Agriculture Module 1: **Farm to Market Marathon**

BACKGROUND INFORMATION

The **food supply chain** describes the process in which food is produced, transported, and distributed throughout the market. This dynamic process includes many steps and involves several moving parts to get products from the **producer** to the **consumer**. Most products, including everything from cotton sweaters to fresh fruits and vegetables, that can be bought at a local store or online originally come from a farm and are developed through **agriculture**. It is vital that a plot of land is properly prepared by plowing and turning the soil, which will allow for crops to grow more easily. As the seed is growing, the land is watered, and weeds are removed in order for the crop to grow properly.

A common way of consuming goods is through large food production and distribution. After the products are produced at the farm, vehicles, such as trucks, planes, and boats, are used to transport the items. The product is then processed by first line handlers, that sort, store, and package items to create finished food products. These finished products are then transported and sold to warehouses through wholesale. Manufacturers then provide these goods to retail food sectors such as grocery stores, restaurants, and vending machine companies for individual consumers to purchase. The consumer is then the last actor in the food supply chain. How far the food is transported determines the amount of **food miles** needed to get the products from the producer to the consumers' homes.

Once the crop is produced and ready to sell, there are different types of markets a producer can contribute their product to within the food supply chain. If there is a small amount of product produced, farmers sell their crops through **direct marketing**. Food supply chains that use direct marketing are generally shorter and promote purchasing fresh products. In this type of exchange, the farmer delivers their goods directly to individual consumers. A **farmers market** is a designated area in which this process takes place on a local scale. Through direct marketing, the financial gain of the produce may be greater for the local farmers because the consumer is directly paying the producer for their goods with little to no transportation, packaging, or retail store fees included. Another popular direct marketing concept is Community Supported Agriculture (CSA) programs. Local farmers may use a CSA program to generate a more constant source of revenue because consumers subscribe to receiving a weekly or biweekly produce box. Consumers can pick-up their boxes from the farm, at a local drop-off site, or the farmer may even deliver the boxes directly to the consumers' houses.

CONCEPTS AND VOCABULARY

Agriculture: The process of preparing a piece of land to grow and produce crops and other items that can be used for consumer markets such as food, clothes, and fuel

Consumer: An individual or manufacturer that buys products from an entity that creates goods

Direct marketing: The direct purchasing of food from the farmers that produced the food in order to promote local businesses, agriculture, and lessen the amount of transportation required for the good to reach the consumer

Farmers market: A designated area where local farmers vend their products, primarily fruits, vegetables, meats, dairy products, and baked goods to consumers fruits, vegetables, meats, dairy products, and baked goods to consumers

Food miles: The distance required for food to travel from the producer to the consumer

Food supply chain: The process of how food items are produced and distributed from the producer to the consumer in a complex and systematic way

Producer: An individual or manufacturer that creates or grows goods

MATERIALS NEEDED

- Flip chart paper
- Writing utensils
- Tape or glue
- Scissors, two per group
- *Strawberry and Strawberry Jam* (Appendix A1.1), one per group
- *Food Supply Chain* (Appendix A1.2), one per group
- *Food Supply Chain Answer Key* (Appendix A1.3), one per group

Materials provided in curriculum

TIME REQUIRED
45 to 60 minutes

SUGGESTED GROUPINGS
Small groups of 3 to 4

GETTING READY

- ☐ Make copies of *Strawberry and Strawberry Jam* (Appendix A1.1), one for each group.
- ☐ Make copies of *Food Supply Chain* (Appendix A1.2), one for each group. Tape or glue the four sheets together so that page 2 overlaps onto page 1 and page 4 overlaps onto page 3 at the blue line. Reference the complete flow chart using the *Food Supply Chain Answer Key* (Appendix A1.3) if needed.
- ☐ Make double-sided copies of *Food Supply Chain Answer Key* (Appendix A1.3), one for each group.

  Facilitator tip: It is recommended that the Food Supply Chain Answer Key be laminated to allow it to be more easily handled by youth and reused.
- ☐ Organize youth into small groups of 3 – 4 youth.
- ☐ Provide each group with one sheet of flip chart paper and writing utensils to answer opening questions.

OPENING QUESTIONS

Ask the youth to respond to each question/prompt below by recording their responses on the flip chart paper provided and sharing their ideas verbally.

- Explain what you know about how food is produced.
- Explain what you know about how food gets from a farm to your plate.

PROCEDURE (EXPERIENCING)

1. Provide each group with *Strawberry and Strawberry Jam*, *Food Supply Chain*, and two pairs of scissors.
2. Explain that *Strawberry and Strawberry Jam* includes the steps, out of order, of how strawberries make it from the strawberry field to the plate as either fresh strawberries or strawberry jam.
3. Ask youth to read the various boxes and cut them out along the bold line.
4. Ask youth to complete the *Food Supply Chain* for fresh strawberries and strawberry jam by placing the pieces they just cut out onto the *Food Supply Chain* in the correct order from producer to consumer. All boxes will be used once in completing the food supply chain and there are two sheets of boxes.
5. Once groups have completed the *Food Supply Chain*, provide each group with a *Food Supply Chain Answer Key* and ask youth to compare the food supply chain they constructed with the one in the *Food Supply Chain Answer Key.*

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their *Food Supply Chain* and discuss how they determined the order of the segmented pieces and whether their figure differed from that in the *Food Supply Chain Answer Key*.

Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share what they discovered about the food supply chain. If necessary, ask more targeted questions.

- Explain why some steps in the food supply chain take longer than others (denoted by longer arrows on the *Food Supply Chain*).
- Explain how the steps for the grocery store differ from those of the farmers market.
- Explain how the steps for fresh strawberries differ from those of the strawberry jam.
- Describe how you think technological innovations over time may have helped improve the food chain process.

CONCEPT AND TERM DISCOVERY/INTRODUCTION

Make sure youth understand that the **food supply chain** is complex set of interdependent steps that require input and maintenance from several different roles. Youth should also recognize that the steps of the food supply chain can vary depending on the end product, the point of sale location, and a host of other factors. The ultimate goal of the food supply chain is to efficiently get products from the **producer** to the **consumer**. Additionally, make sure that key vocabulary terms are either discovered by the youth or introduced to them: **agriculture**, **direct marketing**, **farmers market**, and **food miles