes, causing dead zones void of live fish and wildlife. The dead zone in the Gulf of Mexico is a prime example of the devastating effects of this pollution.[4] (Prod / Env / -)

Apples

According to the Environmental Working Group, 90% of commercial apples have detectable rates of pesticide residue when they meet consumers. Apples are vulnerable to a variety of pests and diseases, creating a strong incentive for heavy pesticide use during production. (Prod / Env, Comm / -)

Corn

The industrialized world is set up to efficiently process corn into a variety of useful products, from animal feed and cornmeal to ethanol fuel and bioplastics. (Proc, Econ, Env, +, -)

Corn

Roughly 1.3 million acres of grassland and prairie were converted for corn use in the Western Corn Belt between 2006 and 2011, posing a threat to the waterways, pollinators, and biodiversity.[4] (Prod / Env / -)

Apples

Apples are harvested in the fall and can be stored without processing for months, providing a local source of food in cold months when much less food can be grown locally.
(Cons, Prod / Econ / +)

Sustainable? You Decide!

Sustainable? You Decide!

Beef and Dairy Much of the beef and dairy in the United States is raised in Confined Animal Feeding Operations without access to graze on outside grasses, leaving these operations to rely on corn being transported to feed the animals. This results in a much higher water and energy footprint than traditional grass grazed beef and dairy. (Prod, Env, -)	**Beef** Beef raised on pasture has a higher Omega 3 content, as well as higher levels of antioxidants, than conventionally raised beef.	**Cheese** A 2,000 cow dairy produces about a quarter million pounds of manure daily. In addition to causing dead zones in lakes and rivers, the nitrate from this waste can make its way to groundwater, where many of us get our drinking water from. Water high in nitrates is a danger to pregnant women and newborn babies, and causes increased risk in colon, stomach, and kidney cancers.
Eggs Egg laying hens are typically raised in small "battery cages" without access to the outdoors. Hens are in very close proximity, requiring the use of antibiotics to reduce diseases that flourish in crowded areas. The overuse of antibiotics has contributed to antibiotic resistance, making bacterial infections in animals and humans increasingly more difficult to treat. (Prod, Comm, -)	**Edible Crickets** Although not part of the American diet today, crickets are high in protein, healthy fats, and micronutrients. Edible insects require less land, water, and feed than conventional meat, while emitting fewer greenhouse gases. They are eaten across the world and can be farmed with limited resources. Plus, many people find them delicious! (Prod, Env, +)	**Salmon** Salmon farms create crowded conditions that put pressure on surrounding ecosystems with their high generation of waste. These conditions also create a reliance on antibiotics. In 2007, Chilean salmon farms used nearly 1 million pounds of antibiotics to fight disease in unnatural farming conditions.

Sustainable? You Decide!

Sustainable? You Decide!

Rice Genetically modified varieties of rice have drastically increased use of pesticides and herbicides. This has increased instances of devastating human loss in agricultural communities due to increase rates of cancer, stillbirths, and birth defects.[3] (Prod, Comm, -)	**Coffee** The Rainforest Alliance certifies coffee to be shade grown in forests. Most industrially grown coffee is grown in the sun for faster growth, which has been a driver of severe deforestation and habitat loss in many coffee growing countries. (Prod, Env, -)	**Beef** Four companies in the United States control 80% of the US beef industry. This consolidation of the market limits access to processing facilities for small and medium sized producers and lends lobbying control over matters of labor and environmental regulations. (Prod / Econ, Comm / -)
Rice Introduction of genetically modified rice varieties like “Miracle Rice” has reduced global famine. (Prod, Comm, +)	**Tomatoes** Local tomatoes are often picked in abundant quantities for a short season, causing many community members to gather together for canning and freezing parties to preserve this bountiful harvest. (Proc/Comm, Ec/ +)	**Watermelon** Watermelon is very resistant to droughts, reducing the need for irrigation. Watermelon are highly dependent on an endangered honeybee population for production. (Prod, Env,Ec / +)

Sustainable? You Decide!

Sustainable? You Decide!

Food Packaging
40% of the plastic that we make is designed for single use. Because plastic does not completely break down, microplastics accumulate in our oceans and soils. It is estimated that 79,000 tons of plastic comprise the Great Pacific Garbage Patch in the Pacific Ocean, having devastating effects on marine wildlife.

Bananas
Bananas travel a long distance to our plates, often traveling by boat. Sea transport emits only .01 kg of CO2 per ton of food traveling a kilometer. Air travel clocks in at 1.13 kg CO2 / tonne km, 113 times more than boats. Out of season berries and other foods that must be transported very fresh are often shipped by air. [8]

Pork
Manure from confined animal feeding operations is highly concentrated and often used in higher amounts than necessary. The runoff of nutrients causes dead zones in waterways and dangerous nitrogen levels in groundwater. (Prod, Env, -)

Your Grocery Trip
One shopping trip by car to buy a few things can have more carbon emissions than the production, processing, and distribution of a food item.[7] It is better to make fewer trips to the store to stock up, or even better, walk, bike, or bus to the store.

Bananas
Fairtrade International has developed a Fairtrade Minimum Price for bananas, which supports a Fairtrade Base Wage for employees on Fairtrade certified banana plantations.[6] (Prod, Comm, Economy, +)

Spinach
Spinach and other vegetables sold at the farmer’s market allow farmers to capture the entire selling price of a produce without needing to invest in a storefront or sell to a middleman.

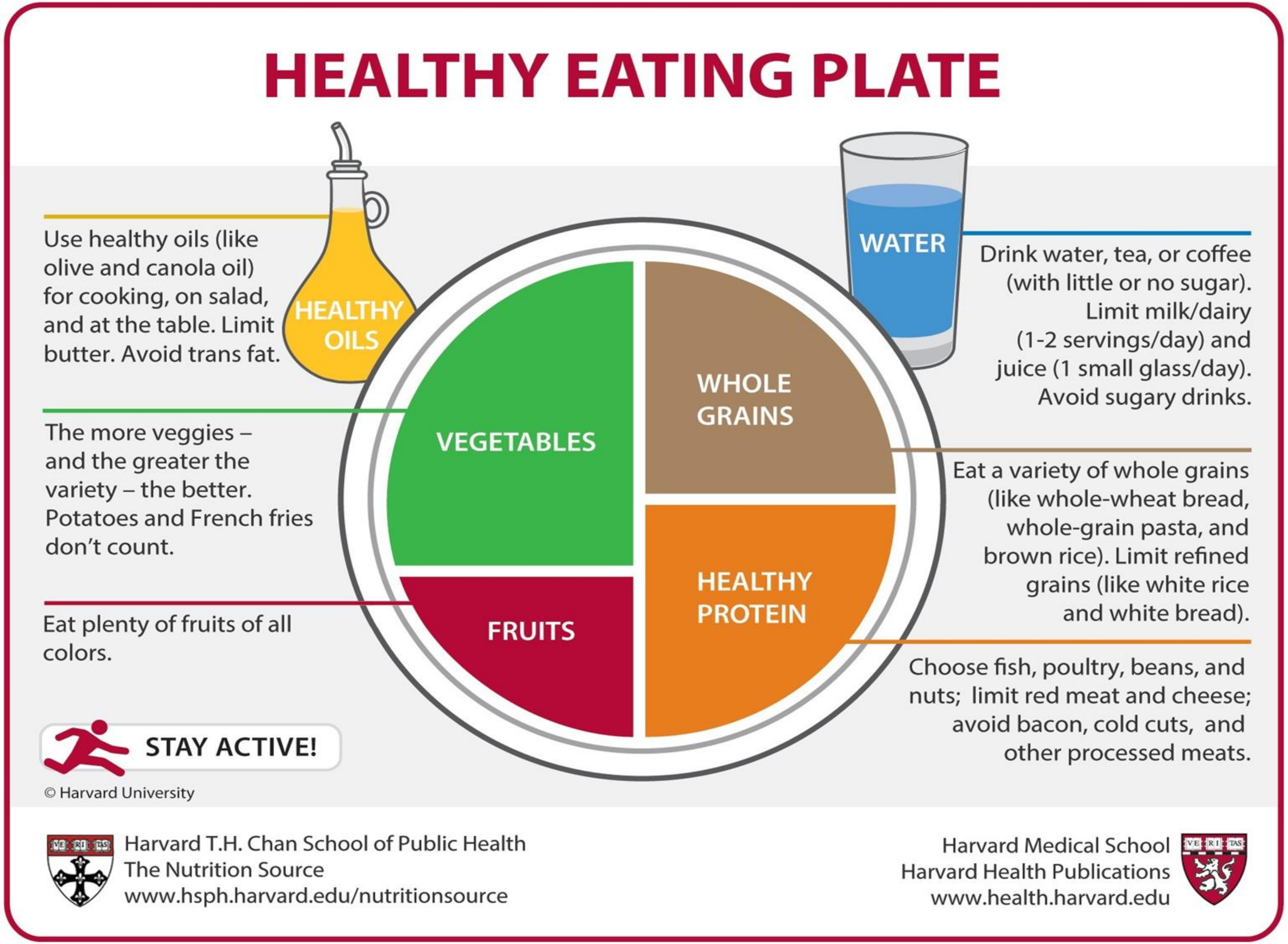


Image Source: Harvard University. “Healthy Eating Plate.” The Nutrition Source. 2011.https://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/

References for *Sustainable? You Decide* Cards

NOTE: Unless numbered below, all *Sustainable? You Decide* card information is from: FoodPrint's Real Food Encyclopedia. https://foodprint.org/eating-sustainably/real-food-encyclopedia/

2. The Southern Poverty Law Center, 2008. Migrant Tomato Workers Face Chronic Abuses. Available: https://www.splcenter.org/news/2008/04/15/migrant-tomato-workers-face-chronic-abuses

3. Pepper, 2008. The Toxic Consequences of the Green Revolution. Available: https://www.usnews.com/news/world/articles/2008/07/07/the-toxic-consequences-of-the-green-revolution

4. Foley, 2015. It's Time to Rethink America's Corn System. Scientific American. Available: https://www.scientificamerican.com/article/time-to-rethink-corn/

6. Fairtrade International, 2021. Bananas. Available: https://www.fairtrade.net/product/bananas
https://www.oregon.gov/deq/FilterDocs/PEF-FoodTransportation-ExecutiveSummary.pdf

7. State of Oregon, Department of Environmental Quality, 2016. Executive Summary: Environmental Footprint Literature Review Food Transportation. Available:

8. Ritchie, H. 2020. Very little of global food is transported by air; this greatly reduces the climate benefits of eating local. Our World in Data. Available: https://ourworldindata.org/food-transport-by-mode

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?*

References:

Teacher Background:

1. *Module III section a animals in the food system.* Center for Integrated Agricultural Systems – University of Wisconsin-Madison https://cias.wisc.edu/curriculum-new/module-iii/module-iii-section-a/
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12. Natural Resource Conservation Service. (n.d.). *Insects and pollinators.* U.S. Department of Agriculture. https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/animals/insects-pollinators
13. United States Department of Agriculture. (n.d.). *Pollinator Facts.* https://www.usda.gov/sites/default/files/documents/pollinator-week-factsheet-06.25.2020.pdf

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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

Animals in Agriculture

Module 6
OPTIONAL
Teacher Print Kit

Instructions: print **double-sided, on the short-edge.**

Food Up!

Food Up!

Gardener's Secret Scavenger Hunt: Teacher Insect List

Aerators 	**Pest Managers** 
Pollinators 	**Decomposers** 

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.	**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.
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 have the opportunity to initiate the decomposition process.	**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. About 35% of the world's food crops are dependent on pollinators.[12]

Animals in Agriculture

Module 6
Student Handouts

Instructions: Print one copy per 2-3 students: pages 1-11, **double-sided, on the short-edge**: pages 24-28

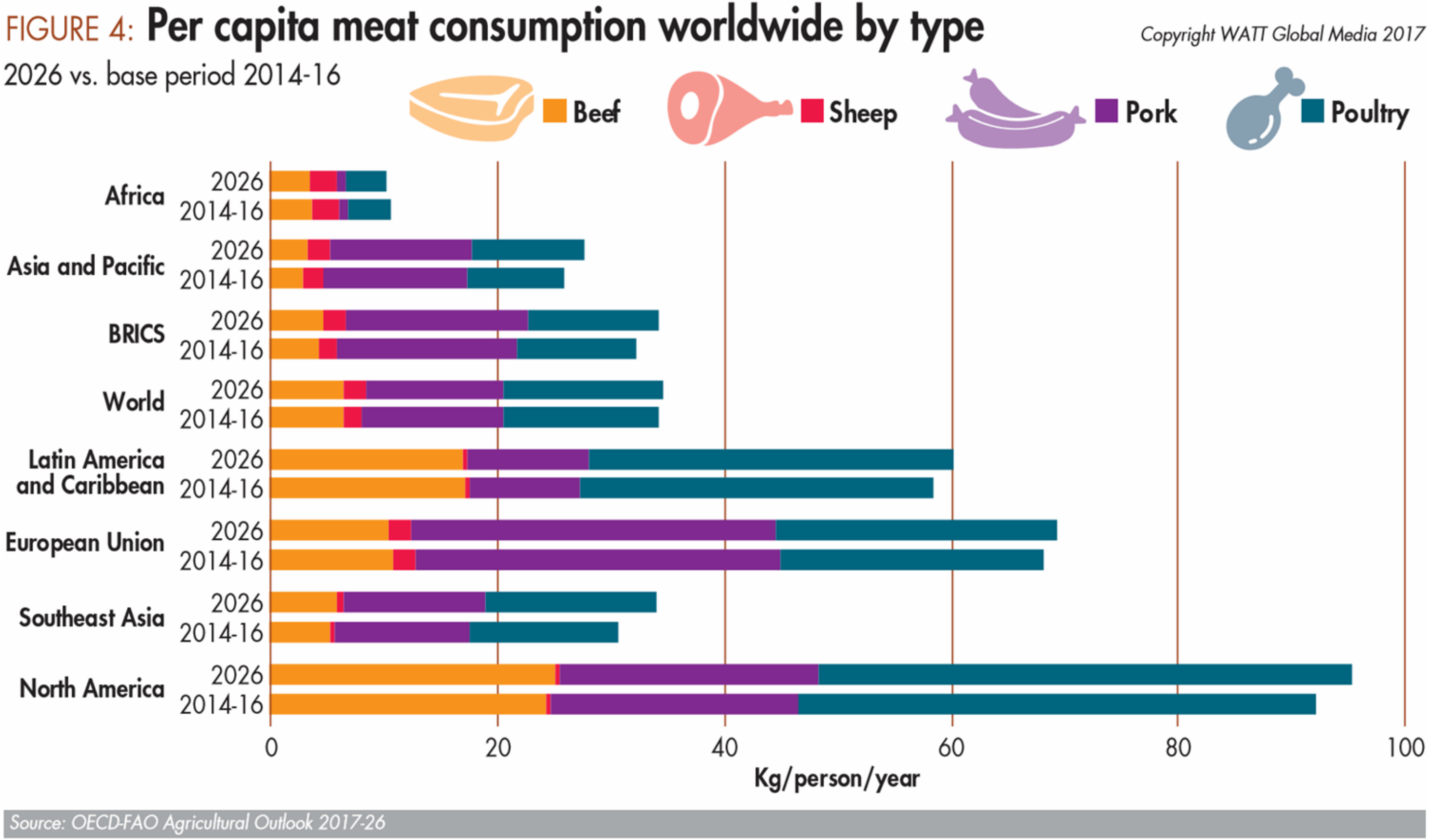
Print one copy per student: page 12

Print one copy total, **double-sided, on the short-edge**: pages 14-23

Cut out card sets on pages 16-23

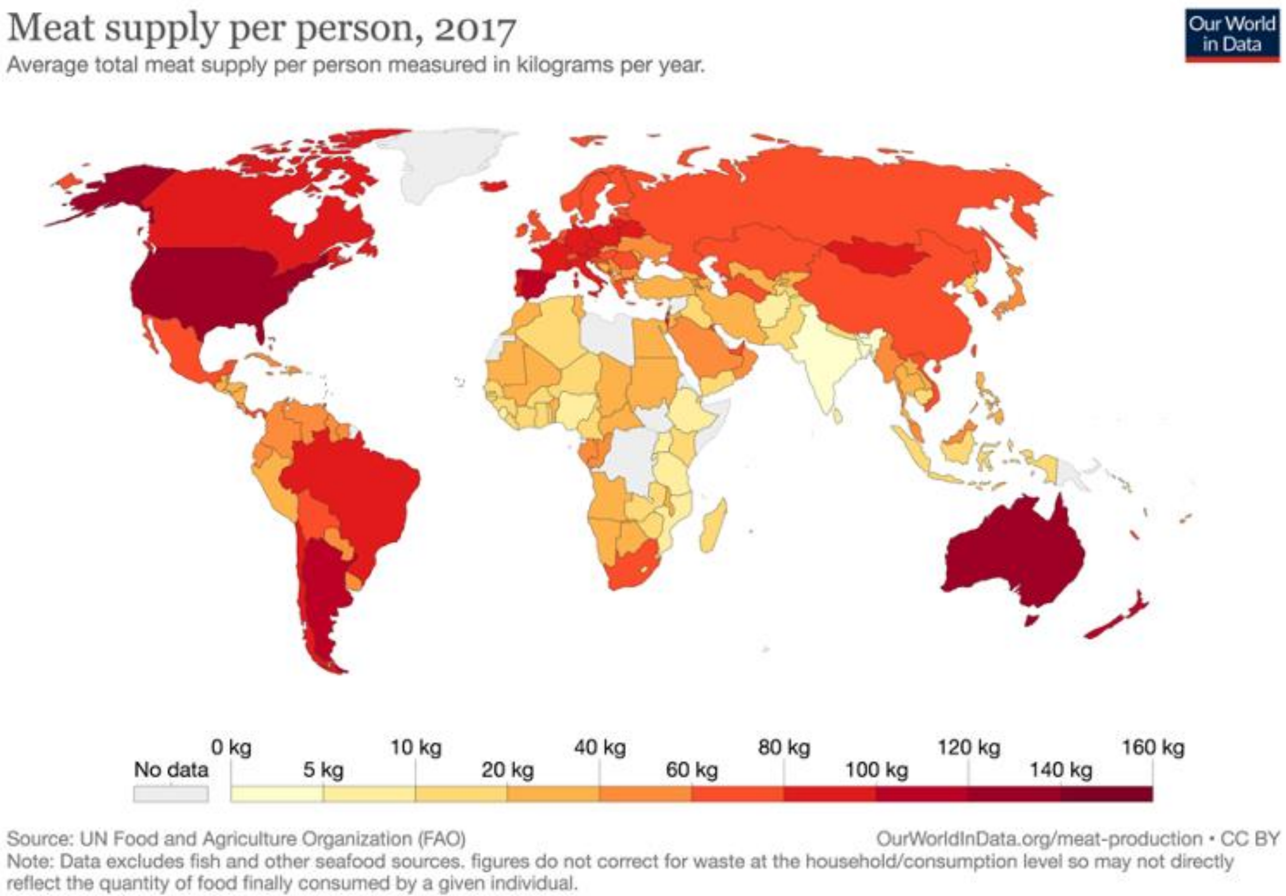
Food Up!

Activity #1: Meat Consumption Charts



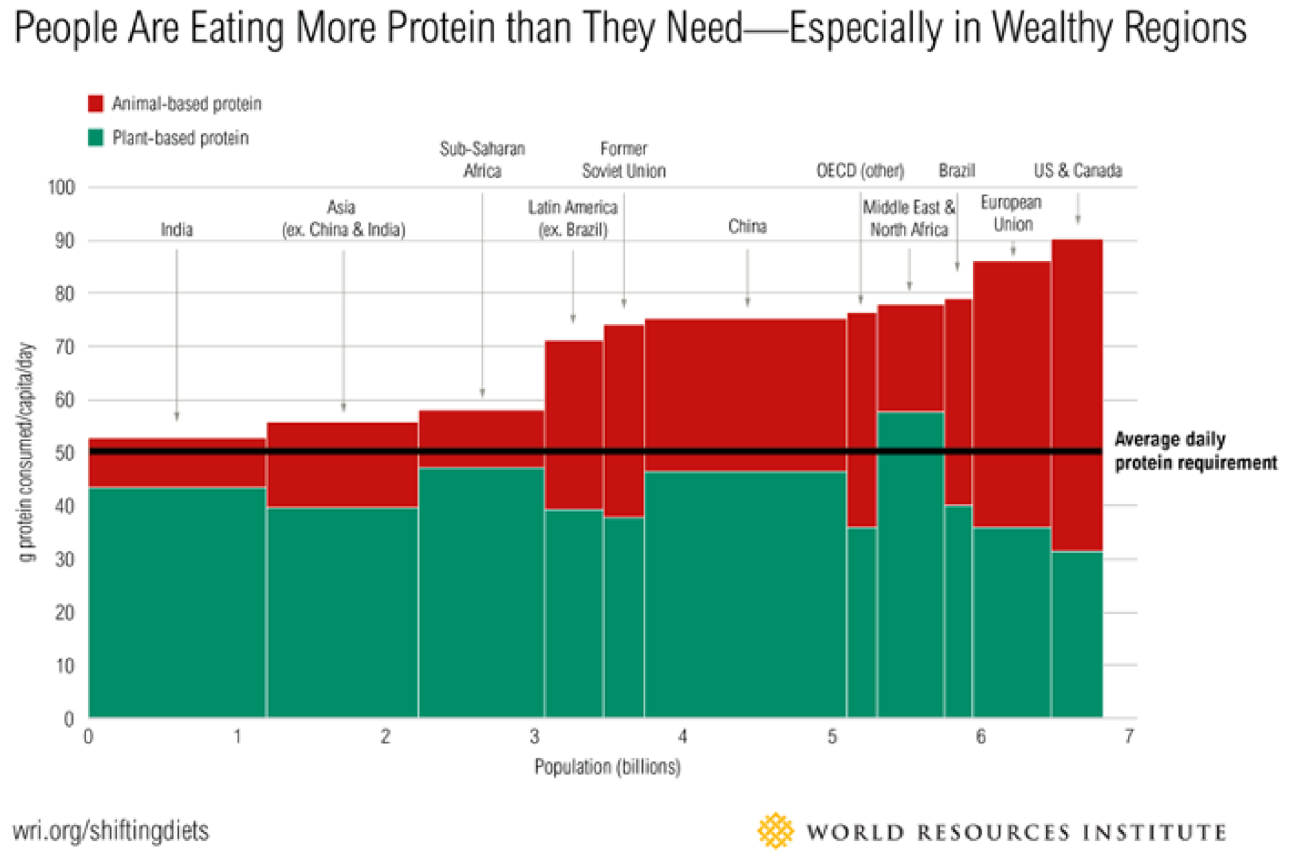
Note: Taken from "Per capita meat consumption worldwide by type 2014-16 VS. 2026, by *Watt Global Media*, 2017, https://www.wattagnet.com/Per-capita-meat-consumption-worldwide-by-type-2014-16-vs-2026.

Activity #1: Meat Consumption Charts



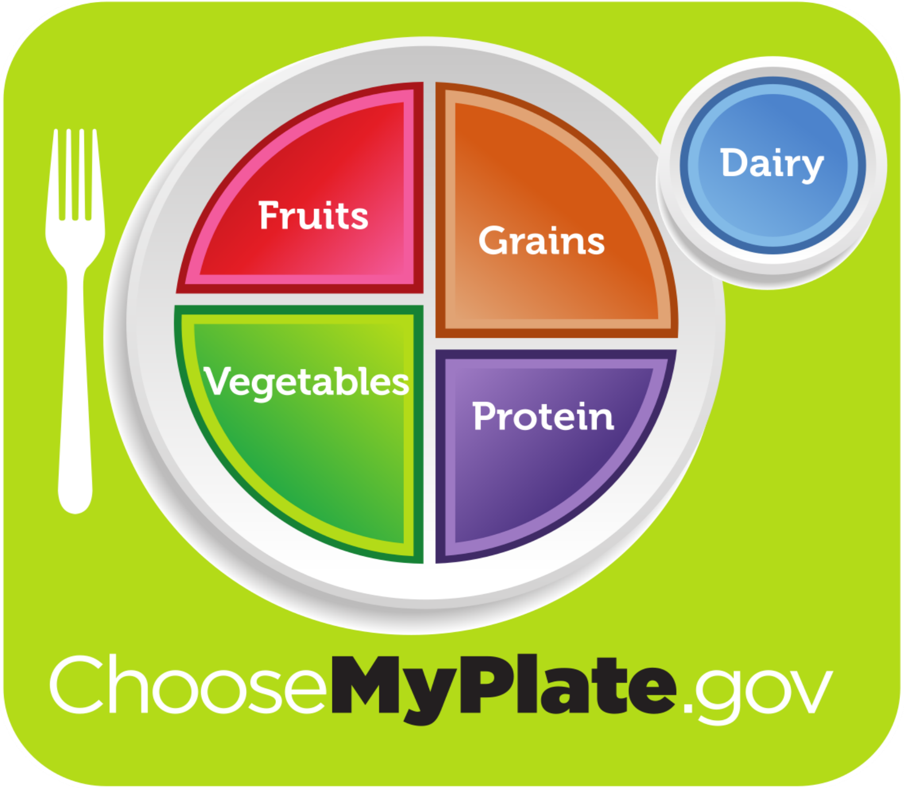
Note: Taken from "Meat and Dairy Production," by H. Ritchie, P. Rosado, & M. Roser, 2019, Our World in Data (https://ourworldindata.org/meat-production#citation).

Activity #1: Meat Consumption Charts



Note: Taken from "Shifting Diets for a Sustainable Food Future: Creating a Sustainable Food Future, Installment Eleven," by J. Ranganathan, D. Vennard, R. Waite, B. Lipinski, T. Searchinger, & P. Dumas, 2016, World Resource Institute (https://www.wri.org/research/shifting-diets-sustainable-food-future).

Activity #1: Food Pyramids



Note: Taken from "MyPlate," by U.S. Department of Agriculture (https://www.myplate.gov/).

Activity #1: Food Pyramids – USDA MyPlate Recommendations

Protein

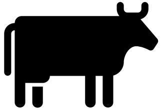
“All foods made from seafood; meat, poultry, and eggs; beans, peas, and lentils; and nuts, seeds, and soy products are part of the Protein Foods Group.”

“Select a wide variety of protein foods to get more of the nutrients your body needs and for health benefits. Meat and poultry choices should be lean or low-fat, like 93% lean ground beef, pork loin, and skinless chicken breasts. Choose seafood options that are higher in beneficial fatty acids (omega-3s) and lower in methylmercury, such as salmon, anchovies, and trout. The advice to consume lean or low-fat meat and poultry and a variety of seafood does not apply to vegetarians. Vegetarian options in the Protein Foods Group include beans, peas, and lentils, nuts, seeds, and soy products.”

Dairy

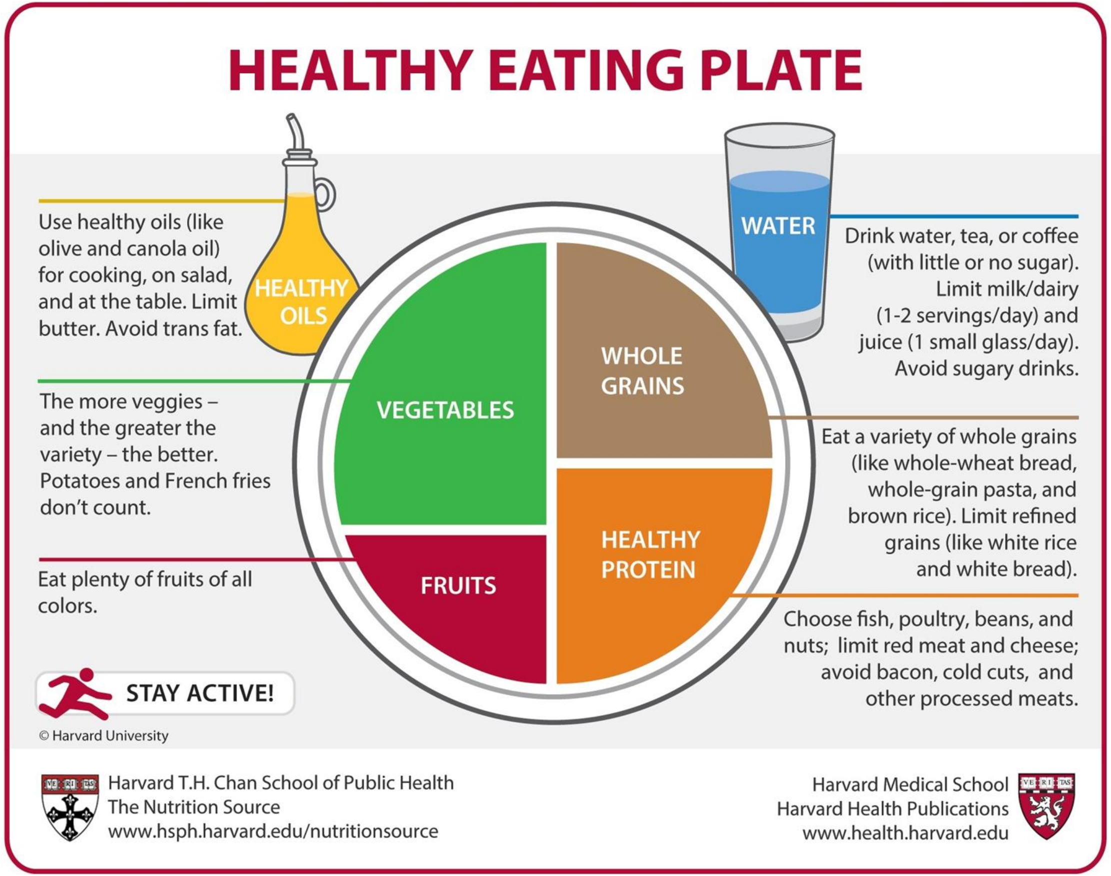
“The Dairy Group includes milk, yogurt, cheese, lactose-free milk and fortified soy milk and yogurt. It does not include foods made from milk that have little calcium and a high fat content, such as cream cheese, sour cream, cream, and butter.”

“About 90% of Americans do not get enough dairy, therefore most individuals would benefit by increasing intake of fat-free or low-fat dairy, whether from milk (including lactose-free milk), yogurt, and cheese, or from fortified soy milk or yogurt.”



Source: U.S. Department of Agriculture. *MyPlate.* https://www.myplate.gov/

Activity #1: Food Pyramids – Harvard Medical School's Healthy Eating Plate



Note: Taken from "Healthy Eating Plate," by Harvard T.H. Chan School of Public Health, *The Nutrition Source,* 2023 (https://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/).

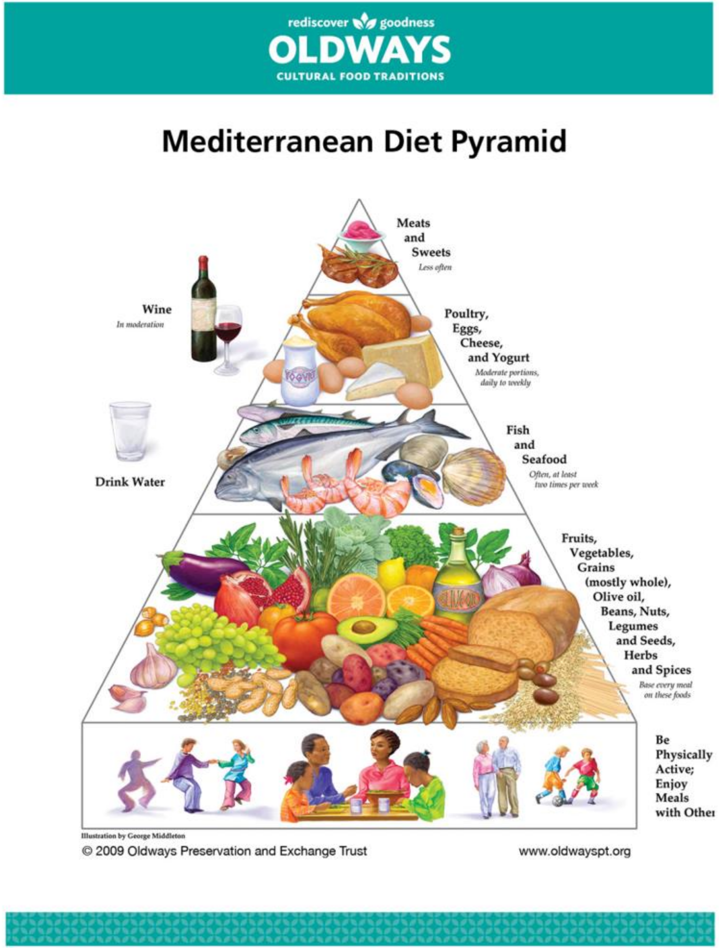
Activity #1: Food Pyramids

Key Differences between MyPlate and Health Eating Plate

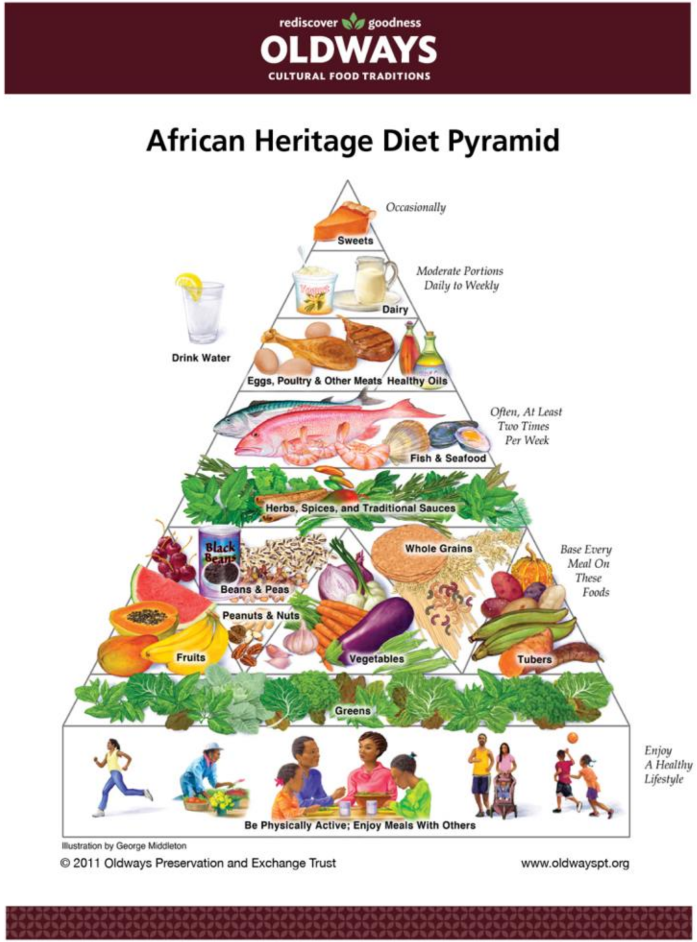
- USDA's MyPlate "protein section offers no indication that some high-protein foods — fish, poultry, beans, nuts — are healthier than red meats and processed meats," while the Healthy Eating Plate indicates that red meat and cheese should be limited.
- USDA's MyPlate does not mention beneficial fats like olive and canola oil.
- "USDA recommends dairy at every meal, even though there is little evidence that high dairy intake protects against osteoporosis but substantial evidence that high intake can be harmful."

Source: Datz, T. (2011). *Healthy eating plate shows shortcomings in government's MyPlate.* The Harvard Gazette. https://news.harvard.edu/gazette/story/2011/09/harvard-serves-up-its-own-plate/

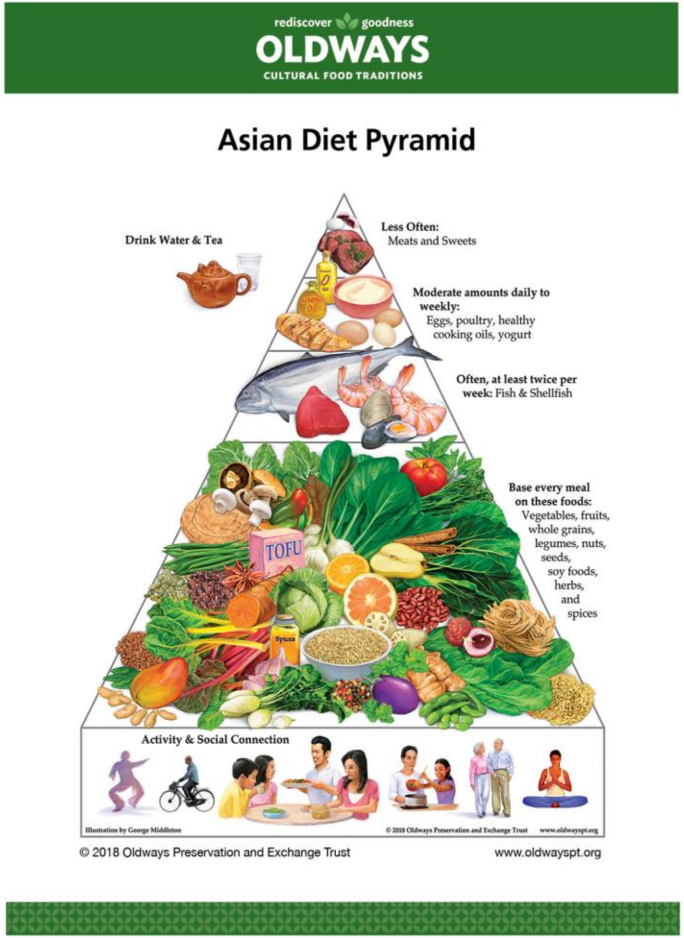
Activity #1: Food Pyramids



Activity #1: Food Pyramids



Activity #1: Food Pyramids



Activity #1: Food Pyramids

Activity #1 – Pyramid Comparison Worksheet

	Differences	Similarities
MyPlate and Healthy Eating Plate		
Traditional Diets		
Traditional Diets (Generally) and Healthy Eating Plate		
My Diet and Traditional Diets		

Food Up!

Activity #3: Industrial vs. Ecological Farming: Pigs

Farms not Factories. *Sow stalls* [photograph]. https://farmsnotfactories.org/the-true-costs-of-factory-farming

Deck Family Farm. (2015). *Mama sow with piglets training to pasture* [photograph]. https://deckfamilyfarm.com/livestock/pasture-raised-pork

Activity #3: Industrial vs Ecological Farming: Chickens

World Animal Protection. (2019). *32 day old broiler (meat) chickens in a commercial indoor system* [photograph]. https://www.worldanimalprotection.org.uk/blogs/10-things-you-should-know-about-factory-farmed-meat-chickens

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✂ Activity #3: Meat Effect Card Set

Lobbying Power Against Safety and Environmental Regulations	Air Pollution and Childhood Asthma	Fast Slaughter Line Speed
High Injury Rates	Property Value	Worker Injury
Falling Wages	Centralized Ownership of Infrastructure	Externalized Damage

To maximize profits, industrial slaughterhouses can process up to 400 cattle/hr.[2]	Confined Animal Feeding Operations produce air pollution that has been associated with childhood asthma in areas around the operation.[3]	The centralized beef industry holds powerful lobbying power. Large companies have been able to band together to limit governmental safety and environmental regulations for the beef industry.[2]
Do to factors such as processing line speed, sharp tools, strong chemicals, and hot pressurized water, meat processing workers face injuries such as torn muscles, pinched nerves, deep cuts, and even amputated fingers.[2]	Properties located within three miles of a Confined Animal Feeding Operation lose up to 26% of their property value.[1]	Injury rates for workers in animal agriculture are 6.7 per 100 workers. The injury rate for the US workforce as a whole is 3.8 per 100 workers.[2]
Many of the industrialized beef industry's effects on the environment and community are externalized costs. This means the industry has costly effects, but does not have to pay for them. Instead, taxpayers pay for them, or the damage goes uncorrected.[2]	Four companies control 80% of the beef market in the United States. These companies own most of the infrastructure along the production chain, limiting access to processing facilities for small and mid size farmers.[2]	The growing corporate control of meat production has been associated with falling wages and benefits for workers and increased use of both legal and illegal immigrant labor in livestock production and processing.[4]

Financial Instability for Farmers	Low Wages	Global Meat Consumption Rates
Illness due to E. Coli Contamination	Antibiotic overuse leads to ineffective antibiotics in human medical system	Deforestation and Unavailability of Traditional Indigenous Lifestyles
Fast Slaughter Line Speeds	Dangerous Drinking Water Requires Filtration	Heart Disease Risk

The average person on our planet eats 102.5 pounds of meat per year. Luxembourg and the United States eat 301.4 and 270. 7 pounds per person, respectively, while Bangladesh and India eat 7.9 and 7.1 pounds, respectively.[5]	The consolidation of meat industries has resulted in falling wages and benefits for workers. To move chickens to slaughter, workers are hired to catch all chickens in a barn in one night, two in each hand. Workers are paid $2.25 per 1,000 birds caught.[14]	The chicken industry controls the sale price for chickens to slaughter, and often pays less than the cost to raise the birds. Farmers can take out $1 million loans to cover the cost of infrastructure to raise chickens, and often never pay the loan back due to this predatory pricing system.[14]
Deforestation has forced native people from their homelands, destroying traditional ways of life.[7] The beef industry was responsible for removing 45.1 million hectares of forest land between 2001 and 2015, a rate five times higher than any other product the Eurogroup analyzed.[13]	Crowded conditions in Confined Animal Feeding Operations have required the regular use of antibiotics to fight disease in animals. Many chickens are forced to live in a space smaller than the size of an A4 piece of paper.[12] Bacteria have begun to evolve to survive these antibiotics due overusage, making it harder to treat bacterial infections in animals.[14]	Cows have evolved to eat a grass fed diet. When forced to eat grains, their stomachs become more acidic than usual, creating a friendly environment for E. coli. Grain fed diets and fast processing lines contribute to E.coli contamination in beef. 29% of deaths due to foodborne illness have been traced to salmonella and E. coli in beef.[2]
A diet high in red meat consumption has been linked to increased risk of heart disease.[6]	Concentrated manure from confined animal feeding operations often results in high nitrogen rates in groundwater. Households, not the CAFOs, must pay for household filtration systems to filter the dangerous nitrate out of their water.[2]	The workplace is ruled by the line. The federally-allowed speed for the slaughter line has more than doubled in the last four decades, from 70 birds per minute in 1979 to 140 birds per minute today.[14]

Greenhouse Gas Production	High Land Use	Deforestation
Dangerous Air Pollution	Dry Colorado River	Extinction of Species and Biodiversity
Animal Waste Causing Fish Kills	Manure Waste Management Challenges	High Water Use

There is a strong link between beef production and deforestation. 45.1 million acres of forest were cut down for cattle pasture between 2001 and 2015, creating five times more deforestation that any other product.[8]	It takes 10 lbs of corn to to produce 1 lb of beef. The more meat we eat, the more land must be cleared to grow corn.[4]	World livestock accounted for 18% of human generated greenhouse gasses in 2008.[4]
Many species can only live in one type of habitat. 80% of terrestrial species live in forests. We are currently undergoing a mass extinction of species around the world, mainly due to agriculture.[8]	85% of water taken from the Colorado River in California, Arizona, and Nevada is for agricultural purposes. The Colorado River has now dried up before it reaches its historical destination. 87% of irrigated corn is grown in areas under water stress.[11]	Confined Animal Feeding Operations are sources of fine airborne particulates, ammonia, hydrogen sulfide, and odor. All these pollutants are dangers to the air quality, workers and community at large. In Iowa alone, there have been 19 deaths of CAFO workers due to hydrogen sulfide exposure from liquid manure.[10]
It takes about 145 gallons of water to produce one loaf of bread, 1,849 gallons of water to produce 3.5 oz of beef.[15]	Typical beef or dairy cow excretes about 120 lbs of manure per day, most CAFOs produce as much manure as a small city.[11]	¼ of Iowa fish kills are due to animal waste leaching into riverways.[9]

Activity #4: Regenerative Agriculture Card Set

Animal Welfare	Soil Health	Nutrient Cycling and Manure Management
Human Nutrition	Informal Savings Accounts	Triple Bottom Line: Community, Environment, and Economy in cooperatively owned processing facilities
Low Upfront Costs	Reduced Irrigation Needs	Healthy Pollinators

When animals are raised on pasture, manure goes straight back to the land animals were fed on. This improves soil health and greatly reduces nutrient runoff into waterways.	In a pastured system, land does not need to be plowed for feed. Grass roots stay intact, reducing erosion and maintaining healthy soil. Rotationally grazed pastures have more earthworms and diverse soil microorganisms.[17]	Animals in pastured systems can spread out and engage in social behaviors. Calves stay with their mothers, and chickens can spread their wings, nest,and perch.[18] Less crowding reduces flies, parasites, and antibiotic usage.[17]
Cooperatively owned animal processing facilities have been created make it easier for small farmers to bring their product to market and keep wealth local. Cooperatives often use a “triple bottom line” model. Not only do they aim for economic profit, but they also aim to be a benefit to the community and the environment.[19]	In many cultures, animals serve as informal savings accounts. As such, the stewardship of animal herds is a way for people to accumulate wealth and save, without access to banks, credit card, or cash money. Beyond their economic worth, these animals are valuable as they signify wealth accumulation and status, while also retaining cultural and social value.	One pasture raised egg contains three times the Vitamin the Vitamin D, double the Omega 3 fatty acids, four times the Vitamin E, and seven times the Vitamin A as industrially raised eggs.[22]Animals are an incredibly important source of nutrition for people, especially in food insecure areas.
Grasslands not only provide important pollinator habitat, but they reduce reliance on pollinator harming pesticides to grow crops for animal feed.[21]	Pasture raised cattle rely much more heavily on rainwater, rather than irrigation, for their feed.[2]	Confined animal feeding operations require a high investment in infrastructure and supplements. These operations cost two to six times more to set up than pasture based operations.[24]

The Gardener's Secret Scavenger Hunt: Insect List

Pollinators	Decomposers
Honey Bee Pollinator 	**Blowflies** Decomposer 
Monarch Butterfly Pollinator 	**Fruit flies** Decomposer 
Silphium Borer Moth Pollinator 	**Black Soldier Flies** Decomposer 

Decomposers	Pollinators
Blowflies Blowflies are essentially nature's cleanup crew! They lay eggs in moist areas that hatch into larvae, consumes decaying matter, and breaks down organic material. Through digestion, these flies release nutrients back to the soil. They are thus effective recyclers and scavengers.	**Honeybees** Honeybees pollinate more than 100 commercially grown crops in the US, adding 18 billion dollars in agricultural productivity to the economy.[25] Hives work together as a queen bee lays eggs, drones fertilize eggs, and worker bees build honeycomb, collect nectar, create honey.
Fruit flies Fruit flies often exist in large populations on compost heaps in gardens. Although often considered a pest of human dwellings, adult fruit flies, along with young larvae, feed on ripe and decaying fruits and vegetables.	**Monarch Butterfly** 180,000 plant species worldwide depend on pollinors, like the monarch butterfly. Climate change, pesticide use, and loss of habitat are devastating for monarch butterfly populations. We can increase their populations by planting milkweed and supporting biodiverse practices.[26]
Black Soldier Flies (BSFs) BSF larvae eat a variety of decomposing material, from compost to rotting meat. The larvae reduce odor and disease by chewing and processing waste. It then converts it into food for poultry and fish. Though the larvae have strong chewing mechanisms, the adult fly does not bite or pester humans.	**Silphium Borer Moth** These moths contribute not only to agricultural production, but also to pollinating plants that draw carbon out of the atmosphere and prevent soil erosion. Like many pollinators, they are an endangered species that we can support by planting native plants and supporting biodiverse farming practices.[26]

Aerators		Pest Managers	
Ants		**Green Lacewig**	
Earthworms* (*not insects, but annelids)		**Lady Beetles**	
Redworms* (*not insects, but annelids)		**Damsel Flies**	

Pest Managers	Aerators
Green Lacewings These delicate insects feed on pollen, nectar, mites, and other insects. Some species are mainly predatory, often feeding on aphids (Aphids damage garden crops by transmitting plant disease and piercing stems of fruiting plants, causing deformities and decimating yields).[29] Lacewings are the natural enemies of many types of pests, and are sometimes used as a form of biological pest control.	**Ants** Ants dig tunnels and create nests in soil that increase water infiltration and soil aeration, allowing water and oxygen to reach plant roots and promoting good microbial activity. Plant parts, seeds, and other dead or decaying materials carried by ants (as their food) also contributes to topsoil, enriching soil organic carbon and nitrogen.[27]
Lady Beetles (Ladybugs) As natural predators, lady beetles eat other insects, including pests that damage crops (like aphids). In their adult stage, lady beetles consume about 50 aphids per day (up to 5,000 in a lifetime!). Their red and black coloring serves as a warning, discouraging other animals from eating them.[28]	**Earthworms** Not only are earthworms great decomposers, but they also aerate soil, allowing water, oxygen, and nutrients to infiltrate to roots. Perhaps no other living organism is as critical as the earthworm in promoting soil health. Earthworms also support soil structure, nutrient cycling, water movement, and plant growth.
Fireflies (lightning bugs) These unique beetles use bioluminescence to attract a mate (and ward off predators). They also often feed on soft bodied insects including cutworms, which are notorious for cutting entire tomato plants and destroying other crops by wrapping around the base stem and killing the plant.[28]	**Redworms** Like earthworms, redworms not only aerate the soil, but they also break down decaying material and turn it into bioavailable nutrients for plant roots. As scavengers, redworms gorge on decomposing matter, and in the process they leave behind castings (excrement) rich in nitrogen, phosphorus and potassium, which are great for the soil.

The Gardener's Secret Scavenger Hunt Checklist

Pollinators	Decomposers	Aerators	Pest Managers
❑ Honey Bee ❑ Monarch Butterfly ❑ Silphium Borer Moth	❑ Blowflies ❑ Fruit flies ❑ Black soldier flies	❑ Ants ❑ Earthworms ❑ Redworms	❑ Green lacewig ❑ Lady beetles ❑ Damsel flies

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Insect Scavenger Hunt: The Gardener's Secret

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Climate Change and Food:
Why a Changing Climate Matters to You

Module 7
Teacher Print Kit

Instructions: Print one copy of this document as a reference *for the Teacher.* You can print double- or single-sided. Additionally, print the Student Handouts for Module 7.

Food Up!

Optional Teacher Background Reading

“Why Should We Care About Climate Change?”
The Yale Program on Climate Change Communication

"Having different perspectives about global warming is common, but the most important thing that anyone should know about climate change is why it matters. It matters because humans have basic needs, including clean air, fresh water, food, and shelter, which we have developed complex systems to provide. We require that cars capture the pollution that they emit in order to keep our air clean, for example, and we build reservoirs to hold fresh water for cities. We have also built roads, bridges, and tunnels for transportation, and grow specific crops in particular places well-suited for them in terms of temperature and precipitation.

"The many systems our societies depend on were built on the assumption that our weather patterns would be fairly stable -- that we would have sunny and cloudy days, wet and dry days, hot and cold days, but that our local climate (the average of all that weather) -- would always come back to ‘normal’” (1).

Optional Teacher Background Continued...

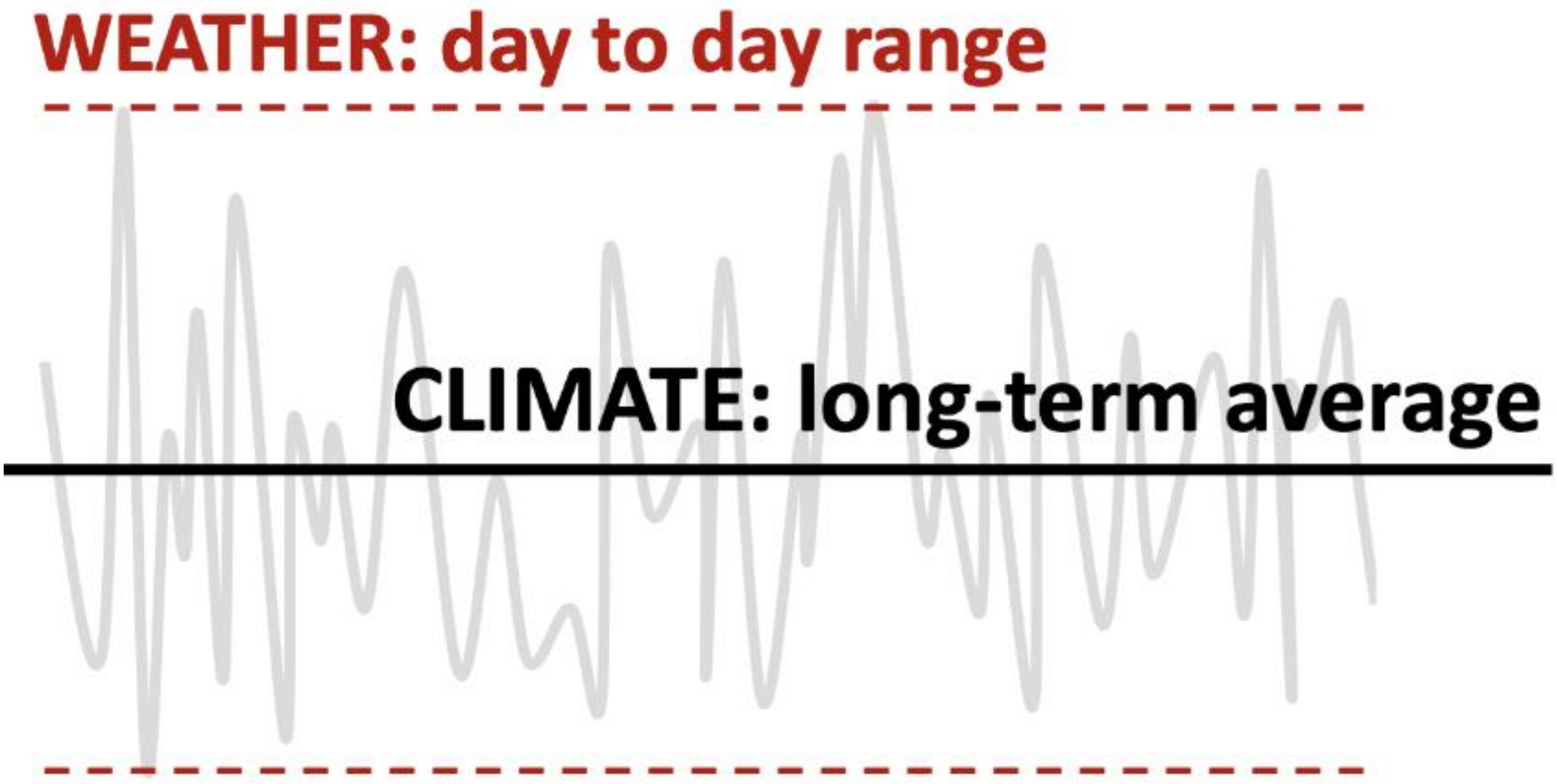
“Unfortunately, when we started to learn about the immense power that we could gain by burning fossil fuels (coal, oil, and gas, which come from ancient plants buried deep underground), scientists also discovered a problem about this power. They discovered that when we dig these materials up and burn them, they produce an powerful, invisible, odorless gas, called carbon dioxide. And they also discovered that this gas acts like a blanket around the planet, trapping heat in the atmosphere. In scientific terms, Earth transforms sunlight’s visible light energy into infrared light energy, which leaves Earth slowly because it is absorbed by greenhouse gases. When people produce greenhouse gases, energy leaves Earth even more slowly—raising Earth’s temperature.

"It took over 100 years for enough gases to build up to a level where we would notice it, but unfortunately we are now able to notice it quite strongly. Scientists have taken thousands upon thousands of measurements using thermometers on land, balloons and airplanes in the air, and buoys and other devices in the oceans. They have determined that our global temperature has risen almost 2 degrees F in the last century, and that most of the extra heat being trapped is going into the oceans, causing them to expand, which increases sea levels along the coast, while causing fish to migrate and sea ice to melt. The increased land temperature is causing glaciers to melt, heat waves and droughts to become more extreme, and it is causing more wildfires to grow out of control.”

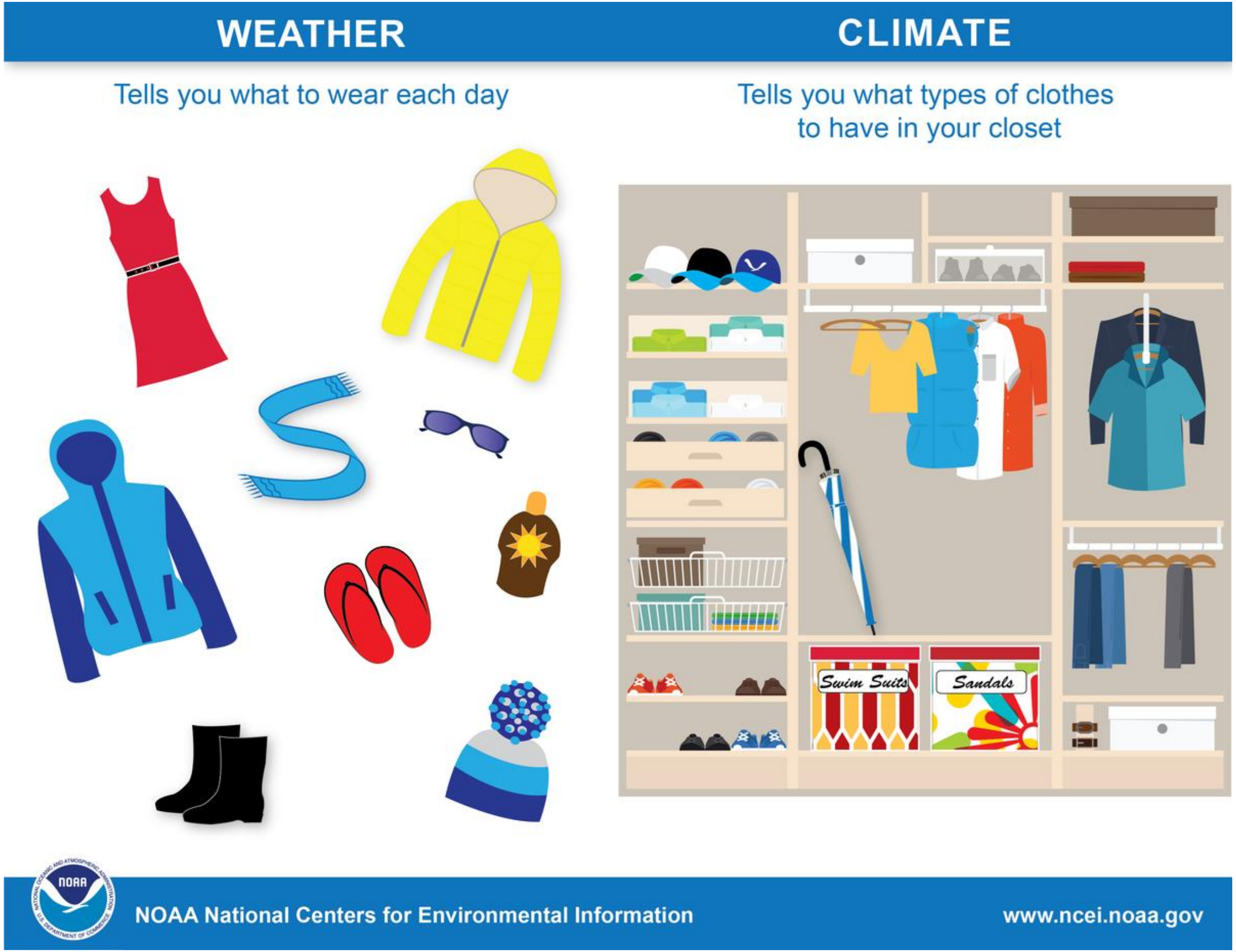
Optional Teacher Background Continued...

“Extreme weather is challenging for all of us no matter where we live, but it is also a major problem for all of the systems we have built to provide ourselves with clean air, fresh water, food, and shelter. Heat makes asthma and allergies worse, for example, and flooding from storms causes drainage systems to break down, which can lead to toxic spills and pollution of our fresh water. A changing climate is also very stressful for the crops and irrigation systems that we depend on. Some plants also respond directly to higher carbon dioxide levels in the atmosphere by reducing the nutrients that they take up from the soil. There are countless impacts of a changing climate on our infrastructure, food systems, and our everyday lives, which is why a stable climate matters to all of us, no matter where we live” (2).

Yale Program on Climate Change Communication. [Why should we care about climate change?]



Graphic taken from “Why should we care about climate change?” by the Yale Program on Climate Change Communication.


WEATHER
CLIMATE
Tells you what to wear each day
Tells you what types of clothes
to have in your closet
Swim Suits
Sandals
NOAA
NOAA National Centers for Environmental Information
www.ncei.noaa.gov

Activity #2: Greenhouse Gas Effects: A Car Example

Activity #3: Drought

Image credit: Bob Nichols, 2013. Texas drought affecting corn crops. USDA. Creative Commons CC BY 2.0. Food Span.

Activity #3: Climate Change Impacts Teacher Guide

Loss of topsoil

- Extreme heat: Heat dries out soil, making it more vulnerable to wind erosion.
- Extreme weather events: Hurricanes and flooding can damage crops and wash away soil.
- Changing rainfall patterns: Periods without rainfall can dry out soil, making it more vulnerable to wind erosion. Heavy rainfall can wash soil away.
- Rising sea level: Rising tides along coastal waterways can wash soil away.

Fungus invasion in corn crop

- Changing rainfall patterns: Long periods of heavy rain create ideal circumstances for fungal diseases to flourish and damage crops.

Saltwater contamination of freshwater supply

- Rising sea level: A higher ocean tidal range can introduce saltwater into groundwater supplies.

Increased cost to fight weeds

- Extreme heat: Temperatures rise and hardier weeds can outcompete more sensitive crops.

Increase in a crop's water needs

- Extreme heat: Heat dries out soil.
- Changing rainfall patterns: Periods with low rainfall can dry out soil.

Higher food prices

Explain to students that reduced crop yields often lead to higher food prices.

- Extreme heat: Damage from heat-tolerant weed species can lead to crop losses.
- Extreme weather events: Droughts, hurricanes, and flooding can erode soil and damage crops.
- Changing rainfall patterns: Dry periods and heavy rains can erode soil and damage crops.
- Rising sea level: Rising tides can erode soil and higher salinity can damage crops.

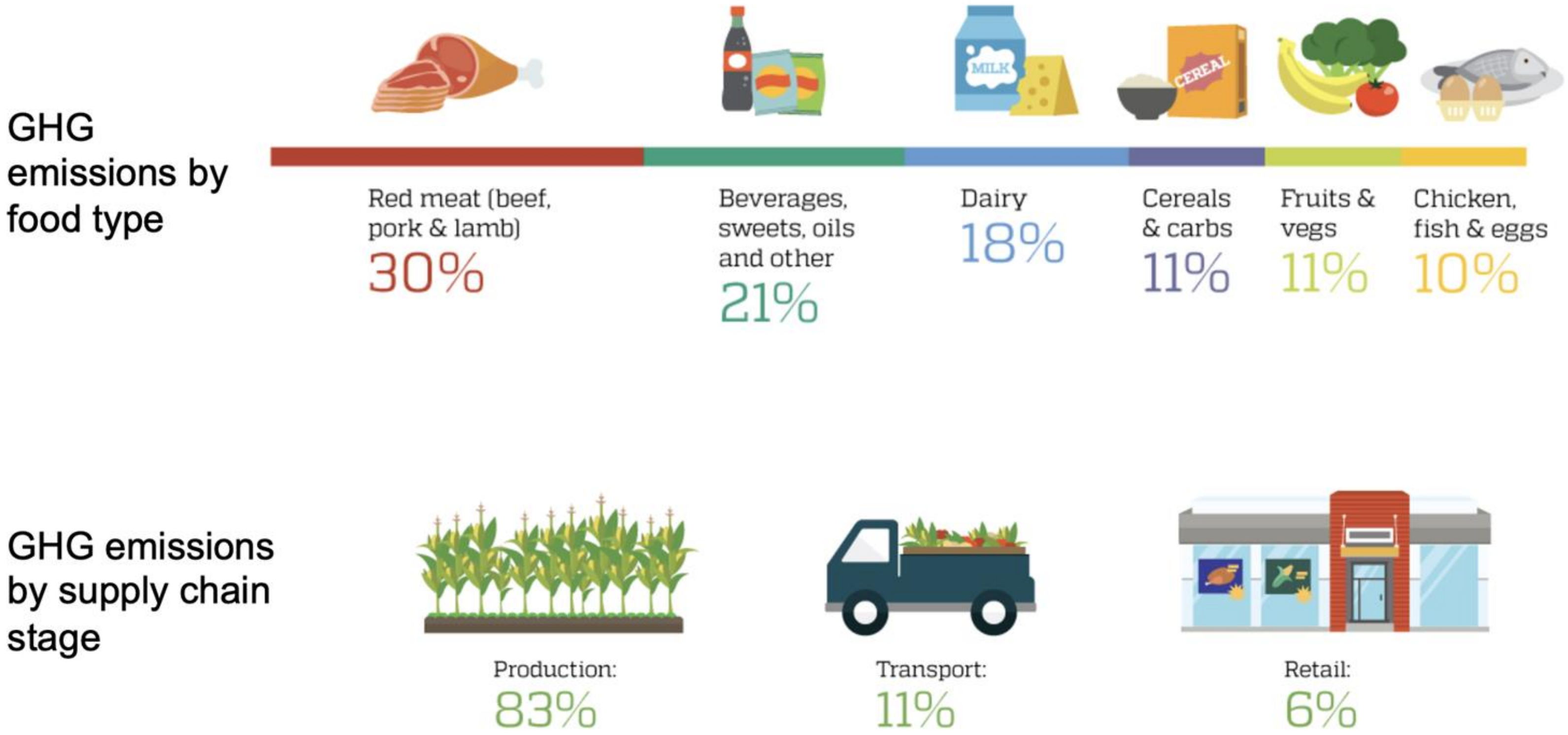
Depletion of freshwater sources for irrigation

- Extreme heat: Higher temperatures increase the evaporation rate. Freshwater in rivers, lakes, and groundwater may become depleted if it evaporates faster than it is replenished.
- Changing rainfall patterns: Periods with low rainfall can cause freshwater sources to dry up.

Activity #3: Climate Change Impacts on Agriculture

- Loss of topsoil
- Fungus invasion in corn crop
- Saltwater contamination of freshwater supply
- Increased cost to fight weeds
- Increase in a crop’s water needs
- Higher food prices
- Depletion of freshwater sources for irrigation

Activity #5: Food System Greenhouse Gas Emissions



ACTIVITY #5: IS YOUR DIET WARMING THE PLANET?

Teacher Notes and Disclaimer on “Climate Food Cards

Health Warnings/Data details:

- Please seek professional advice before making significant changes to your diet. Take into account your own personal circumstances and the necessary balance of many essential vitamins and minerals. For example, it is recommended for vegans to take vitamin B12 supplements.
- Greenhouse gas emissions and water footprints from food production vary significantly depending on the production method and country of origin.
    - For example, see 'Poore, J. & Nemecek, T. (2018). Reducing food’s environmental impacts through producers and consumers. Science.’ You can download here (including all data).
- The conversion between greenhouse gas emissions (g CO_2e) and car time depends on the efficiency of the car and the car speed.
- To calculate the number of minutes driving from the g CO_2e we had to assume a type of car. Note that cars vary in their emissions per mile. For climate food flashcards version 2, we assumed a typical UK car which causes 155 g CO_2e / km.
- We also needed to assume a car speed. In this version we assumed the car is driving at 40 mph.
- For extreme enthusiasts and data geeks, you can see the full information used to make the cards here.

TAKE A BITE OUT OF CLIMATE CHANGE

Food Up!
URBAN AG CURRICULUM

Module 7: Heating Up—Why a Changing Climate Matters to You

Goals and Objectives:

Climate change is widely considered the greatest threat to global health in the 21st century. In addition to an increase in the frequency of extreme (and dangerous) weather events and the spread of infectious disease, climate change is and will continue to have a dramatic impact on agriculture. Concurrently, conventional agricultural practices are driving climate change by burning fossil fuels to generate synthetic fertilizers and operate machinery, as well as releasing carbon dioxide via deforestation and poor land management. The connection between climate change and food is a paramount, personal reality that will impact all consumers during their lifetimes. In this lesson, students will refresh their understanding of the difference between *climate* and *weather*, explore the basics of climate change and greenhouse gasses, consider the relationships between climate change and agriculture, and make connections to their own diets and the garden.

Students should walk away from this module with a better understanding of how agriculture shares a bidirectional relationship with climate change, as agriculture is both impacted by climate change and driving it forward. New agricultural strategies and a greater awareness of this relationship is needed to generate meaningful change. This module is slightly longer than some others and is best for bigger groups.

Time: 1 hour 25 minutes

Optional additional activities: 30 minutes

Materials:

☐ Module 1 Teacher Print Kit
☐ Module 1 Student Handouts
☐ Post-It Notes
☐ Open area for physical activity
☐ Whiteboard and markers (or large sheet of paper and markers)
☐ 4 large pieces of paper
☐ Blank paper (1 per student)
☐ Tape
☐ Pens or pencils and colored markers (if available)
☐ Chalk for paved spaces **or** stakes and string for grassy/field spaces
☐ 12 dodgeballs OR newspaper and masking tape
☐ 2 thermometers (for taking air temperature outside)
☐ A clear, jar, or vase and something to cover it (plastic wrap or a dark t-shirt)

Optional:

- ☐ A Small bag with “What are Humans doing?” written on it (optional)
- ☐ Technology to play a YouTube video
- ☐ 2 pieces of string (~ 1 foot and ~7.5 feet)

  Note: you can do this activity without string; it serves as an aid to draw a large circle for the game

Teacher Background:

The United Nations describes climate change as “long-term shifts in temperatures and weather patterns.”[1] Importantly, these shifts may be caused by natural events, such as variations in the solar cycle. However, beginning in the 1800s, human activities have been the main driver of climate change, driven by our energy use through burning fossil fuels like coal, oil, and gas. The process of burning fossil fuels produces greenhouse gas emissions that act like a blanket around the Earth, trapping the sun’s heat and raising global temperatures significantly faster than in the past. In this lesson, climate change refers to long-term shifts in temperatures and weather patterns, mainly caused by human activities, especially due to the burning of fossil fuels.

Two major greenhouse gasses causing climate change include carbon dioxide and methane. These are emitted when we burn gasoline to drive cars, and coal to heat buildings. Clearing land and forests can also release carbon dioxide that was stored in soil and trees. Landfills for garbage and food waste, as well as livestock production (cattle, buffalo, sheep, and goat production) are also major sources of methane emissions. Industries and activities including energy, transportation, agriculture, and road construction are among the main emitters.[1]

Although our planet’s forests and oceans absorb greenhouse gasses from the atmosphere through photosynthesis and other processes, these natural carbon sinks are not able to keep up with our rising emissions. The resulting buildup of greenhouse gases causes alarmingly fast warming worldwide. It is estimated that the earth’s average temperature rose by about 1 degree Fahrenheit during the 20th century. If that does not sound like much, consider this: When the last ice age ended and the northeastern United States was covered by more than 3,000 feet of ice, average temperatures were just 5 to 9 degrees cooler than they are now. The last decade—2010 2019 — was the hottest decade in the last 1,300 years.[2]

Climate change will impact all industries to some extent, but perhaps the most visible impact will be on agriculture. Climate change on the food system is already being felt locally, regionally, and globally. Warmer temperatures influence agricultural pests, diseases, food storage, and causes food safety issues.[3] Overall, climate change will have a negative impact on food production, with less availability and affordability for food. Globally, the risks will be the greatest in tropical regions and for the poor. The risks go beyond agricultural production, with impacts to the highly integrated food system infrastructure. Transportation systems, equipment manufacturing, and energy access will be impacted by extreme weather conditions and rising sea levels.

However, some agricultural management practices are driving climate change. Industrial and conventional farming systems, reliant on energy intensive inputs and practices, such as synthetic fertilizer, heavy fossil-fuel run equipment, and tillage are major culprits. Livestock production alone accounts for a significant percent of total greenhouse gas emissions globally, and clearing land to feed livestock is especially problematic. New farming strategies are needed to help us adapt to a changing climate and reduce the implications of agriculture on the environment.

Opening Discussion:

Before jumping into details about climate change, agriculture, and health, start with a discussion on personal experiences relating to weather and climate change.

- *Has your life ever been directly impacted by a weather event or climate change? How so?*
    - Flooding of property, evacuation due to a fire, loss of farm revenue, car accident in a snowstorm, hailstorm damage to a car or house, missing school due to heatwave or polar vortex…
- *In the examples you just gave, do you think other people in your community were negatively impacted by the event? How so?*
    - Higher costs for goods and insurance due to variability in the weather
    - Loss of wages due to closures
    - Missed school with academic consequences
    - Negative health impacts

Thanks for sharing your experiences with weather and climate change. In today's lesson, we will investigate the connection between climate change, agriculture, and the food we eat.

Activity #1: What is climate? Reviewing your closet

Time: 10-15 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Includes: Weather vs Climate Graphics (pages 4-5)
- ☐ Student Handouts (print 1 copy per 2 students)
    - ☐ Includes: Weather vs Climate Graphics (page 2)
- ☐ White board (or a large sheet of paper) and markers
- ☐ Post-it Notes

Optional:

- ☐ Technology to play YouTube videos

Prep: Gather materials and make sure you have a clean writing space

Lesson:

Start by helping students differentiate climate from weather.

1. Draw two columns on the white board or on a large piece of paper. Title one column ‘WEATHER’ and the other ‘CLIMATE.’

2. Discuss: *What is the difference between climate and weather?*
    - Note: The difference between weather and climate is a measure of *time.* Weather is the conditions of the atmosphere over a short period of time, while climate is how the atmosphere “behaves” over relatively long periods of time.[4]

    - Another way to think about this difference is as follows: Weather occurs on a local, small-time horizon, and includes forecasts. Climate happens at regional or global scales, over a long-time horizon (decades to centuries). We use models and big data to make climate predictions.

3. Once the students understand the basic difference, write the word TIME in between the two columns, or draw a symbol of time, like a clock.

4. Next, ask your students to think of climate vs. weather as a **closet filled with clothes and accessories.** Write the following under each column for the students to see:
    - **WEATHER** → Tells you what to wear each day.
    - **CLIMATE** → Tells you what type of clothes to have in your closet.

5. Pass out several sticky notes per student and ask them to draw pictures of all items they might have in their closet: clothing, accessories like hats and gloves, umbrellas, boots, etc.

6. Next, have student volunteers come up to the board and stick their drawings in the appropriate columns. Students will post clothing appropriate for the current day in the WEATHER column. Other clothes appropriate for your climate, but not necessarily today's weather, will be posted in the CLIMATE column.
   - For example, on a hot summer day in Wisconsin, students might post their sandals under the WEATHER column, but their sweatshirt or winter boots would go under the CLIMATE column. Note that items can certainly go in both columns! Keep the discussion flowing as students post on the board.

   - See page 5 of the Teacher Print Kit for an example closet from NOAA National Centers for Environmental Information.

7. Next, repeat the CLIMATE column of the closet activity for a location as far away as you can think of… perhaps Iceland, Egypt, or a tropical island. Help the students think about what a closet might look like in this location. For example, in Egypt and across the middle east, you are likely to find lots of lightweight clothing, such as *kaftans* (a long lightweight garment with wide sleeves and often a sash), and fewer winter coats and boots.

8. Discuss: *What are the major differences between these two climates? Why does the climate matter?*
   - Example: The differences between these climates can mean different lifestyles, industries, crops, plants, and animals. Extreme climates (dry, wet, hot, or cold) are more difficult for human existence and farming than more moderate climates.

9. Optional (5 mins): Write the following statements on the board.[5]
   - *The temperature in New York City averaged 82 degrees Fahrenheit on July 20, 2010.*

   - *The temperature in New York City averaged 77 degrees Fahrenheit for the month of July between 1981 and 2010.*

- Ask students to reflect on the difference between these two statements. *What is similar about the measurements? What is the difference?*

- If needed, explain that the first statement describes weather, while the second statement describes climate. A region's climate is the temperature, precipitation, humidity, and other weather conditions over a long period, whereas weather refers to those conditions over a short period of time, usually hours or days.

10. Lastly, to prepare students for later lesson sections, ask them: *What makes a climate good for growing food?*
    - Note: This is an opportunity to bring up the many variables that impact crop growth and mention that different plants are adapted and suited to different climates, but that extremes in temperature and precipitation (or lack thereof) make it harder to farm… think deserts and Antarctica.

Activity #2: What is climate *change?* Meeting the greenhouse gases; a game

Time: 30 minutes

Now that your students know what "climate" means, help them understand, in basic terms, what "climate change" means.

[NOTE: this lesson is not intended to make an *argument* for why climate change is real. This is settled science; 97-99% of climate scientists agree that climate change is happening because of human activities. If you have students with questions about the evidence of climate change, the resources listed at the end of this module and provided in the teacher print kit will help you respond.]

Materials:

- ☐ Student Handouts
    - ☐ Includes: The Greenhouse Gas Effect: A Car Example (page 3-4)
    - ☐ Includes: Human Action Cards (Pages 6-7)
- ☐ Scissors

For Greenhouse Effect Game (for 8+ participants):

- ☐ Open area for game
- ☐ 2 pieces of string ~ 1 foot (30 cm) and ~7.5 feet (230 cm) long
    - Note: You can do this activity without string; it just serves as an aid to draw a large circle for the game
- ☐ Chalk for paved spaces **or** stakes and string for grassy/field spaces
- ☐ 12 dodgeballs **or** newspaper and masking tape
    - Ask students to make simple balls by balling up newspaper and using a bit of masking tape to bind the paper into balls.

Optional:

- ☐ Technology to play YouTube videos
- ☐ Small bag with "What are Humans doing?" written on it

Note: This game requires 8+ participants; it works best with even more people, up to 20-25.

Prep:

Draw a 2-foot (60cm) circle on the ground by holding one end of the short string in one place and using chalk attached to the other end to make the circle.
This circle represents the Earth. Draw a larger, 15-foot (460cm) diameter circle around it using the longer string. This circle represents the Earth's atmosphere.

Lesson:

1. Begin by discussing *climate change* as a group. Brainstorm answers to the following question and write some ideas on the board:
   - *Now that you understand weather vs. climate, what is climate change?*

2. Suggest the following definition of climate change and write it on the board. [NOTE: If this feels like a difficult starting point, you can watch one or two of the optional background videos listed below to get everyone up to speed.]
   - Climate change refers to long-term shifts in temperatures and weather patterns, mainly caused by human activities, especially the burning of fossil fuels*.*

3. Discuss: *What are some examples of climate change visible today? Why do such changes matter?*
   - More frequent and extreme weather events, including more frequent heat waves, more intense droughts, changes in atmospheric and ocean circulation, ocean acidification, sea level rise, changes in pest and disease presence.

   - Consider: social, environmental, health (including mental health), and economic impacts

4. Now ask your students, *what causes climate change?*
   - This is your opportunity to discuss **greenhouse gases** and the **greenhouse effect**.

   - In very simplified terms, certain gases in the atmosphere—often called greenhouse gases—block heat from the sun from escaping, which leads to warming. Similarly, a greenhouse is full of windows that let in sunlight. That sunlight creates warmth, which cannot escape those same windows.

   - Human activities, such as burning fossil fuels, have dramatically **increased** the concentration of greenhouse gases in Earth's atmosphere, warming the planet. However, our planet would have been in cooling period today without human intervention.[6]

   - Explain (and reiterate) that greenhouse gases are gases that trap heat. **Carbon dioxide (or CO_2)** is the most discussed greenhouse gas. It is also often used as a metric for estimating the impacts of all greenhouse gases: water vapor, methane, ozone, nitrous oxide, chlorofluorocarbons.

Note: Human activities are causing climate change. It is true that the climate has changed in the past, and throughout the history of the Earth. What is most striking about our current situation is the **accelerated speed at which the climate is changing**.

5. Display the “The Greenhouse Effect: A Car Example” image (page 3 in the Student Handouts). *Have you ever gotten into a car on a warm day and found the car to be much, much hotter than the air outside? This is actually a great example of the greenhouse effect!* Walk through the graphic using the Greenhouse Gas Effect Notes on page 4 of the Student Handouts.
    - *That’s exactly how greenhouse gases act. They let sunlight pass through the atmosphere, but they prevent the heat that the sunlight brings from leaving the atmosphere. Overall, greenhouse gases are a good thing. Without them, our planet would be too cold, and life as we know it would not exist. But there can be too much of a good thing. Scientists are worried that human activities are adding too much of these gases to the atmosphere, which is leading to warming of the Earth over time.*

6. *Now you are ready to play the **Greenhouse Effect Game!***
    - This game demonstrates the greenhouse effect by showing how carbon dioxide in the atmosphere traps some of the sun's heat, insulates the Earth and allows life to survive. It also shows what happens when human actions affect the concentration of greenhouse gases in the atmosphere.

    - Allow about 20 minutes for the game and explanations. Follow the instructions above to prepare to play. This game is played in 3 rounds or more. Each round takes about 30 seconds.

7. **Round 1**. Two students are the keepers of the CO_2 molecules, represented by the dodgeballs. Provide one ball each to the keepers. These students should stand anyone inside the ‘atmosphere’ circle, outside the Earth.
    - They must not move their feet during the game. (**Note**: this is optional based on the size and activity level of your group).

    - All other students are the sun's rays. They start outside the atmosphere and must try to reach the "Earth" (to touch it with a hand or foot) and then escape through the atmosphere without being touched by a CO2 molecule. The CO_2 keepers will throw the dodgeballs to tag rays within the bounds of the atmosphere. (Another option is to have students tag on another with a ball.)

    - Rays that are touched by a CO_2 molecule (dodgeball) while in the atmosphere must stay standing still in the "atmosphere".

    - Rays must only try to reach Earth once.

    - Rays that have escaped into space then make a circle around the atmosphere. *You can time this for 30 seconds.*

- Discuss: How many rays have been trapped in the atmosphere by CO_2 molecules? This represents the amount of heat energy from the sun that has been trapped in the atmosphere, which is called the greenhouse effect. Discuss how this affects the temperature of Earth. Remember that a certain amount of CO_2 is required to keep the planet warm enough to support life.

8. **Round 2**. What happens if the amount of CO_2 in the atmosphere is increased?
    - Firstly, remove any sun's rays that were trapped in Round 1.
    - Place 4 Human Action Cards (pages 6-7 in Student Handouts) in the bag. [Cards are color coded: Red cards add carbon dioxide to the atmosphere and Green cards reduce CO_2 (sequester or remove it).]
    - Take a Human Activity card out of the bag and read the card. Add the appropriate number of CO_2 molecules (dodgeballs) to the two that are already in the atmosphere by handing them to the CO_2 keepers.
    - Play the game again and discuss what happens.

9. **Round 3** and following rounds. Add all the Human Action Cards to the bag. Repeat the game, picking a Human Action card out of the bag. As you repeat the game, do not remove CO_2 molecules between rounds unless indicated by a human action card (this will allow illustration of CO_2 concentrations in the atmosphere to go up and down), however do remove rays between each round so that the number of CO_2 molecules can go up even more, or go down. If the numbers of CO_2 molecules become too much for the keepers to handle, a teacher or two can come in to help.

Note: The game should illustrate that when the amount of CO_2 increases, more of the sun's heat energy gets trapped, and the temperature of the Earth goes up. Burning fossil fuels is one of the main ways humans increase the amount of CO_2 in the atmosphere. When human actions reduce the amount of CO_2 in the atmosphere, the greenhouse effect is less strong.

10. Debrief: Create two columns on the board, and head one column with “Adds CO_2” and the other with “Removes CO_2.”
    - Start with “Adds CO_2.” Brainstorm: *What actions do humans take to add CO_2 and other greenhouse gases to our atmosphere?* Encourage students to think of anything they do that requires energy and think of how that energy is made. Think of items they own, or places that they go. How are these items made and delivered? How are these places heated and cooled?

    - Next, address the "Removes CO_2 column." Using your list from the "Adds CO_2" column, brainstorm ways to enjoy the same activities, things, and places, without emitting as much CO_2 from fossil fuels. *Are there alternatives to some activities that would work well but create less greenhouse gases?*
        - Examples: Car emissions→Ride the bus→Ride in an electric car plugged into a solar grid
        - Methane emissions from cows→Choose to eat chicken instead of beef

11. Discuss: *Why is more CO_2 in the atmosphere bad?*
    - While CO_2 is both a natural, necessary substance in our atmosphere, it is also a pollutant in high concentrations.

    - High levels of CO_2 are trapping heat and warming the planet, which means more extreme weather events, more acidic oceans impacting fish, global ecosystem shifts that may impact exposure to allergens, infectious disease spread, more mental health burden from heat waves and ecoanxiety.

12. *What change can you make this week that will reduce your greenhouse gas footprint?*

Optional Background Videos:

- *What's the Big Deal With a Few Degrees?* By Global Weirding with Katharine Hahoe – 9:04 mins. https://www.youtube.com/channel/UCi6RkdaEqgRVKi3AzidF4ow

- *How Global Warming Works in Under 5-minutes* by the University of California. https://www.howglobalwarmingworks.org/in-under-5-minutes-ab.html

- *Climate Change 101 with Bill Nye* by National Geographic - 4:06 mins. https://www.youtube.com/watch?v=EtW2rrLHs08

- *The Greenhouse Effect* by the U.S. Environmental Protection Agency – 1:55 mins. https://www.youtube.com/watch?v=VYMjSule0Bw

Optional Alternative Activities and Versions of the Game:

- Climate Centre. (2017). Greenhouse Gas Game.

- UCAR Center for Science Education. (2018). Greenhouse Gas Game.

Activity #3: No Rain, No Gain – How a changing climate is stressing our farms

Time: 20 minutes

Materials:

- ☐ Student Handouts
  - ☐ Includes: Drought Image (page 8)
- ☐ Teacher Print Kit
  - ☐ Climate Change Impacts Teacher Guide (page 8)
  - ☐ Climate Change Impacts on Agriculture (page 9)
- ☐ Large Paper
- ☐ Markers
- ☐ Tape

Lesson:

1. Display or pass around the Drought Image (page 8 in the Student Handout or page 7 in the Teacher Print Kit). Ask: *What happened to these crops? How might climate change have been responsible?*
   - These Texas corn crops were killed by drought—one extreme weather event that occurs *more frequently* because of climate change. Ask students to brainstorm other climate change-related events.
     - Rising sea level
     - Extreme heat
     - Changes in rainfall patterns
     - More frequent and intense extreme weather events (e.g., droughts, hurricanes, flooding)

2. Next, help students explore how different aspects of climate change impact agriculture. Write each aspect of climate change (listed in blue above) on large pieces of paper and post them around the room.

3. Then display and read the **Climate Change Impacts on Agriculture Slide** (page 9 in the Teacher Print Kit) or write the following impacts on the board:
   - Loss of topsoil
   - Fungus invasion in corn crop
   - Saltwater contamination of freshwater supply
   - Increased cost to fight weeds
   - Increase in a crop's water needs
   - Higher food prices
   - Depletion of freshwater sources for irrigation

4. Next start the movement activity. Read each Climate Change Impacts on Agriculture aloud and direct the students to move to the area of the room where the aspect of climate change they believe is responsible for that impact is posted. Once students have made their choice, give each group of gathered students one to two minutes to discuss why they selected this aspect. Ask one volunteer from each group to share with the class.

5. Use the **Climate Change Impacts Teacher Guide** to respond to students' explanations and facilitate discussion. For example, for the impact "Loss of topsoil," students could move to "Extreme heat" because it dries out the soil and makes it vulnerable to being blown away.

6. Next, briefly discuss how students can adapt to these issues in the garden. For example, mulching can help soils retain water. Adding organic material like compost can help increase soil fertility and build topsoil. Planting perennial crops or trees can also help hold and build soil, preventing erosion.

Connecting to the Garden

Note: This optional activity requires you to be outside for a bit; it can be set up to run while you are working in the garden. The purpose of this activity is to demonstrate the greenhouse effect using temperature readings.

Time: 5-10 minutes (spaced over 1 hour)

Materials:

- ☐ Student Handouts
  - ☐ Includes: Two Thermometers Greenhouse Effect Recording Sheet (page 9)
- ☐ Two thermometers (for taking air temperature outside)
- ☐ A clear bowl, jar, OR vase and a cover (plastic wrap or a dark t-shirt)

Lesson:

1. Lay both thermometers outside for a few minutes in a sunny area. Mark down the time and the baseline temperatures of both thermometers on your record sheet.

2. Place a vase in the sun with a thermometer in it. Cover it with a plastic wrap or a dark t-shirt.

3. Place the second thermometer next to the bowl (not in the shade). Ensure that the thermometer sensor is not touching a surface and is only exposed to air. Usually, laying a thermometer down on its side achieves this.

4. Record the temperatures on both thermometers every 5-10 minutes for about 1 hour. Ask two student volunteers to be "temperature checkers" in charge of recording these data. Use an audible timer to remind these students to return to the thermometers to record the temperature.

5. Look at the trend in temperatures and note which thermometer is typically reporting higher temperatures. Ask and discuss: *Why are the temperatures inside and outside of the vase different?*

   Note: Solar energy (light) enters the vase, becomes thermal energy (heat) and becomes trapped. As more and more light enters into the vase, it becomes warmer and warmer. This is like the greenhouse effect. The second thermometer is not trapped in a confined space. Because it is in the air, the thermometer is exposed to a mixture of both warm and cool air.[9]

Activity #4: Is your food warming the planet?

Time: 15-20 minutes

Materials:

- ☐ Blank Paper (1 per student)
- ☐ Markers
- ☐ Student Handouts (print 1 copy per 2-3 students
    - ☐ Includes: Food System Greenhouse Gas Emissions (page 10) and Food Waste (page 11)
    - ☐ Includes: Climate Food Flashcards (pages 12-20)

Lesson:

1. Start by asking your students how agriculture might be causing climate change. *Does growing food lead to greenhouse gas emissions? How do you think agriculture might contribute to climate change?*

    Yes, it does. Remind your students that historically, agriculture has been a major source of human caused CO_2 and methane emissions—two greenhouse gases that are contributing to climate change. Farming practices like tilling the soil, manufacturing pesticides and fertilizers, and rearing cows who produce manure, all contribute to emissions.

2. Next, distribute 1 piece of blank paper and markers / pencils / pens to each student. Ask them to draw a plate depicting the dinner that they ate yesterday – including all beverages, desserts, and sides. Give them 5 minutes or so to draw.

3. Discuss: *All the foods on your plates originated on a farm. Do you think these foods may have different impacts on the environment or lead to different greenhouse gas emissions? Why?*

4. Display the "Food System Greenhouse Gas Emissions" slide (or distribute copies). Tell students to examine the charts and ask: *Which areas of the food system are responsible for the most GHG emissions? Are these statistics surprising? Why? What causes a food to generate more greenhouse gas emissions than another food?*

    Certain foods contribute more to climate change than other foods. Depending on the knowledge/age level of the group, engage in a conversation about the most carbon intensive foods and what goes into that number (growing feed for animals, using synthetic/chemical Nitrogen fertilizers, manufacturing pesticides, moving up the food chain, transportation, keeping cold or frozen, etc.).

5. Divide students into groups of 2-3. Distribute one copy of the **Climate Food Flashcards** to each group (pages 12-20 in the Student Handouts).

6. Ask the group to select one team member's meal to analyze. First, they should find cards with foods that closely remember the selected diet. For example, if the student drank a Coke, use the "Fizzy Drink" card. If they ate French fries, suggest they use "Potato" and "Vegetable Oil." Don't worry about the serving sizes for this activity, just use the portion listed on the card for each food eaten and include it once for each meal item containing that food.

7. On a blank sheet of paper, ask the students to add up the total equivalent Driving Minutes (shown in the black circle of each card) for the meal. Ask the students to report the driving minutes summary to the class and discuss why the numbers may vary across groups / meals.

8. Next, ask the students to substitute items in the meal to reduce the emissions and driving time equivalent of their plate. They should write down any changes and add the driving time numbers again. Ask each group to report the driving minutes summary to the class of their revised meal and discuss why the numbers may vary across groups / meals.
   - *How did you reduce the emissions from your meal?*

9. Lastly, display the Food Waste images (page 11 in the Student Handouts) and discuss sources of emissions from food waste. Food gets lost or wasted all along the farm-to-fork supply chain. Food is lost on farms, during harvesting, processing, and storage. It's wasted in retail stores, school cafeterias, and in homes. Around one-third of it is lost or wasted in the US, from the time it is produced until it is consumed.
   - *What impact does food waste have on climate change? Why do we waste so much food? Where in the food supply chain is food lost or wasted?*

Optional: Show the below video which discusses diets and population size.

- The easiest ways to fix climate change is population control and going vegan - right? With Dr. Katharine Hahoe (7.5 mins) https://www.youtube.com/watch?v=KwejlpXK7ls
- Understanding Food and Climate Change - an interactive guide (Center for Ecoliteracy). https://foodandclimate.ecoliteracy.org/interactive-guide/cover.xhtml

Closing Discussion:

Aim to end on a positive note, letting students brainstorm their own power to make change.

- *What effects of climate change feel most important to you?*
- *What power do you have to reduce damage to the Earth in your everyday life?*
- *What power do others have to influence climate change? What are ways that you can influence others to act to mitigate climate change?*
- *What are some ideas or ways we could reduce our emissions or address climate change through how we grow and eat food?*

If you need ideas on potential solutions to discuss with your students, consider some ideas provided by the Center for Ecoliteracy (2018) outlined in their interactive guide, Climate Change Basics: Understanding Food and Climate Change. The final section titled *Promising Strategies for Addressing Climate Change* is particularly useful.

Optional:

- The Johns Hopkins Center for a Livable Future's original short film, Growing Solutions (42 minutes), shows how farmers are innovating to protect and regenerate the resources needed for a secure farming future, especially in the face of climate change. The film features a farmer who's growing topsoil; seed-saving high schoolers; a farmer training program for military veterans; a communal system for water conservation; and a perennial style of farming that mimics the prairie. A discussion guide is also provided.

References:

Teacher Background:

1. The United Nations, The Science: Climate Action Page (2022). https://www.un.org/en/climatechange/what-is-climate-change
2. The National Resources Defense Council, 2022. What is Climate Change?
3. Center for Ecoliteracy, 2018. Climate Change Basics: Understanding Food and Climate Change: An Interactive Guide.

Activity 1:

4. Definition from NASA (2005). "What's the difference between weather and climate?"
5. This part of Activity 1 was adapted from Unit 2 Lesson 5: *Our Changing Climate* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020).

Activity 2:

6. Global Climate Change. The Causes of Climate Change. NASA.

   The Greenhouse Effect Game adapted from The Saiga Resource Center, 2018. Activity: Greenhouse Effect Game.

Activity 3:

Adapted from Lesson 2, Module 5: *Our Changing Climate* from the *Foodspan* curriculum created by the John Hopkins Center for a Livable Future (2020)

Connecting to the Garden:

Adapted from Kids Mind, Lessons: The Tale of Two Thermometers. How to Explain the Greenhouse Effect to Kids (with printables).

Adapted from Section 9, Unit 6: *Systems for Survival* created by Michelle Romanelli of the Yale-New Haven Teachers Institute.

Activity 4:

Climate Food Flashcards borrowed from the Greenhouse Gas and Dietary choices Open-Source Toolkit.

Information on food waste from the Center for Ecoliteracy, 2018. Climate Change Basics: Understanding Food and Climate Change: An Interactive Guide.

Closing Discussion:

Center for Ecoliteracy, 2018. Climate Change Basics: Understanding Food and Climate Change: An Interactive Guide. Promising Strategies for Addressing Climate Change.

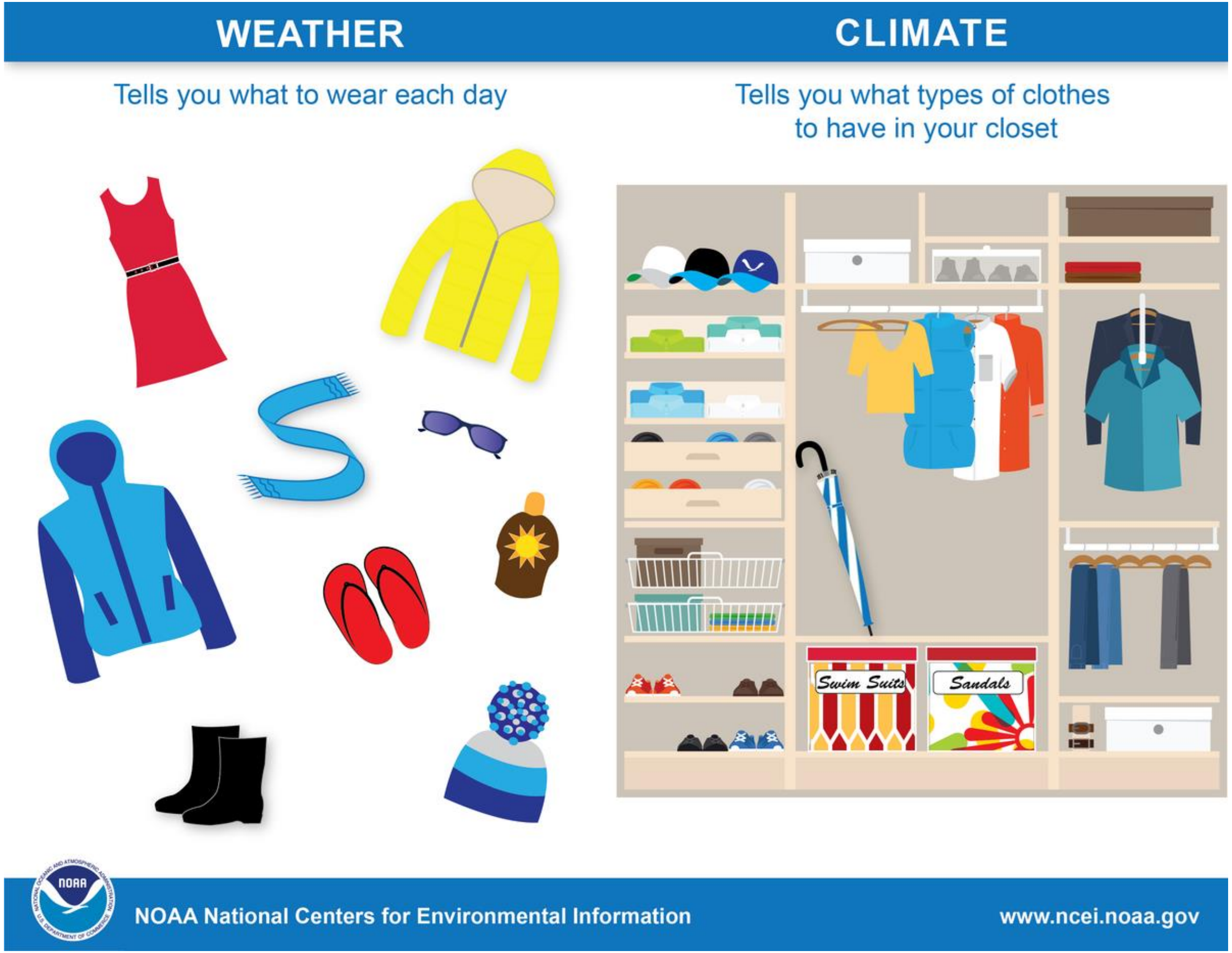
Climate Change and Food: Why a Changing Climate Matters to You

Module 7
Student Handouts

Instructions: It is easiest to print this document **double-sided, on the short-edge**. Print 1 copy for every 2 students in your class.

Food Up!

Food Up!



Taken from “What’s the Difference Between Weather and Climate?” by National Centers for Environmental Information. https://www.ncei.noaa.gov/news/weather-vs-climate.

Activity #2: Greenhouse Gas Effects – A Car Example

Activity #2: Greenhouse Gas Effects – A Car Example

- Sunshine (solar energy) passes easily through the glass to heat objects in the car's interior -- remember how hot the car seat gets in summer?
- The car's interior absorbs the short-wave energy and heats up. When the seats heat up, they produce long-wave infrared radiation.
- Here's the tricky part: The glass in the car's windows now begins to act as a kind of one-way mirror. Short-wave solar energy continues to enter with no problem but much of the long-wave infrared radiation is blocked and prevented from leaving

On a much larger scale, this is what's happening to the earth:

- Energy from the sun hits the earth's atmosphere as solar radiation. Some of it is bounced back into space by the atmosphere, but most passes through the atmosphere to warm the surface of the earth.
- Once the earth has been warmed by the short-wave solar energy, excess heat is radiated back into the environment as long-wave infrared radiation.
- Some of the gases in earth's atmosphere act like the glass in the car windows. They let in solar energy and block or absorb infrared energy. As a result, the atmosphere gets warmer.

What does pollution have to do with it?

In all, 30 greenhouse gases have been discovered to date, including carbon dioxide (CO2), water vapor, methane and ozone. But lately new gases are being added to the mix: Chlorofluorocarbons (CFCs). These are the harmful gases produced by cars and factories, and we humans are responsible!

(2022). “The Greenhouse Effect Experiments.” FamilyEducation. https://www.familyeducation.com/school/global-warming/greenhouse-effect-experiments

Climate is what you expect, weather is what you get

Activity #2: Human Action Cards

Humans

Drive Cars

Humans

Cut Down Trees

Humans

Plant Trees

Humans

Travel by Bus

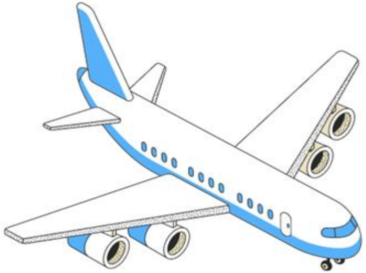
Humans

Recycle

Humans

Burn Trash

Humans



Travel by Plane

Humans
Create

Energy-efficient
Technology

Activity #2: Human Action Cards

Public transit has the potential to reduce CO_2 emissions by 37 million metric tons per year.[1]

(Remove 2 CO_2 molecules)

Trees absorb the CO_2 from the atmosphere and release oxygen in exchange.

(Remove 4 CO_2 molecules)

Every year, Deforestation releasing more than 1.5 billion tons of CO_2 into the atmosphere.[3]

(Add 4 CO_2 molecules)

There are 1.45 billion cars in the world. The average driver emits ~ 4.6 metric tons of CO_2 per year.[4]

(Add 2 CO_2 molecules)

Increasing energy efficiency is extremely effective in cutting CO_2 emissions.[2]

(Remove 4 CO_2 molecules)

Aviation is responsible for around 5% of global warming and is rising.[5]

(Add 2 CO_2 molecules)

Burning garbage emits large amounts of CO_2 and toxic chemicals into the atmosphere.[6]

(Add 2 CO_2 molecules)

If the U.S. recycling levels reach 75%, the CO_2 impact would equate to removing 55 million cars from the roads each year.[7]

(Remove 2 CO_2 molecules)

Activity #3: Drought

Image credit: Bob Nichols, 2013. Texas drought affecting corn crops. USDA. Creative Commons CC BY 2.0. Food Span.

Two Thermometers Greenhouse Effect Recording Sheet

Time	Thermometer #1 (outside)	Thermometer #2 (inside vase or jar)
Baseline		
10 mins		
20 mins		
30 mins		
40 mins		
50 mins		
1 hour		

Activity #4: Food System Greenhouse Gas Emissions

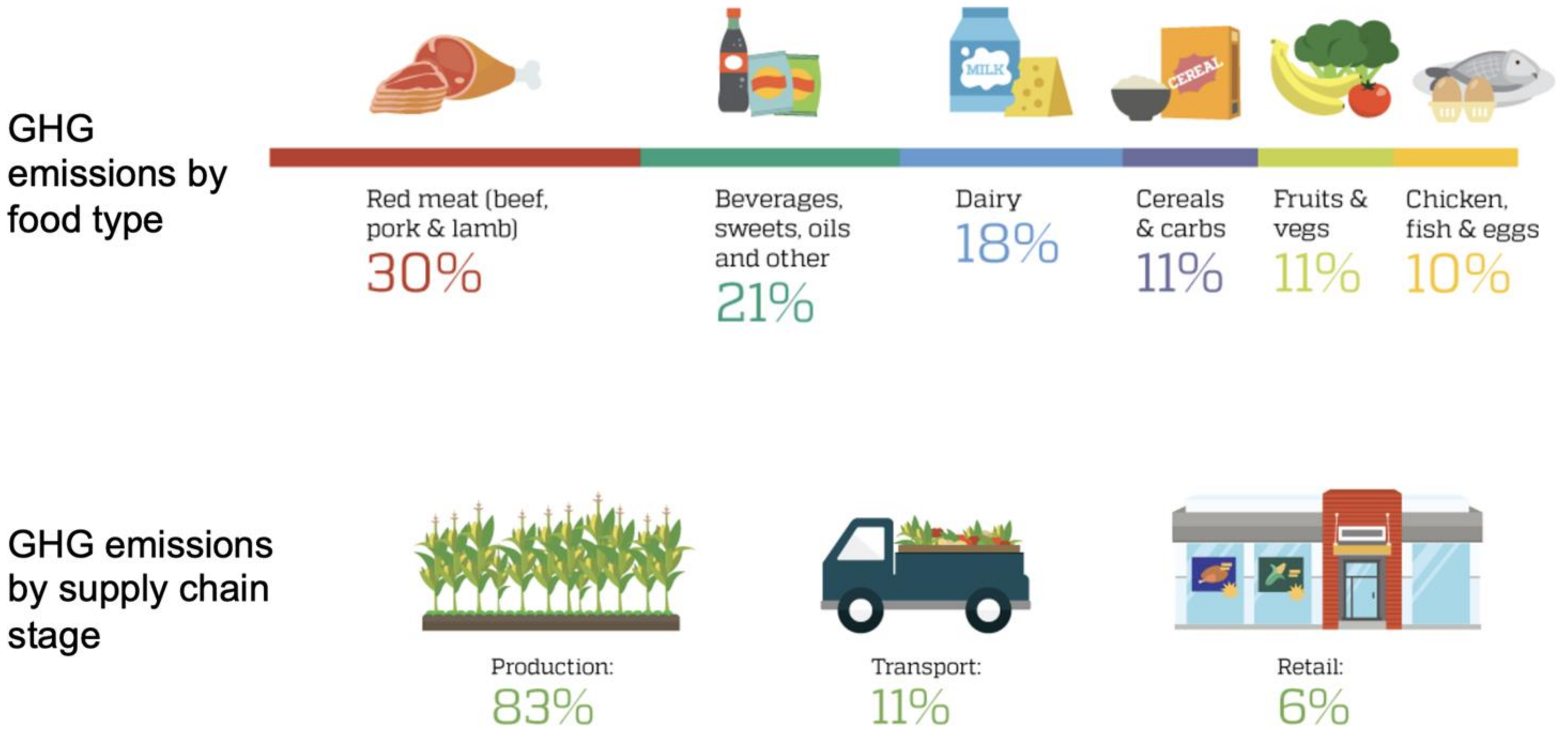
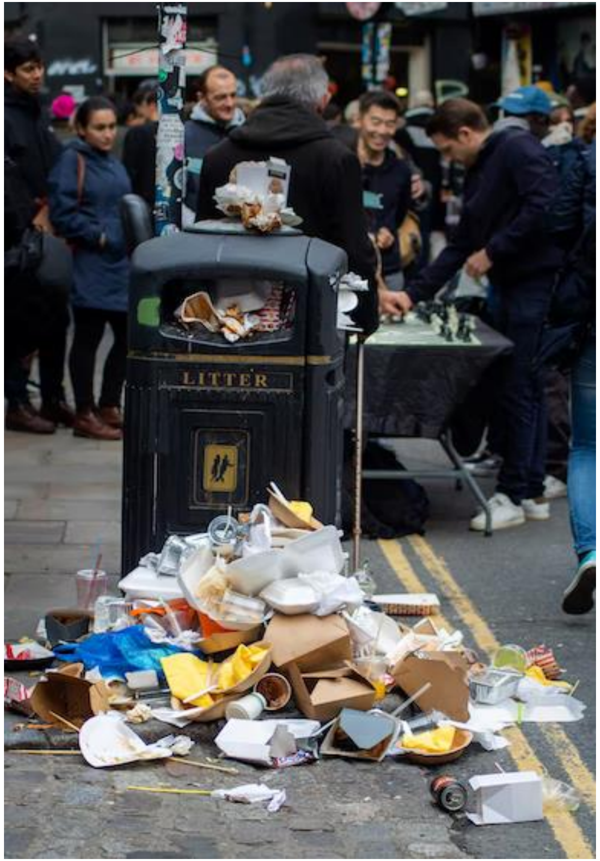


Image Source: Module 5: Our Changing Climate. Foodspan from John Hopkins Center for a Livable Future (2020); Data source: Weber CL, Matthews HS. Food-Miles and the Relative Climate Impacts of Food Choices in the United States. Environ. Sci. Technol. 2008, 42 (10), 3508–3513.

Activity #4: Food Waste



Methane, a powerful greenhouse gas, is emitted into our atmosphere from the food waste in our landfills.

Activity #4: Climate Food Flashcards

Steak
Portion, fried (100g)

CO_2e 29 minutes driving

Emissions	4723	gCO_2e
Water	668	litres
Fibre	0	g
Calories	242	kCal
Protein	30	g

Sausage
Two small (100g)

CO_2e 6 minutes driving

Emissions	1035	gCO_2e
Water	424	litres
Fibre	6	g
Calories	259	kCal
Protein	14	g

Quorn
From frozen, portion (100g)

CO_2e 2 minutes driving

Emissions	379	gCO_2e
Water	200	litres
Fibre	11	g
Calories	196	kCal
Protein	13	g

Cod
Portion (100g)

CO_2e 4 minutes driving

Emissions	642	gCO_2e
Water	137	litres
Fibre	0	g
Calories	198	kCal
Protein	21	g

Lamb
Portion (100g)

CO_2e 27 minutes driving

Emissions	4430	gCO_2e
Water	350	litres
Fibre	0	g
Calories	249	kCal
Protein	30	g

Veggie sausage
Two small (100g)

CO_2e 2 minutes driving

Emissions	361	gCO_2e
Water	73	litres
Fibre	3	g
Calories	247	kCal
Protein	14	g

Salmon
Portion (100g)

CO_2e 5 minutes driving

Emissions	879	gCO_2e
Water	290	litres
Fibre	0	g
Calories	320	kCal
Protein	22	g

Chicken
Portion (100g)

CO_2e 6 minutes driving

Emissions	923	gCO_2e
Water	325	litres
Fibre	0	g
Calories	240	kCal
Protein	28	g

Activity #4: Climate Food Flashcards

Ham
Three slices (100g)

CO$_2$e 6 minutes driving

Emissions	1070	gCO$_2$e
Water	394	litres
Fibre	0	g
Calories	115	kCal
Protein	19	g

GGDOT

Pizza
Large slice (100g)

CO$_2$e 3 minutes driving

Emissions	477	gCO$_2$e
Water	108	litres
Fibre	6	g
Calories	272	kCal
Protein	12	g

GGDOT

Baked beans
From a can (200g)

CO$_2$e 3 minutes driving

Emissions	430	gCO$_2$e
Water	115	litres
Fibre	25	g
Calories	162	kCal
Protein	10	g

GGDOT

Lentils
Cooked at home (200g)

CO$_2$e 0.9 minutes driving

Emissions	151	gCO$_2$e
Water	179	litres
Fibre	29	g
Calories	176	kCal
Protein	12	g

GGDOT

Cheese
Three slices (100g)

CO$_2$e 10 minutes driving

Emissions	1590	gCO$_2$e
Water	139	litres
Fibre	0	g
Calories	416	kCal
Protein	25	g

GGDOT

Eggs
Two eggs (100g)

CO$_2$e 3 minutes driving

Emissions	470	gCO$_2$e
Water	139	litres
Fibre	0	g
Calories	143	kCal
Protein	14	g

GGDOT

Beans
Cooked at home (200g)

CO$_2$e 1 minutes driving

Emissions	206	gCO$_2$e
Water	115	litres
Fibre	25	g
Calories	186	kCal
Protein	14	g

GGDOT

Chickpeas
From a can (200g)

CO$_2$e 2 minutes driving

Emissions	393	gCO$_2$e
Water	168	litres
Fibre	27	g
Calories	230	kCal
Protein	14	g

GGDOT

Activity #4: Climate Food Flashcards




Food	Portion	CO_2e (minutes driving)	Emissions (gCO_2e)	Water (litres)	Fibre (g)	Calories (kCal)	Protein (g)
Almonds	Handful (30g)	0.4	63	295	7	184	6
Peanut butter	Two tablespoons (30g)	0.8	126	95	5	187	7
Milk	One cup (250ml)	3	550	116	0	110	9
Oat milk	One cup (250ml)	0.7	110	111	7	148	3




Food	Portion	CO_2e (minutes driving)	Emissions (gCO_2e)	Water (litres)	Fibre (g)	Calories (kCal)	Protein (g)
Peanuts	Handful (30g)	0.6	96	95	6	181	7
Cream	Two tablespoons (28g)	0.8	137	23	0	54	1
Soy milk	One cup (250ml)	2	250	88	2	113	9
Cereal	Portion (30g) + milk (200g)	3	519	121	2	202	9

Activity #4: Climate Food Flashcards

Porridge
With 200g water

CO_2e 0.6 minutes driving

Emissions	101	gCO_2e
Water	106	litres
Fibre	6	g
Calories	110	kCal
Protein	3	g

GGDOT

Veg spread
One tablespoon (14g)

CO_2e 0.1 minutes driving

Emissions	19	gCO_2e
Water	29	litres
Fibre	0	g
Calories	77	kCal
Protein	0	g

GGDOT

Yogurt
Small pot (100g)

CO_2e 1 minutes driving

Emissions	200	gCO_2e
Water	49	litres
Fibre	0	g
Calories	97	kCal
Protein	4	g

GGDOT

Bread
Two slices (80g)

CO_2e 0.4 minutes driving

Emissions	60	gCO_2e
Water	30	litres
Fibre	6	g
Calories	190	kCal
Protein	7	g

GGDOT

Butter
One tablespoon (14g)

CO_2e 0.7 minutes driving

Emissions	116	gCO_2e
Water	34	litres
Fibre	0	g
Calories	104	kCal
Protein	0	g

GGDOT

Vegetable oil
One tablespoon (14g)

CO_2e 0.3 minutes driving

Emissions	52	gCO_2e
Water	28	litres
Fibre	0	g
Calories	126	kCal
Protein	0	g

GGDOT

Soy yogurt
Small pot (100g)

CO_2e 0.5 minutes driving

Emissions	80	gCO_2e
Water	41	litres
Fibre	3	g
Calories	45	kCal
Protein	4	g

GGDOT

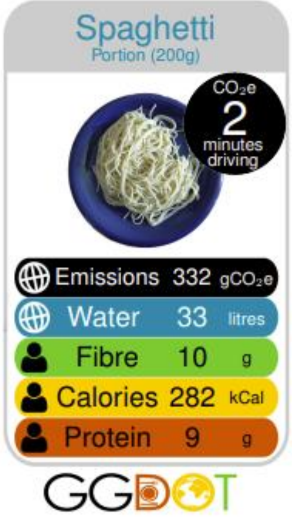
Toast
Two slices (64g)

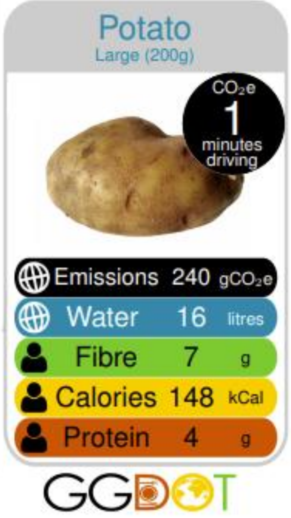
CO_2e 0.5 minutes driving

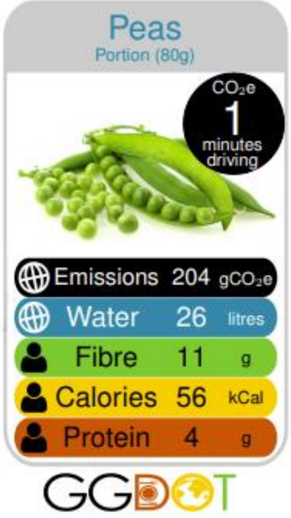
Emissions	90	gCO_2e
Water	30	litres
Fibre	5	g
Calories	190	kCal
Protein	6	g

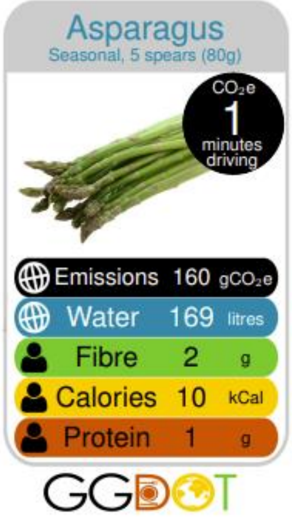
GGDOT

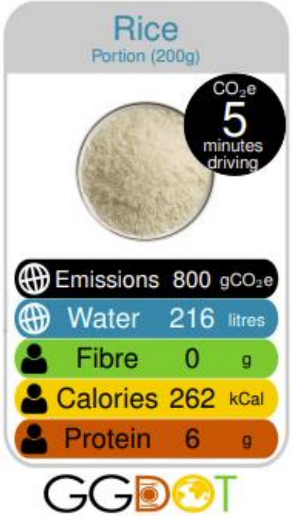
Activity #4: Climate Food Flashcards

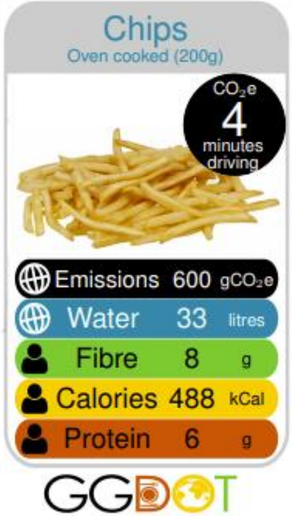


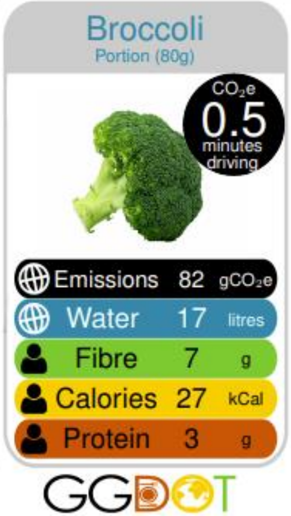


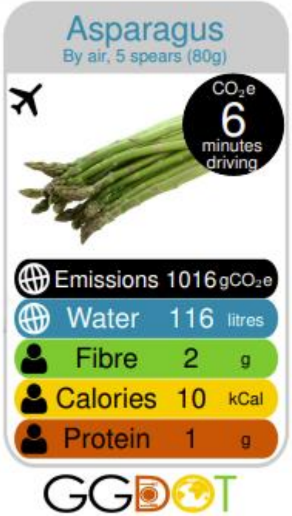












Activity #4: Climate Food Flashcards

French beans
By air (80g)

CO₂e 3 minutes driving

Emissions	477	gCO_2e
Water	26	litres
Fibre	7	g
Calories	21	kCal
Protein	2	g

GGDOT

Sweetcorn
From frozen (80g)

CO_2e 1 minutes driving

Emissions	182	gCO_2e
Water	75	litres
Fibre	7	g
Calories	54	kCal
Protein	3	g

GGDOT

Carrot
One, cooked (80g)

CO_2e 0.5 minutes driving

Emissions	90	gCO_2e
Water	2	litres
Fibre	6	g
Calories	27	kCal
Protein	0	g

GGDOT

Tomato
Seasonal, medium (80g)

CO_2e 0.1 minutes driving

Emissions	13	gCO_2e
Water	0.8	litres
Fibre	3	g
Calories	11	kCal
Protein	0	g

GGDOT

French beans
Seasonal (80g)

CO_2e 0.5 minutes driving

Emissions	88	gCO_2e
Water	26	litres
Fibre	7	g
Calories	21	kCal
Protein	2	g

GGDOT

Cabbage
Portion (80g)

CO_2e 0.3 minutes driving

Emissions	54	gCO_2e
Water	11	litres
Fibre	5	g
Calories	11	kCal
Protein	1	g

GGDOT

Tomato
Heated greenhouse (80g)

CO_2e 6 minutes driving

Emissions	1002	gCO_2e
Water	0.8	litres
Fibre	3	g
Calories	11	kCal
Protein	0	g

GGDOT

Lettuce
Seasonal (30g)

CO_2e 0.3 minutes driving

Emissions	44	gCO_2e
Water	4	litres
Fibre	1	g
Calories	3	kCal
Protein	0	g

GGDOT

Activity #4: Climate Food Flashcards

Avocado
One medium (80g)

CO₂e 1 minutes driving

Emissions	192	gCO_2e
Water	107	litres
Fibre	9	g
Calories	152	kCal
Protein	2	g

GGDOT

Banana
Small (80g)

CO_2e 0.3 minutes driving

Emissions	55	gCO_2e
Water	43	litres
Fibre	2	g
Calories	65	kCal
Protein	1	g

GGDOT

Raspberries
Seasonal, handful (80g)

CO_2e 1 minutes driving

Emissions	176	gCO_2e
Water	21	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

GGDOT

Strawberries
Seasonal, handful (80g)

CO_2e 1 minutes driving

Emissions	136	gCO_2e
Water	17	litres
Fibre	3	g
Calories	24	kCal
Protein	0	g

GGDOT

Apple
From storage, small (80g)

CO_2e 0.2 minutes driving

Emissions	40	gCO_2e
Water	35	litres
Fibre	3	g
Calories	41	kCal
Protein	0	g

GGDOT

Orange
Small (80g)

CO_2e 0.2 minutes driving

Emissions	32	gCO_2e
Water	32	litres
Fibre	5	g
Calories	29	kCal
Protein	1	g

GGDOT

Raspberries
By air, handful (80g)

CO_2e 3 minutes driving

Emissions	568	gCO_2e
Water	21	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

GGDOT

Strawberries
By air, handful (80g)

CO_2e 2 minutes driving

Emissions	408	gCO_2e
Water	14	litres
Fibre	3	g
Calories	24	kCal
Protein	0	g

GGDOT

Activity #4: Climate Food Flashcards

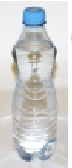
Orange juice
Small glass (200ml)

CO_2e 2 minutes driving

Emissions	400	gCO_2e
Water	146	litres
Fibre	1	g
Calories	72	kCal
Protein	2	g

GGDOT

Water
Plastic bottle (500ml)



CO_2e 0.8 minutes driving

Emissions	136	gCO_2e
Water	0.5	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

GGDOT

Sugar
One teaspoon (6g)

CO_2e 0.1 minutes driving

Emissions	15	gCO_2e
Water	6	litres
Fibre	0	g
Calories	24	kCal
Protein	0	g

GGDOT

Biscuit
One plain (13g)

CO_2e 0.1 minutes driving

Emissions	17	gCO_2e
Water	19	litres
Fibre	1	g
Calories	60	kCal
Protein	1	g

GGDOT

Tap water
Large glass (500ml)

CO_2e 0 minutes driving

Emissions	0	gCO_2e
Water	0.5	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

GGDOT

Fizzy drink
One can (330ml)

CO_2e 1 minutes driving

Emissions	158	gCO_2e
Water	50	litres
Fibre	0	g
Calories	205	kCal
Protein	0	g

GGDOT

Milk chocolate
Small bar (25g)

CO_2e 0.5 minutes driving

Emissions	88	gCO_2e
Water	182	litres
Fibre	1	g
Calories	130	kCal
Protein	2	g

GGDOT

Chocolate biscuit
One plain (13g)

CO_2e 0.1 minutes driving

Emissions	23	gCO_2e
Water	40	litres
Fibre	1	g
Calories	63	kCal
Protein	1	g

GGDOT

Activity #4: Climate Food Flashcards

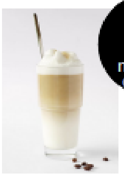
Crisps
Small packet (25g)

CO$_2$e 0.3 minutes driving

Emissions	54	gCO_2e
Water	41	litres
Fibre	4	g
Calories	123	kCal
Protein	2	g

GGDOT

Latte
With 400ml milk



CO$_2$e 6 minutes driving

Emissions	1024	gCO_2e
Water	503	litres
Fibre	0	g
Calories	176	kCal
Protein	14	g

GGDOT

Coffee
Cup, with tbsp milk

CO$_2$e 0.6 minutes driving

Emissions	96	gCO_2e
Water	39	litres
Fibre	0	g
Calories	9	kCal
Protein	1	g

GGDOT

Tea
Cup, with tbsp milk

CO$_2$e 0.6 minutes driving

Emissions	94	gCO_2e
Water	9	litres
Fibre	0	g
Calories	7	kCal
Protein	1	g

GGDOT

References

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7. Downs, A., & Acevedo, R. (2019). How our trash impacts the environment. *Earth Day.* https://www.earthday.org/how-our-trash-impacts-the-environment/.

Climate Food Flashcards can be downloaded here.

Steak
Portion, fried (100g)

CO_2e 29 minutes driving

Emissions	4723	gCO_2e
Water	668	litres
Fibre	0	g
Calories	242	kCal
Protein	30	g

GGDOT

Sausage
Two small (100g)

CO_2e 6 minutes driving

Emissions	1035	gCO_2e
Water	424	litres
Fibre	6	g
Calories	259	kCal
Protein	14	g

GGDOT

Quorn
From frozen, portion (100g)

CO_2e 2 minutes driving

Emissions	379	gCO_2e
Water	200	litres
Fibre	11	g
Calories	196	kCal
Protein	13	g

GGDOT

Cod
Portion (100g)

CO_2e 4 minutes driving

Emissions	642	gCO_2e
Water	137	litres
Fibre	0	g
Calories	198	kCal
Protein	21	g

GGDOT

Lamb
Portion (100g)

CO_2e 27 minutes driving

Emissions	4430	gCO_2e
Water	350	litres
Fibre	0	g
Calories	249	kCal
Protein	30	g

GGDOT

Veggie sausage
Two small (100g)

CO_2e 2 minutes driving

Emissions	361	gCO_2e
Water	73	litres
Fibre	3	g
Calories	247	kCal
Protein	14	g

GGDOT

Salmon
Portion (100g)

CO_2e 5 minutes driving

Emissions	879	gCO_2e
Water	290	litres
Fibre	0	g
Calories	320	kCal
Protein	22	g

GGDOT

Chicken
Portion (100g)

CO_2e 6 minutes driving

Emissions	923	gCO_2e
Water	325	litres
Fibre	0	g
Calories	240	kCal
Protein	28	g

GGDOT

Ham
Three slices (100g)

CO_2e 6 minutes driving

Emissions	1070	gCO_2e
Water	394	litres
Fibre	0	g
Calories	115	kCal
Protein	19	g

GGDOT

Pizza
Large slice (100g)

CO_2e 3 minutes driving

Emissions	477	gCO_2e
Water	108	litres
Fibre	6	g
Calories	272	kCal
Protein	12	g

GGDOT

Baked beans
From a can (200g)

CO_2e 3 minutes driving

Emissions	430	gCO_2e
Water	115	litres
Fibre	25	g
Calories	162	kCal
Protein	10	g

GGDOT

Lentils
Cooked at home (200g)

CO_2e 0.9 minutes driving

Emissions	151	gCO_2e
Water	179	litres
Fibre	29	g
Calories	176	kCal
Protein	12	g

GGDOT

Cheese
Three slices (100g)

CO_2e 10 minutes driving

Emissions	1590	gCO_2e
Water	139	litres
Fibre	0	g
Calories	416	kCal
Protein	25	g

GGDOT

Eggs
Two eggs (100g)

CO_2e 3 minutes driving

Emissions	470	gCO_2e
Water	139	litres
Fibre	0	g
Calories	143	kCal
Protein	14	g

GGDOT

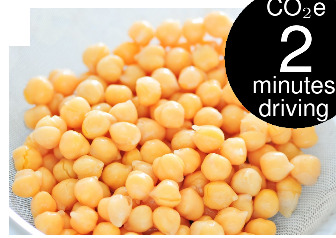
Beans
Cooked at home (200g)

CO_2e 1 minutes driving

Emissions	206	gCO_2e
Water	115	litres
Fibre	25	g
Calories	186	kCal
Protein	14	g

GGDOT

Chickpeas
From a can (200g)



CO_2e 2 minutes driving

Emissions	393	gCO_2e
Water	168	litres
Fibre	27	g
Calories	230	kCal
Protein	14	g

GGDOT

Almonds
Handful (30g)

CO_2e 0.4 minutes driving

Emissions	63	gCO_2e
Water	295	litres
Fibre	7	g
Calories	184	kCal
Protein	6	g

Peanut butter
Two tablespoons (30g)

CO_2e 0.8 minutes driving

Emissions	126	gCO_2e
Water	95	litres
Fibre	5	g
Calories	187	kCal
Protein	7	g

Milk
One cup (250ml)

CO_2e 3 minutes driving

Emissions	550	gCO_2e
Water	116	litres
Fibre	0	g
Calories	110	kCal
Protein	9	g

Oat milk
One cup (250ml)

CO_2e 0.7 minutes driving

Emissions	110	gCO_2e
Water	111	litres
Fibre	7	g
Calories	148	kCal
Protein	3	g

Peanuts
Handful (30g)

CO_2e 0.6 minutes driving

Emissions	96	gCO_2e
Water	95	litres
Fibre	6	g
Calories	181	kCal
Protein	7	g

Cream
Two tablespoons (28g)

CO_2e 0.8 minutes driving

Emissions	137	gCO_2e
Water	23	litres
Fibre	0	g
Calories	54	kCal
Protein	1	g

Soy milk
One cup (250ml)

CO_2e 2 minutes driving

Emissions	250	gCO_2e
Water	88	litres
Fibre	2	g
Calories	113	kCal
Protein	9	g

Cereal
Portion (30g) + milk (200g)

CO_2e 3 minutes driving

Emissions	519	gCO_2e
Water	121	litres
Fibre	2	g
Calories	202	kCal
Protein	9	g

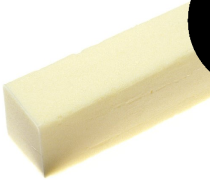
Porridge
With 200g water

CO_2e 0.6 minutes driving

Emissions	101	gCO_2e
Water	106	litres
Fibre	6	g
Calories	110	kCal
Protein	3	g

GGDOT

Veg spread
One tablespoon (14g)



CO_2e 0.1 minutes driving

Emissions	19	gCO_2e
Water	29	litres
Fibre	0	g
Calories	77	kCal
Protein	0	g

GGDOT

Yogurt
Small pot (100g)

CO_2e 1 minutes driving

Emissions	200	gCO_2e
Water	49	litres
Fibre	0	g
Calories	97	kCal
Protein	4	g

GGDOT

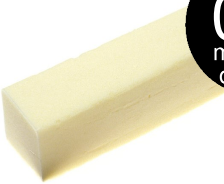
Bread
Two slices (80g)

CO_2e 0.4 minutes driving

Emissions	60	gCO_2e
Water	30	litres
Fibre	6	g
Calories	190	kCal
Protein	7	g

GGDOT

Butter
One tablespoon (14g)



CO_2e 0.7 minutes driving

Emissions	116	gCO_2e
Water	34	litres
Fibre	0	g
Calories	104	kCal
Protein	0	g

GGDOT

Vegetable oil
One tablespoon (14g)

CO_2e 0.3 minutes driving

Emissions	52	gCO_2e
Water	28	litres
Fibre	0	g
Calories	126	kCal
Protein	0	g

GGDOT

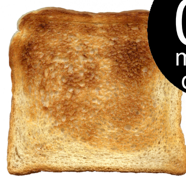
Soy yogurt
Small pot (100g)

CO_2e 0.5 minutes driving

Emissions	80	gCO_2e
Water	41	litres
Fibre	3	g
Calories	45	kCal
Protein	4	g

GGDOT

Toast
Two slices (64g)



CO_2e 0.5 minutes driving

Emissions	90	gCO_2e
Water	30	litres
Fibre	5	g
Calories	190	kCal
Protein	6	g

GGDOT

Spaghetti
Portion (200g)

CO_2e 2 minutes driving

Emissions	332	gCO_2e
Water	33	litres
Fibre	10	g
Calories	282	kCal
Protein	9	g

GGDOT

Potato
Large (200g)

CO_2e 1 minutes driving

Emissions	240	gCO_2e
Water	16	litres
Fibre	7	g
Calories	148	kCal
Protein	4	g

GGDOT

Peas
Portion (80g)

CO_2e 1 minutes driving

Emissions	204	gCO_2e
Water	26	litres
Fibre	11	g
Calories	56	kCal
Protein	4	g

GGDOT

Asparagus
Seasonal, 5 spears (80g)

CO_2e 1 minutes driving

Emissions	160	gCO_2e
Water	169	litres
Fibre	2	g
Calories	10	kCal
Protein	1	g

GGDOT

Rice
Portion (200g)

CO_2e 5 minutes driving

Emissions	800	gCO_2e
Water	216	litres
Fibre	0	g
Calories	262	kCal
Protein	6	g

GGDOT

Chips
Oven cooked (200g)

CO_2e 4 minutes driving

Emissions	600	gCO_2e
Water	33	litres
Fibre	8	g
Calories	488	kCal
Protein	6	g

GGDOT

Broccoli
Portion (80g)

CO_2e 0.5 minutes driving

Emissions	82	gCO_2e
Water	17	litres
Fibre	7	g
Calories	27	kCal
Protein	3	g

GGDOT

Asparagus
By air, 5 spears (80g)

CO_2e 6 minutes driving

Emissions	1016	gCO_2e
Water	116	litres
Fibre	2	g
Calories	10	kCal
Protein	1	g

GGDOT

French beans
By air (80g)

CO_2e 3 minutes driving

Emissions	477	gCO_2e
Water	26	litres
Fibre	7	g
Calories	21	kCal
Protein	2	g

GGDOT

Sweetcorn
From frozen (80g)

CO_2e 1 minutes driving

Emissions	182	gCO_2e
Water	75	litres
Fibre	7	g
Calories	54	kCal
Protein	3	g

GGDOT

Carrot
One, cooked (80g)

CO_2e 0.5 minutes driving

Emissions	90	gCO_2e
Water	2	litres
Fibre	6	g
Calories	27	kCal
Protein	0	g

GGDOT

Tomato
Seasonal, medium (80g)

CO_2e 0.1 minutes driving

Emissions	13	gCO_2e
Water	0.8	litres
Fibre	3	g
Calories	11	kCal
Protein	0	g

GGDOT

French beans
Seasonal (80g)

CO_2e 0.5 minutes driving

Emissions	88	gCO_2e
Water	26	litres
Fibre	7	g
Calories	21	kCal
Protein	2	g

GGDOT

Cabbage
Portion (80g)

CO_2e 0.3 minutes driving

Emissions	54	gCO_2e
Water	11	litres
Fibre	5	g
Calories	11	kCal
Protein	1	g

GGDOT

Tomato
Heated greenhouse (80g)

CO_2e 6 minutes driving

Emissions	1002	gCO_2e
Water	0.8	litres
Fibre	3	g
Calories	11	kCal
Protein	0	g

GGDOT

Lettuce
Seasonal (30g)

CO_2e 0.3 minutes driving

Emissions	44	gCO_2e
Water	4	litres
Fibre	1	g
Calories	3	kCal
Protein	0	g

GGDOT

Avocado
One medium (80g)

CO_2e 1 minutes driving

Emissions	192	gCO_2e
Water	107	litres
Fibre	9	g
Calories	152	kCal
Protein	2	g

Banana
Small (80g)

CO_2e 0.3 minutes driving

Emissions	55	gCO_2e
Water	43	litres
Fibre	2	g
Calories	65	kCal
Protein	1	g

Raspberries
Seasonal, handful (80g)

CO_2e 1 minutes driving

Emissions	176	gCO_2e
Water	21	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

Strawberries
Seasonal, handful (80g)

CO_2e 1 minutes driving

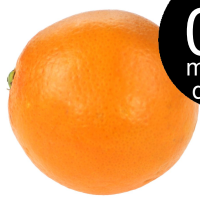
Emissions	136	gCO_2e
Water	17	litres
Fibre	3	g
Calories	24	kCal
Protein	0	g

Apple
From storage, small (80g)

CO_2e 0.2 minutes driving

Emissions	40	gCO_2e
Water	35	litres
Fibre	3	g
Calories	41	kCal
Protein	0	g

Orange
Small (80g)



CO_2e 0.2 minutes driving

Emissions	32	gCO_2e
Water	32	litres
Fibre	5	g
Calories	29	kCal
Protein	1	g

Raspberries
By air, handful (80g)

CO_2e 3 minutes driving

Emissions	568	gCO_2e
Water	21	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

Strawberries
By air, handful (80g)

CO_2e 2 minutes driving

Emissions	408	gCO_2e
Water	14	litres
Fibre	3	g
Calories	24	kCal
Protein	0	g

Orange juice
Small glass (200ml)

CO_2e **2** minutes driving

Emissions	400	gCO_2e
Water	146	litres
Fibre	1	g
Calories	72	kCal
Protein	2	g

GGDOT

Water
Plastic bottle (500ml)

CO_2e **0.8** minutes driving

Emissions	136	gCO_2e
Water	0.5	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

GGDOT

Sugar
One teaspoon (6g)

CO_2e **0.1** minutes driving

Emissions	15	gCO_2e
Water	6	litres
Fibre	0	g
Calories	24	kCal
Protein	0	g

GGDOT

Biscuit
One plain (13g)

CO_2e **0.1** minutes driving

Emissions	17	gCO_2e
Water	19	litres
Fibre	1	g
Calories	60	kCal
Protein	1	g

GGDOT

Tap water
Large glass (500ml)

CO_2e **0** minutes driving

Emissions	0	gCO_2e
Water	0.5	litres
Fibre	0	g
Calories	0	kCal
Protein	0	g

GGDOT

Fizzy drink
One can (330ml)

CO_2e **1** minutes driving

Emissions	158	gCO_2e
Water	50	litres
Fibre	0	g
Calories	205	kCal
Protein	0	g

GGDOT

Milk chocolate
Small bar (25g)

CO_2e **0.5** minutes driving

Emissions	88	gCO_2e
Water	182	litres
Fibre	1	g
Calories	130	kCal
Protein	2	g

GGDOT

Chocolate biscuit
One plain (13g)

CO_2e **0.1** minutes driving

Emissions	23	gCO_2e
Water	40	litres
Fibre	1	g
Calories	63	kCal
Protein	1	g

GGDOT

Crisps
Small packet (25g)

CO_2e **0.3** minutes driving

Emissions	54	gCO_2e
Water	41	litres
Fibre	4	g
Calories	123	kCal
Protein	2	g

GGDOT

Latte
With 400ml milk

CO_2e **6** minutes driving

Emissions	1024	gCO_2e
Water	503	litres
Fibre	0	g
Calories	176	kCal
Protein	14	g

GGDOT

Coffee
Cup, with tbsp milk

CO_2e **0.6** minutes driving

Emissions	96	gCO_2e
Water	39	litres
Fibre	0	g
Calories	9	kCal
Protein	1	g

GGDOT

Tea
Cup, with tbsp milk

CO_2e **0.6** minutes driving

Emissions	94	gCO_2e
Water	9	litres
Fibre	0	g
Calories	7	kCal
Protein	1	g

GGDOT

Food Up!
URBAN AG CURRICULUM

Module 8: Mental Health and Urban Agriculture

Goals and Objectives:

Nature-deficit disorders, defined as health disorders caused by decreased access to nature and the outdoors, can include ADHD, stress, anxiety, and depression.[1] These disorders can occur in children as a result of little to no connection to nature.[1] Children that live in cities experience more nature-deficit disorders because they grow up in areas that have low biodiversity and don't get the same exposure to nature as other children.[1] Beyond these negative health outcomes, children that grow up without exposure to nature may begin to fear it and will ultimately care less about protecting the environment.[1] Gardening or interacting with nature is a great way for children to prevent or combat nature-deficit disorders.

In this module, students will learn about their emotions and understand how emotions change without a connection to nature. Students will also explore mindfulness techniques practiced in nature or the garden to understand how their emotions and feelings change when they get outside. Students will reflect on their experiences within nature and the impacts on their mental health. Lastly, students will learn about the various aspects of healing gardens and gain an understanding of plants that promote healing.

Time: 1 hour 30 minutes – 2 hours

Materials:

- ☐ Paper (for Activity #1 and Activity #3)
- ☐ Pencils
- ☐ Colored pencils or crayons
- ☐ Module 8 Student Handouts
- ☐ Whiteboard and markers

Teacher Background:

Gardening and interacting with nature can be beneficial to one's mental health. Gardening is enjoyable for many people because it provides stress relief while also increasing social interactions.[2] Green care therapy, prescribed by doctors, involves intentional exposure to nature to improve mental health. Studies have demonstrated that hospital patients or those experiencing mental health struggles improve when they have some sort of interaction with nature, be it via gardening or walking outside.[3] One study, performed in Japan, found that looking at plants changed EEG readings and demonstrated reductions in stress, depression, and other negative emotions.[3]

Gardening is beneficial to a person's overall health for several reasons. First, the physical requirements in the garden can improve a person's strength, agility, or aerobic abilities especially if a person is recovering from an illness.[3] Second, community or school gardens can help children to come out of social isolation if they have poor mental health or a learning disability.[3] Additionally, gardening can help a child develop better self-esteem. They can witness their accomplishments from their hard work of growing a seed into a plant, or even into a food on their plate.[4]

Opening Discussion:

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

- *What do you enjoy about nature?*
- *How do you feel when you are outside? Do you feel differently if you are outside in a parking lot versus outside in a forest or park?*
- *Do you ever feel anxious or unhappy if you have not been outside or connected with nature in a while?*
- *Can you describe some of the negative emotions you may feel?*

Activity #1: Nonviolent Communication

Time: 15 minutes

Materials:

☐ Paper and Pencils
☐ Whiteboard and markers

Teacher Background

Nonviolent communication (NVC) is a method that will help students to understand their feelings and express themselves more clearly.[4] NVC can help children and teens learn how to communicate effectively and develop improved self-awareness.[4] This form of communication helps people to become more aware of their feelings so that they can communicate deeply with others. In return, the hope is that student's peers will respond in a deeper, more empathetic way. Read this optional article to learn more about NVC.

Lesson:

1. Ask students to think about a time when they did not connect with nature for a while and list one of the negative feelings that they had. Here are a few examples to get the conversation started:
    - *During winter when you cannot go outside for a long time, how does that make you feel?*
    - *If you are sick and can't go outside, how do you feel?*

2. Ask students to answer these questions on a piece of paper individually about the distinct feeling they had after they did not connect with nature.
    - *What was the situation you were in when the feeling occurred?*
    - *What was the distinct emotion that you felt?*
    - *What was causing the emotion?*

3. Write out each of the following questions on a whiteboard individually and then ask students to answer the questions. Write some of the answers on the board.
    - *When you have a negative feeling do you ever blame yourself?*
    - *When you have a negative feeling do you blame others?*
    - *Instead of placing blame, how can you see your own feelings and needs?*
    - *How can you see others' feelings and needs?*

Activity #2: Mindfulness in the Garden

Time: 15-30 minutes

Materials:

☐ Outside environment or garden

Prep

☐ Think of additional mindfulness questions to ask students
☐ Choose an outside environment for students to complete the activity

Lesson:

1. Ask students to compare their emotions when they are inside and outside. In the classroom, have students sit facing a wall without windows silently for 5 minutes.
   - *Describe how you felt when you were inside.*

2. Outside, ask students to sit silently for another 5 minutes.
   - *Describe how you felt when you were outside.*
   - *Was it more difficult to sit silently inside than outside?*

3. Ask the students to select an outdoor area to observe in the garden or in a park. Next, have the students individually and silently observe their surroundings and the environment for a few minutes.

4. Ask the students a few guiding questions while they are making their observations. Allow them time to think about each question.
   - *What do you feel?*
   - *What do you hear?*
   - *What do you smell?*
   - *What do you see?*
   - *What colors do you see?*
   - *Choose your favorite plant and observe its colors, shapes, smells, etc.*

5. Give the students some time to reflect silently on their own. Then, discuss with the students some of their observations.
   - *How did you feel before the exercise compared to after the exercise?*
   - *What things stood out to you in the garden or outside environment?*
   - *Did you observe any changes to the environment during the exercise?*

Activity #3: Healing Garden

Time: 30+ minutes

Materials:

☐ Colored pencils or crayons
☐ Paper for the students to color on
☐ Student Handouts
  ☐ Activity #3 Healing Garden Descriptions (page 1)

Teacher Background

Healing gardens are designed to purposefully benefit the people that are interacting with the garden. A healing garden may include medicinal plants that help to combat anxiety or other disorders.[5] Additionally, healing gardens may include sensory plants, or aspects to promote physical activity.[5]

Prep:

☐ Print out Activity #3: Healing Garden Aspects List on page 1 in the Student Handouts.

Lesson:

1. In this activity, the students will be creating sketches of their dream healing garden.

2. Teachers will introduce students to the many different aspects of the healing garden and their important benefits.

    - Sensory plants can be included in the garden to stimulate all the senses and comfort those who need healing.

    - See Student Handout (page 1) to learn more about sensory plants.

    - Plants that attract wildlife will engage those who need healing and can help children learn more about different animals.

    - Digging beds allow children to become more active so that they can relax their mind and have fun digging.

    - Sitting areas can provide children with a space to socially engage with their peers while they are outside.

3. Ask the students questions about what they want to include in their garden.
    - *What do you want the healing garden to help you with?*
    - *What do you want to do in your dream healing garden?*
    - *Do you want your plants to produce food?*
    - *Do you want plants that have vibrant colors or smell good?*
    - *Do you want plants that attract animals or bugs?*
4. Give students paper and colored pencils to draw some aspects of the healing garden that they would like to create.
5. Have students discuss with each other in small groups the reasons they chose to include each aspect of the healing garden.

Activity #4: Healing Garden Matching Game

Time: 15 minutes

Materials:

- ☐ Student Handouts
    - ☐ Activity #4 Matching Cards (pages 3-5)
- ☐ Scissors

Prep:

☐ Cut out matching cards on pages 3-5 in the Student Handouts.

Lesson:

1. Students will demonstrate what they have learned about healing gardens and their benefits with this fun matching game. Once the cards are printed and cut out, allow students to work in pairs or independently to determine which picture matches the description of the aspect within the healing garden.
.
2. Once the students complete the activity, read each of the descriptions and call on one student to provide the correct answer to the matching game.

Connecting to the Garden

Time: variable, 15+ minutes

Lesson:

1. In this part of the lesson, choose a garden in the community or at school to allow students to reflect on what they have learned about healing gardens in the previous two lessons.

2. Ask students to observe some of the brightly colored plants in the garden.

   - *How do colorful plants make you feel?*
   - *Why are colorful plants important in a healing garden?*

3. Ask students to look for plants that smell good or are fun to touch.

4. Have students search for some plants that are attracting bees or butterflies.

   - *Do these plants have bright colors?*
   - *Do these plants smell good?*
   - *How does it make you feel to see butterflies and bees interacting with the plants?*

5. Search for a place in the garden that can promote physical activity. Physical activity is great for mental health and gardening requires some physical activity.

   - *Is there a place where people can dig in the dirt? Does the garden have space for walking or moving around?*
   - *Why is physical activity important for mental health?*
   - *How does physical activity make you feel afterwards?*

6. Planting food crops is a great way to improve mental health because it gets rid of a lot of worry surrounding food insecurity. Adding food crops to the garden can help students to understand that they can become more independent from needing to purchase food.

   - *Would you include food crops in your healing garden?*

- *What do you think are some of the ways that adding food crops to a healing garden can help to improve mental health?*
  Examples:
  - Decreases stress about where to obtain food.
  - Improve independence and autonomy.

7. End the activity with a short discussion about the importance of a healing garden.

   - *What are some the benefits that healing gardens provide?*

   - *Why is it important to include some of the healing garden aspects into a regular garden?*

Closing Discussion:

Finish the lesson with a discussion to make sure that the students can tie all activities together from this module.

- *How can you spend more time with nature and in the garden? Do you think this would improve your mental health?*

- *Did the mindfulness activity help you to feel better afterwards?*

- *Which part of the healing garden was your favorite to learn about?*

References:

1. Hand, Kathryn L., et al. “The Importance of Urban Gardens in Supporting Children's Biophilia.” *Proceedings of the National Academy of Sciences*, vol. 114, no. 2, 27 Dec. 2016, pp. 274–279., https://doi.org/10.1073/pnas.1609588114.
2. Dooley, Emily C. “People Turned to Gardening for Stress Relief, Food Access during Pandemic.” *College of Agricultural and Environmental Sciences*, 17 Mar. 2022, https://caes.ucdavis.edu/news/people-turned-gardening-stress-relief-food-access-during-pandemic.
3. Thompson, Richard. “Gardening for Health: A Regular Dose of Gardening.” *Clinical Medicine*, vol. 18, no. 3, June 2018, pp. 201–205., https://doi.org/10.7861/clinmedicine.18-3-201.
4. “Nonviolent Communication (NVC).” *Therapy for Nonviolent Communication, Therapist for Nonviolent Communication*, GoodTherapy, 3 Aug. 2018, https://www.goodtherapy.org/learn-about-therapy/types/non-violent-communication.
5. “Design a Healing Garden.” *KidsGardening*, 13 Dec. 2021, https://kidsgardening.org/resources/garden-activities-design-a-healing-garden/.

Activity 1:

Adapted from: “Applicable Activities for NVC.” *Nonviolent Communication*, https://users.pfw.edu/lind/activities.html.

Activity 2:

Adapted from: “Mindfulness in the Garden.” *KidsGardening*, 4 May 2022, https://kidsgardening.org/resources/garden-activities-mindfulness/.

Activity 3:

Adapted from: “Design a Healing Garden.” *KidsGardening*, 13 Dec. 2021, https://kidsgardening.org/resources/garden-activities-design-a-healing-garden/.

Activity 4:

Adapted from: “Design a Healing Garden.” *KidsGardening*, 13 Dec. 2021, https://kidsgardening.org/resources/garden-activities-design-a-healing-garden/.

“Sensory Garden Plants.” *KidsGardening*, 22 June 2022, https://kidsgardening.org/resources/growing-guide-sensory-garden-plants/.

“7 Design Elements of a Healing Garden.” *Frontier Landscaping*, 28 Apr. 2023, https://frontierlandscaping.com/seven-design-elements-of-a-healing-garden/.

Mental Health and Urban Agriculture

Module 8
Student Handouts

Instructions: It is easiest to print this document **double-sided**. Print 1 copy for every 2 students in your class.

Food Up!

Activity #3: Healing Garden Aspects List

Digging Bed An empty digging bed to dig can get your body moving and decrease stress.	**Sensory Plants** Plants that stimulate the five senses of touch, taste, smell, and hearing help to connect with nature.	**Colorful Plants** Colors make people feel happiness, excitement, and joy.
Plants to Attract Wildlife Bees and butterflies are exciting to see in the garden interacting with plants.	**Gifts from the Garden** It’s fun and rewarding to be able to give someone a present that you made yourself.	**Water Features** Water is beautiful to look at and fountains promote a sense of calm.
Plants with Healing Properties Plants such as chamomile or lavender are great ways to relieve stress.	**Seating Area** Social interaction is important for mental health and a seating area can help people to connect with each other	**Welcoming Environment** It’s important that everyone in the healing garden is accepted and treated equally.

Food Up!

Activity #4: Matching Cards: Description

Staying active is a great way to improve mental health. This section of the garden is left unplanted to allow physical exercise in the form of digging!

Many plants have properties like sweetness or color to make them appealing to other species. These species are exciting for people to see!

Lamb’s ear’s fuzzy surface is fun to touch while basil and mint are fun to smell! Stevia can also be tasted! What are these plants examples of?

This part of the healing garden can help people to feel relaxed and calm because of the soothing noises it creates.

Lavender can be used to relieve sadness while chamomile has properties that relieve stress.

Beautiful colors can cause happiness and improve mental health.

Food Up!

Activity #4: Matching Cards: Pictures

Digging Bed 	**Bees and Butterflies** 	**Sensory Plants** 
Water Features 	**Plants with Healing Properties** 	**Colorful Plants** 

Food Up!
URBAN AG CURRICULUM

Module 9: The Value Within Our Food

Goals and Objectives:

Students will explore the value of food and the ramifications of food loss and waste, particularly regarding consumer-based responsibility. Students will learn of the global burden of food loss and waste and how it interrelates to the food supply chain. Students will brainstorm preventative solutions of all scales at each step of the food supply chain, as well as what they themselves can do to make a difference. Students will discover the hidden resources that are discarded as waste and will engage in critical thinking regarding the essential inputs required for food production and the extent of loss resulting from food waste. To help students apply their knowledge, this lesson concludes with an activity for students to reflect on messaging strategies and design their own poster to guide consumer behavior.

Time: 1 hour 15 minutes

Optional additional activities: 60 minutes

Materials:

- ☐ Module 9 Teacher Print Kit
- ☐ Module 9 Student Handouts
- ☐ Scissors
- ☐ Whiteboard and markers (or large sheet of paper and markers)
- ☐ Pens OR pencils
- ☐ Printer Paper
- ☐ Tape OR 24 magnets
- ☐ 5 clear jars OR cups
- ☐ Multicolor Pom Poms of Assorted Sizes

Optional:

- ☐ post-It notes
- ☐ Projector
- ☐ Technology to play a video

Teacher Background:

Everything from biodiversity loss, economic inequities, emerging infectious diseases, and intensification of climate-related disasters have been driven by unsustainable and wasteful food systems. From the production to processing to packaging, the food chain requires substantial demands of resources and energy. When food is wasted, all the resources—water, fertilizer, energy, and labor—and the environmental costs—greenhouse gas emissions, soil erosion, and water pollution— are also wasted. Worldwide, 1.3 billion tons of food is tossed out every year, including 45 trillion gallons of water, which translates to 25% of our total freshwater supply.[1] These 1.3 billion tons of food wastage is enough to feed every hungry person in the world more than twice over. To be exact, it would only take recovering 25% of our food that is currently lost or wasted to end world hunger.[2]

The United States is the leading country in food waste, with approximately 40% of edible and nutritive food produced never eaten. The average American household tosses out 25% of purchased food from spoilage, over-prepping, over-purchasing, as well as misinformation on date labeling.[3] Within that 40% of food never eaten, the amount of energy that is lost is enough to power more than 50 million homes. Additionally, the greenhouse gas emissions stemming from unconsumed food equates to the emissions of 37 million cars, or more than 42 coal-fired power plants. This impact accounts for approximately 10% of global greenhouse gas emissions.[4]

The environmental footprint of food loss and waste in the United States alone encompasses an area of agricultural land equivalent to the combined size of California and New York, which is approximately 140 million acres. This represents nearly 30% of the agricultural land dedicated to producing food that ultimately goes unconsumed.[5]

However, there are great differences between where and how food is lost between low-income and high-income countries. In low-income countries, 40% of the food that is grown is lost from environmental consequences and inadequate resources. Inadequate refrigeration storage poses a risk to crops, making them susceptible to pests and diseases. Additionally, transportation timelines and access to markets are hindered by limited road infrastructure.[6] Furthermore, the shifting climate has led to a significant rise in extreme weather events, causing widespread crop destruction and hindering harvesting opportunities. However, there is also an economic factor at play.
Many small farms cannot afford high labor costs, making it financially challenging to harvest the crops they have cultivated. Moreover, if market prices are low, the labor investment required to gather the crops may not be worthwhile.[7]

All efforts to recover food loss, specifically in low-income countries, will have secondary impacts on reducing malnutrition, hunger, poverty, carbon emissions, and water shortages.

Opening Discussion:

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

- *The United States wastes about 1/3 of their total edible food. Why do we think that the U.S. tosses out so much food?*
    - *In terms of food waste, do you think that we differ from other countries?*
- *Why do you think wasting food is so common?*
- *What resources are in our food that we are also throwing away?*
- *What are some benefits to reducing our food waste?*

Activity #1: Food Waste vs. Food Loss

Time: 30 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Includes: Answer Key – Food Waste (page 1-2)
- ☐ Student Handouts
    - ☐ Includes: Food Waste versus Food Loss (page 1, print 1 for every 2-3 students)
    - ☐ Includes: Food Supply Chain Cards (Cut out; page 2)
    - ☐ Includes: Food Loss and Food Waste Cards (Cut out; page 4-7)
- ☐ Scissors
- ☐ Whiteboard or large piece of paper with markers
- ☐ Tape or 24 Magnets

Prep: Cut out the Food Supply Chain Cards (page 2) and the Food Loss and Waste Cards (pages 4-7) from the Student Handouts.

Lesson:

1. Hand out the Food Supply Chain Cards (page 2) and the Food Loss and Waste Cards (pages 4-7), giving only one card to each student.
2. On the whiteboard or large piece of paper, create a T-chart with one side labelled as "food waste" and the other side labelled as "food loss."
3. Ask your students; Does anyone want to share what they know about food waste versus food loss?
4. Display or handout the "What is Food Waste and How does it differ from Food Loss?" on page 1 of the Student Handouts to review the definitions. As a class, hypothesize where food loss and food waste are represented on the food supply chain.
5. Start with the Food Supply Chain Cards, having each student take their turn to place the card under either the "food waste" or "food loss" categories, using either magnets or tape. Ask each student to explain why they are placing their card under the chosen category. (Make sure that each of the cards has room in between for the placement of the Food Loss and Waste Cards.)
6. Now ask the students with the Food Loss and Waste Cards to place their card, one at a time, near the part of the food chain they think it belongs to. Ask each student to explain why they are placing the card there.
7. Check the answers via the Answer Key on pages 1-2 in the Teacher Print Kit.
8. Looking at the T-chart, discuss:

- *Where do you think food waste is most prevalent in the world? What about food loss?*
    - *Why do we think this is?*
- Brainstorm solutions together for reducing food waste and loss at each step of the food supply chain.
    - Examples:
        - **Production:** Increase investment in developing countries for lowering post-harvest losses, increase crop protection, expand markets
        - **Storage:** Improving storage to maintain freshness and protect food from pests, improve safe and hygienic food handling practice.
        - **Processing and Packaging:** Increasing quality of protective material, reduce portion sizes, re-design date labels.
        - **Distribution and Marketing:** Improve transportation infrastructure, increase educational awareness on food date labeling and proper storage practices, redistribute unsold food via donating.
        - **Consumption:** Purchase and use ‘ugly’ foods, save and eat leftovers, plan meals, prepare a shopping list, increase public awareness on food waste.

Activity #2: Discovering the True Costs

Time: 30 minutes

Materials:

- ☐ Teacher Print Kit
    - ☐ Includes: Answer Key (page 3)
- ☐ Student Handouts
    - ☐ Includes: The Hidden Waste Worksheets (pages 10-19)
    - ☐ Includes: Figure Legend (page 20). Print 1 copy for every 2-3 students.
- ☐ Scissors
- ☐ Pens/pencils
- ☐ Multicolor Pom Poms of Assorted Sizes →
- ☐ Scotch tape OR post-It notes
- ☐ 5 clear jars OR cups

Optional:

- ☐ Projector
- ☐ Student Handouts: "How Much Goes into Our Food?" (pages 8-9)

Prep: Print out one copy of each of the Hidden Waste Worksheets (pages 10-19) in the Student Handouts, as well as the Figure Legend (page 20).

Lesson:

1. Place your students into 5 groups, with at least 2 in each group. (If you have a small number of students, you may choose to not use one of the worksheets and make 4 different groups).

2. Set up 5 jars, labelled with either scotch tape or a post-It for each food item: Bread, Beef, Cheese, Milk, Chocolate. Place the jars either at the front of the room, or in front of each group.

3. Give each group at least 6 small purple pompoms, 8 large purple pompoms, 3 small blue pompoms, 12 large blue pompoms, 4 small yellow pompoms, 26 large yellow pompoms, 2 small green pompoms, and 18 large green pompoms. Please note that the colors for each category – carbon dioxide, water, energy, and land – do not have to be these exact colors.

4. Explain that, *as a group, you have all been assigned a different food item. Together, you will place the amount of each resource you believe it takes to produce that food item in the appropriate jar. Make sure to work as a team, brainstorming how much goes into each food, from the farm to the table.* Give each group around 10-15 minutes to decide their resources and ask them to record their guesses on the Hidden Waste Worksheets.
   - **Optional:** Hand each group a copy of "How Much Goes into Our Food?" on pages 8-9 from the Student Handouts. Students may use these graphs for a better estimation of how much resources their assigned food item takes.

5. Have the class come back together into one large group. Collect all the jars and place them all together on a table. Ask the class, *what other resources have we not added to the jar?* Write down each mentioned resource on a piece of paper and add it to the respective jar.
   - Examples: Labor/Work, Fertilizer, feed, capital, soil, packaging, processing, plastics, transportation, storage, etc.

6. Reveal the correct number of resources for each food item (Answer Key on page 3 in the Teacher's Print Kit) as you discuss the contents of each jar. Add more pompoms to the jar if the current amount is not accurate to the food item. Have students record the accurate number for them to compare with their predicted value.

7. Discuss as a class, *what other components—not necessarily visible resources—are also wasted when we toss aside edible food?*
   - Examples: environmental degradation (soil erosion, air pollution, rising temperatures), labor rights and treatment, global trade, etc.

Connecting to the Garden

Time: 15 minutes

Materials:

- ☐ Student Handout
  - ☐ The Food Waste Pyramid (page 21). Print 1 copy to every 2-3 students.
- ☐ Teacher Print Kit
  - ☐ Includes: The Food Waste Pyramid (page 4).

Lesson:

1. Optional: Start with the class watching *food wastage footprint*. *Make sure to pay attention to the solutions throughout the video.*

2. Pass out one copy of the "Food Waste Pyramid" to every 2-3 students. Go through each of the stages together. If the class has watched the video, ask *what solutions did we hear throughout the video, and what stage would they belong to on the pyramid?*
   a. Reference page 4 of the Teacher Print Kit for the solutions and correlating pyramid section.

3. Walk through the garden and ask students to identify what scraps or produce they see that might belong on the pyramid.
   a. Example: Students may see some "ugly" or bruised produce. To reduce the chance that the produce will go straight to the landfill, students may suggest reducing the selling price, donating the produce to a food pantry, or repurposing it for animal feed. These examples would belong on the prevention side of the pyramid.
   b. Example: Students may see crops that have been broken or damaged from extreme weather, or maybe contaminated via insects. They identify this as food loss and may propose solutions like creating a greenhouse or investing in storage technology.

4. Wrap up the activity by asking students, *what are some solutions for preventing food loss and waste in our garden?*

Optional Activity #3: Messaging the Value

Time: 40 minutes

Materials:

- ☐ Student Handout
    - ☐ Includes: Food Facts! (page 22). Print 1 copy for every 2-3 students.
- ☐ Blank notebook paper OR poster paper
- ☐ Pens, colored pencils AND/OR markers

Optional:

- ☐ Projector

Lesson:

1. Pass out blank paper to each student. If poster paper is available, give one poster to a group of 2-3 students.

2. Give one copy of “Food Facts!” on page 22 of the Student Handout to every 2-3 students, as an information source. (You may also project the handout instead of printing it out.)

3. Ask each group to think of how they would like to convey what they have learned to their school and classmates. *How would you communicate the value of food? What messages might be most impactful to your classmates?* Students are not limited to designing a poster exclusively on consumer behavior or waste. Throughout the module, we have discussed food loss, the food supply chain, and disparities between countries.

4. Give the class 30 minutes to work on their poster. If your students are in groups, ask each group to briefly present their poster and messaging strategy.

5. If allowed, hang the posters around the classroom or school. You may want to end this lesson by reflecting on current student food waste and consumption behavior at school. Ask the class to reflect on the wastefulness or sustainability of school lunches.

    - *How much of the cafeteria food is packaged in plastic and/or processed?*
    - *Do many students finish their tray? How often do you witness food being tossed out? What are some reasons for this and solutions?*

Optional Activity #4: Exploring Our Plate

Time: 20 minutes; 10 minutes of class time, 10 minutes of out-of-class work

Materials:

- ☐ Pens/pencils
- ☐ Student Handout
    - ☐ Exploring Our Plate Worksheet (Page 24). Print 1 copy for every student.

Lesson:

1. Pass out the “Exploring Our Plate” activity sheet to each student. In the activity, students will complete the activity sheet during their lunch time.

2. Read aloud the three worksheet questions: *How many food items were wrapped in plastic packaging? How much food was left on your plate? How much of your meal came from other countries?* Explain that plastic packaging could include saran wrap, a carton, a plastic bag, etc.

3. Prompt students to think about where their food came from. If their food was produced by a large company, ask students to explore if these companies have human rights, anti-discrimination, or equitable policies and practices. *Remember that food items are not simply nutrition, or edible items. Food carries the air, water, land, and energy that created it. Food also carries the labor and treatment of humans, the environmental degradation, the transportation, storage, and all the steps it took from harvesting to your plate.*

4. After completion of the activity, open the floor for students to reflect and comment on their experience. *What have you learned? How will your experience impact your eating behaviors?*

Closing Discussion:

You may wish to help the students connect the dots in this lesson using a brief closing comment, such as the one below.

Lastly, discuss the following.

- *What makes you throw away food? What can you to do reduce your food waste?*
- *How does the global food chain and food system relate to food waste and sustainability?*
- *How is food waste related to climate change and our environment?*
- *What do you think are some misconceptions about food waste and sustainability? How should we address these?*
- *Why is there a difference in food waste between countries? In what ways is this political?*
- *How can food waste be a human rights issue?*
    a. Example: When we purchase food, we are giving money to support the producers. Our supermarkets are filled with food from large corporations, some with unjust worker's rights and discrimination cases. When we throw away that food, we are also disregarding the labor efforts, and treatment of the labor force.

References:

1. (2022). Food waste = Water waste. *Life Foster.* https://www.lifefoster.eu/food_waste_water_waste/
2. Robinson, D. (2022, December 2). 25 shocking facts about food waste. *Earth.Org.* https://earth.org/facts-about-food-waste/#:~:text=If%2025%25%20of%20the%20food,million%20people%20around%20the%20world.
3. (2023). Wasted food facts. *Stop Waste.* https://www.stopwaste.org/at-home/reducing-wasted-food/wasted-food-facts.
4. (n.d.) Global food waste facts. *OZ Harvest.* https://www.ozharvest.org/food-waste-facts/
5. Jaglo, K., Kenny, S., & Stephenson, J. (2021). From farm to kitchen: The environmental impacts of U.S. food waste. *U.S. Environmental Protection Agency Office of Research and Development.* https://www.epa.gov/system/files/documents/2021-11/from-farm-to-kitchen-the-environmental-impacts-of-u.s.-food-waste_508-tagged.pdf
6. Malhotra, S. (2019). Measuring and reducing food loss in developing countries. *International Food Policy Research Institute.* https://www.ifpri.org/blog/measuring-and-reducing-food-loss-developing-countries

Connecting to the Garden

Food and Agriculture Organization of the United Nations. (2013, September 11). *Food wastage footprint* [Video]. Youtube. https://www.youtube.com/watch?v=IoCVrkcaH6Q

Optional Activity #4: Exploring Our Plate

Adapted from “Every plate tells a story,” by World’s Largest Lesson. https://worldslargestlesson.globalgoals.org/resource/plate-pioneerz-every-plate-tells-a-story/.

The Value Within Our Food

Module 9
Teacher Print Kit

Instructions: Print one copy of this document as a reference *for the Teacher.* You can print double- or single-sided.

Food Up!

Activity #1 Answer Key: Food Loss

Production

Drought or Storm impacting food yields

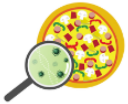
Pests feed off of crops and harvest

Crop loss due to lack of access to technology

Food becomes unprofitable to sell and is not harvested or delivered

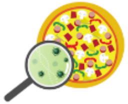
Storage

Crops spoiled due to inadequate storage



Food contaminated from bacterial exposure when poorly handled

Distribution



Food contaminated from bacterial exposure when poorly handled

Crops are unable to be transported due to lack of infrastructure

Processing

Removal of edible food portions, such as fat, skin, and peels

Packaging

Food becomes stale or spoils fast from inadequate sealing

Food left on plate from too large of a portion

Activity #1 Answer Key: Food Waste

Marketing

Food becomes unprofitable to sell and is not harvested or delivered

Unsold food thrown away in grocery stores

Consumers throw out edible food due to confusion of food labels

Food deemed too 'ugly' to sell or accept

Retail

Food deemed too 'ugly' to sell or accept

Unsold food thrown away in grocery stores

Consumption

Food becomes spoiled in your home

Food left on plate from too large of a portion

Consumers throw out edible food due to confusion of food labels

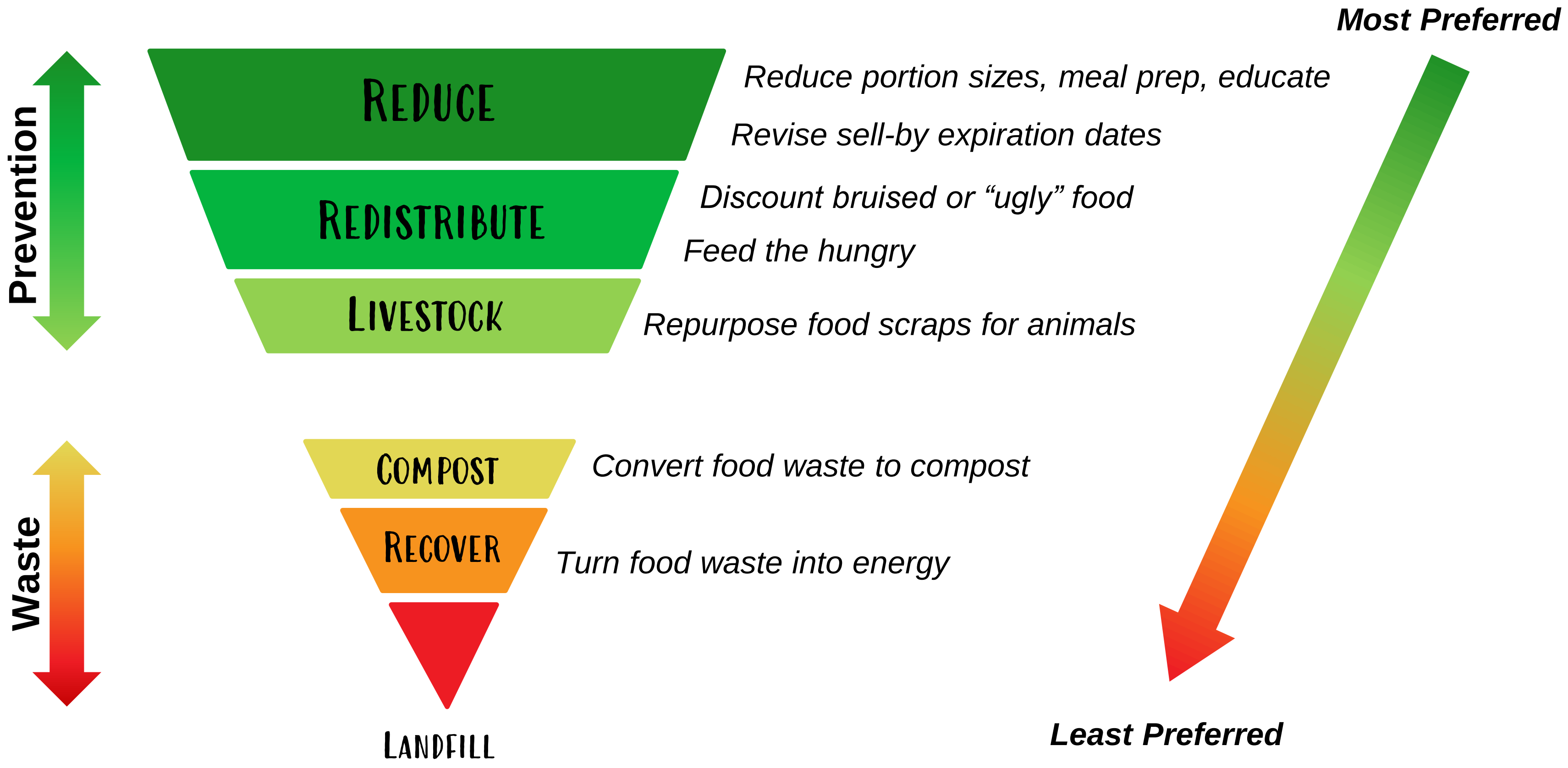
Consumers overbuy products with not enough time to eat it all

Edible, safe food thrown away

Activity #2 Answer Key: Discovering the True Costs

	ONE loaf of bread	**ONE** pound of beef	**ONE** serving of cheese (100g)	**ONE** gallon of milk	**ONE** chocolate bar (100g)
Pounds of **Carbon Dioxide**	1 Lbs. 1 small pompom	35 Lbs. 6-8 large pompoms	6 Lbs. 6 small pompoms	20 Lbs. 4-5 large pompoms	2 Lbs. 2 small pompoms
Gallons of **Water**	150 gallons of water. 3 small pompoms	1,800 gallons of water. 12 large pompoms	670 gallons of water. 5 large pompoms	880 gallons of water. 6 large pompoms	450 gallons of water. 3 large pompoms
Kilocalories of **Energy**	95 kilocalories. 1 small pompom	25,840 kilocalories. 26 large pompoms	350 kilocalories. 3-4 small pompoms	2,400 kilocalories 3 large pompoms	406 kilocalories. 4 small pompoms.
Squared Feet of **Land** Used	1 ft^2 0-1 small pompoms	1770 ft^2 18 large pompoms	110 ft^2 1 large pompom, 1 small pompom	300 ft^2 3 large pompoms	120 ft^2 1 large pompom, 2 small pompoms

The Food Waste Pyramid



The Value within our Food

Module 9
Student Handouts

Instructions: It is easiest to print this document **double-sided**. Print 1 copy for every 2 students in your class. Individually cut out the Food Supply Chain Cards and the Food Loss and Waste Cards from pages 2-6 into card decks.

Food Up!

What is Food Waste and how does it differ from Food Loss?

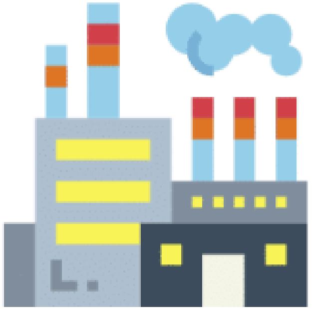
Food Loss: The food that does not reach retail and consumers. Food loss is often the result of lack of technology, extreme weather events, inadequate storing, and contamination.

Food Waste: The food that is lost while still safe and nutritious. Food waste is more common in higher-income countries, and is the result of consumer behaviors, government policies, poor planning, and misinformation on labelling.

Source: Perry, G. (2019). *What is food loss and food waste? And why does it matter for people and the planet?* The Vine. https://thevine.io/what-is-food-loss-and-food-waste-and-why-does-is-it-matter-for-people-and-the-planet/

Activity #1: Food Supply Chain Cards

Processing

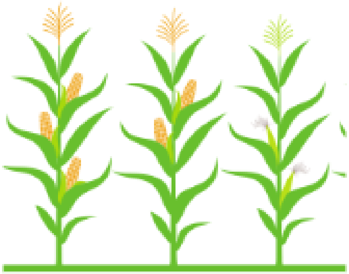


Packaging

Marketing

Storage

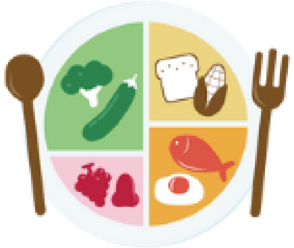
Production



Distribution

Retail

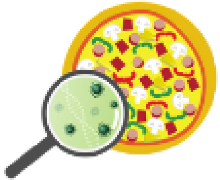
Consumption



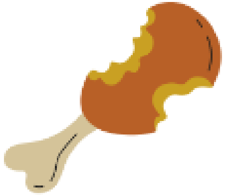
Activity #1: Food Loss and Food Waste Cards

Drought or Storm impacting food yields

Crops spoiled due to inadequate storage



Food contaminated from bacterial exposure when poorly handled

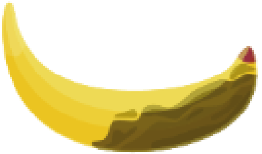


Edible, safe food thrown away

Food deemed too 'ugly' to sell or accept

Food becomes spoiled in your home

Food becomes stale or spoils fast from inadequate sealing

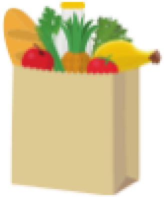


Unsold food thrown away in grocery stores

Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!

Activity #1: Food Loss and Food Waste Cards

Food becomes unprofitable to sell and is not harvested or delivered

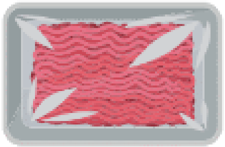


Consumers overbuy products with not enough time to eat it all

Pests feed off of crops and harvest

Food is left on plate from too large of a portion

Consumers throw out edible food due to confusion of food labels



Removal of edible food portions, such as fat, skin, and peels

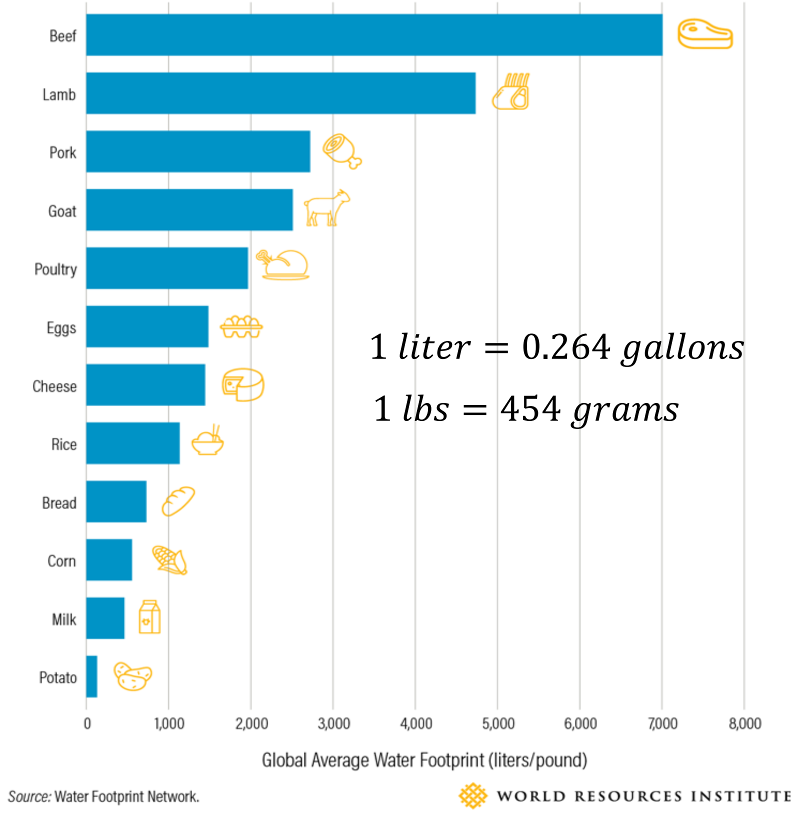
Crops are unable to be transported due to lack of infrastructure

Crop loss due to lack of access to technology

Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!

How much goes into our food?

Water

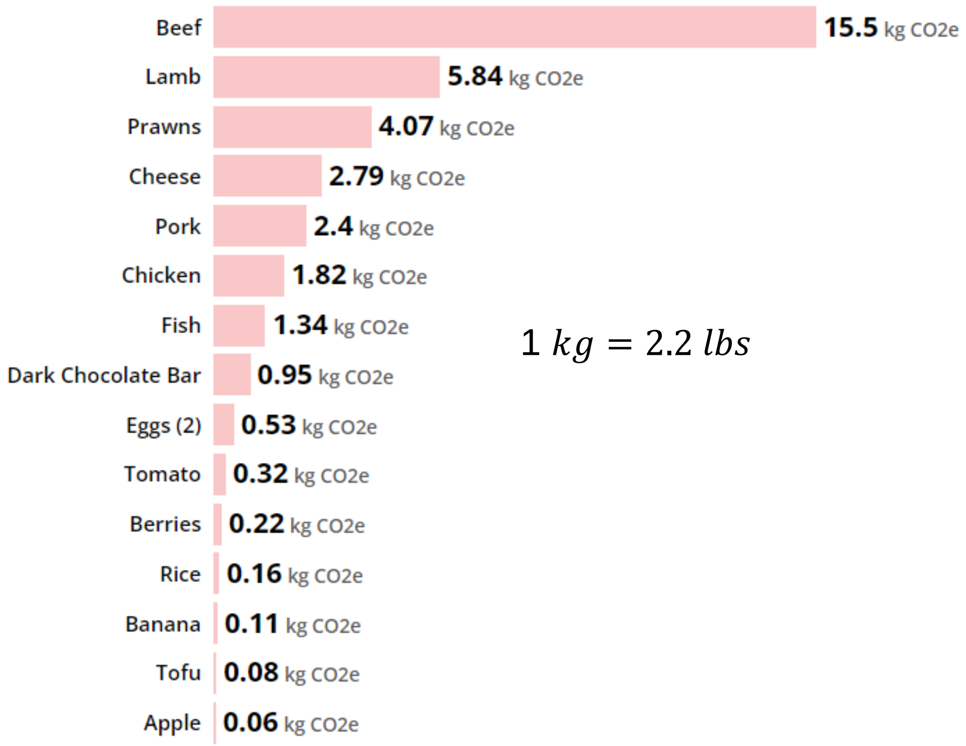


$1 \ liter = 0.264 \ gallons$

$1 \ lbs = 454 \ grams$

Note: Taken from “Water could limit our ability to feed the World,” by the World Resources Institute, 2020 (https://impakter.com/water-could-limit-our-ability-to-feed-the-world-these-9-graphics-explain-why/).

Greenhouse Gas Emissions

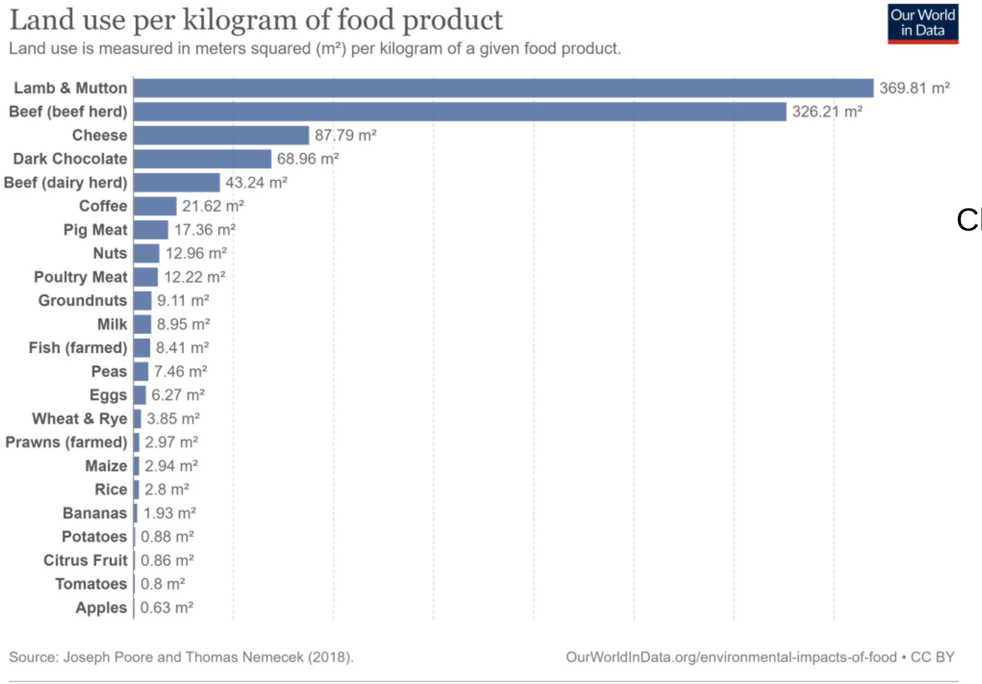


$1 \ kg = 2.2 \ lbs$

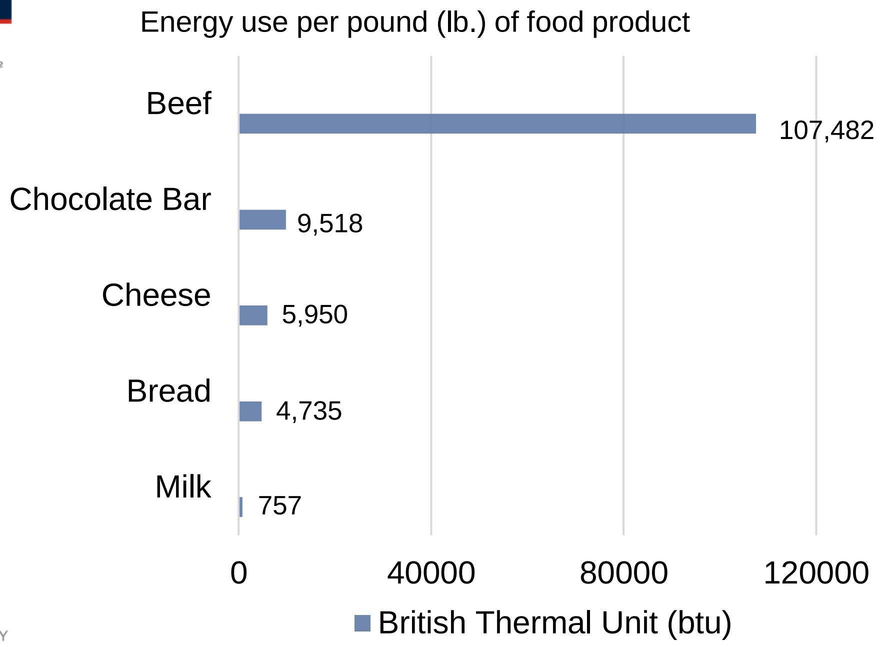
Note: Taken from “Food,” by CO2 Everything, 2018 (https://www.co2everything.com/category/food).

How much goes into our food?

Land



Energy



$$1\ square\ meter = 10.76\ square\ feet$$

$$1\ btu = 0.252\ kilocalories$$

$$1\ lb = 0.12\ gallons$$

$$1\ lb = 454\ grams$$

Note: Taken from "Environmental Impacts of Food Production," by Our World In Data, 2019 (https://ourworldindata.org/environmental-impacts-of-food).

Names:

Bread is the **MOST** wasted food in the US, with over 240 million slices of bread thrown away each year.[1]

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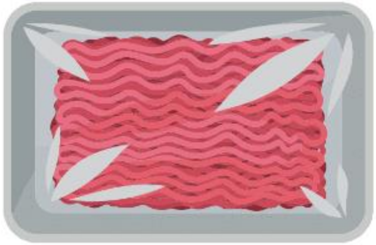
*How much goes into **ONE** loaf of bread?*	Estimated	**Actual**
Pounds of **Carbon Dioxide** 		
Gallons of **Water** 		
Energy 		
Land Used 		

Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!
Food Up!

Names:

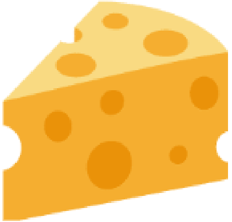


*How much goes into **ONE** pound of beef?*	Estimated	**Actual**
Pounds of **Carbon Dioxide** 		
Gallons of **Water** 		
Energy 		
Land Used 		

Each year, 5 million acres of rainforest are deforested in South and Central America for cattle pasture.[2]

The water it takes to produce **ONE** pound of beef is equivalent to showering for 12 hours.[3]

Names:



Cheese is one of the top foods contributing to greenhouse gas emissions, as it needs roughly 10 pounds of milk for one pound of cheese.[4]

*How much goes into **ONE** serving size of cheese? (100g)*	Estimated	**Actual**
Pounds of **Carbon Dioxide** 		
Gallons of **Water** 		
Energy 		
Land Used 		

Names:

In the United States, 68 Olympic-size swimming pools of milk are wasted every year. That is equivalent to 45 million gallons.[5]

*How much goes into **ONE** gallon of milk?*	Estimated	**Actual**
Pounds of **Carbon Dioxide** 		
Gallons of **Water** 		
Energy 		
Land Used 		

Names:

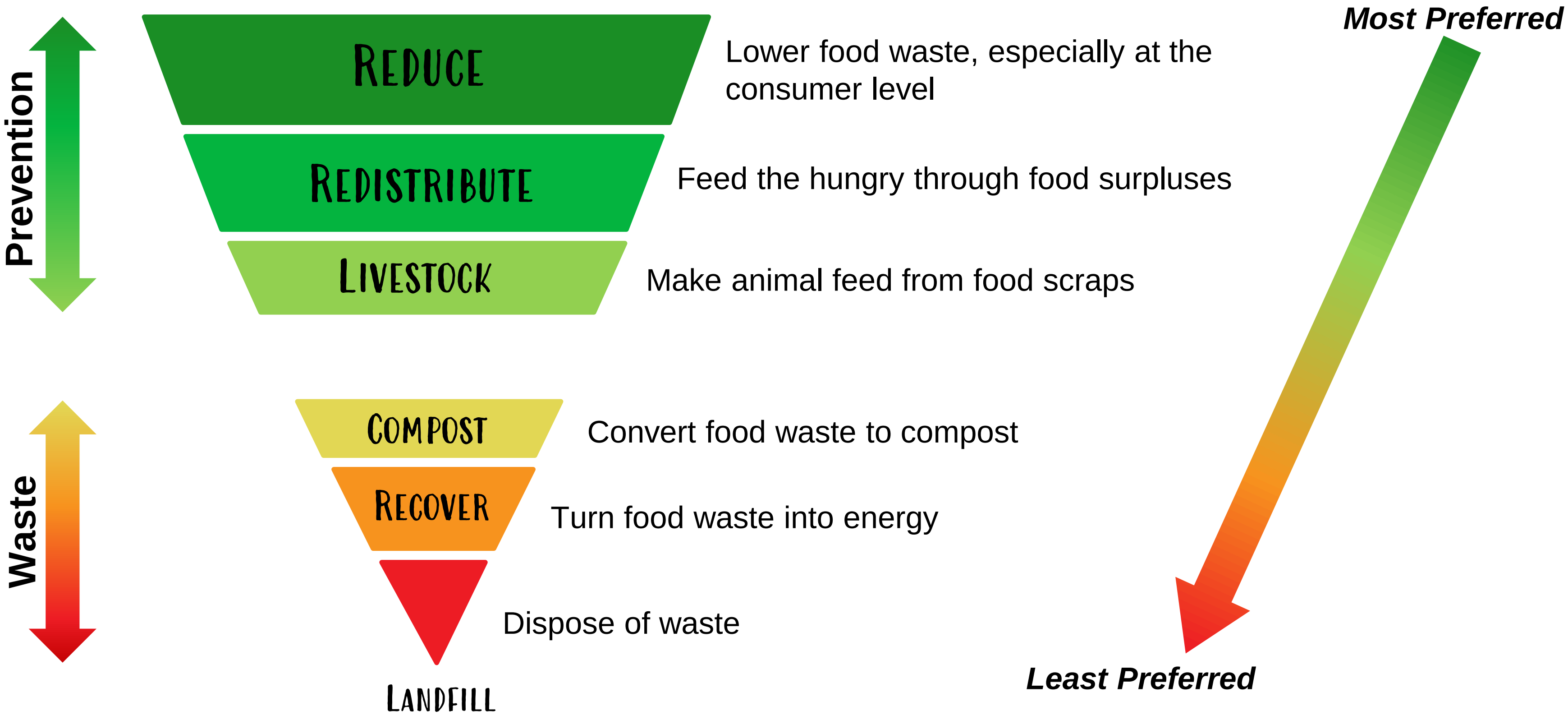
Over the past 60 years, Côte d’Ivoire Ha lost 94% and Ghana has lost 80% of their forest to cocoa production.[6]

*How much goes into **ONE** chocolate bar? (100g)*	Estimated	**Actual**
Pounds of **Carbon Dioxide** 		
Gallons of **Water** 		
Energy 		
Land Used 		

Activity #2: Figure Legend

Pounds of **Carbon Dioxide** 	1 lbs.	5 lbs.
Gallons of **Water** 	50 gallons	150 gallons
Kilocalories of **Energy** 	100 kcal	1,000 kcal
Land Used in square ft 	10 ft^2	100 ft^2

Connecting to the Garden: The Food Waste Pyramid



Activity #3: Food Facts!

- Every year, 1/3 of the world's food is wasted or lost. The edible food we waste is enough to feed 3 billion people.[7]
- Uneaten food takes away 25% of our water supply 18% of our cropland, and 21% of our landfills.[7]
- The average American household tosses out 25% of the food they purchase.[8]
- Half of all produce is tossed out in the United States due to their appearance. This equates to 60 million tons of fruits and veggies.[7]
- Uneaten food accounts for around 10% of greenhouse gases.[9]
- It would only take saving ¼ of the food currently wasted to feed every hungry person.[9]
- If food waste was a country, it would be the third largest emitter of greenhouse gases, right behind the United States and China.[9]
- Food loss is more prevalent in low-income countries, as 40% of their food loss occurs at the post-harvest level. However, in high-income countries, more than 40% of food is wasted at the retail and consumer level.[7]

Food Up!
Food Up!
Food Up!
Food Up!
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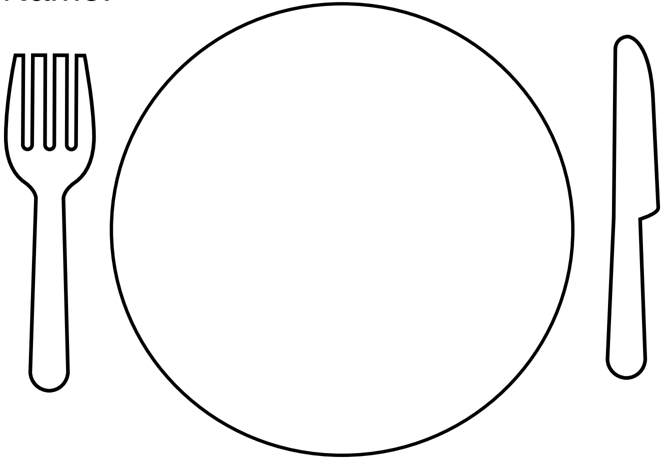
Food Up!
Food Up!
Food Up!

Activity #4: Exploring our Plate

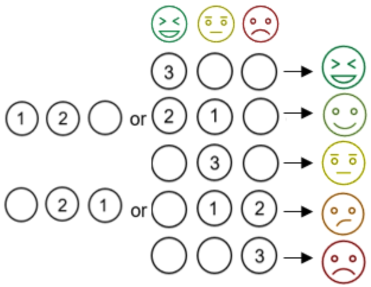
Name:



What was on your plate?

How many food items were wrapped in plastic packaging? 0 1 2+	
How much food was left on your plate? 0 1-2 spoonfuls 3+ spoonfuls	
How much of your meal came from other countries? None Some All	

Plate Score Key:



Total Plate Score:

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Worksheet adapted from “Every plate tells a story,” by World’s Largest Lesson (https://worldslargestlesson.globalgoals.org/resource/plate-pioneerz-every-plate-tells-a-story/).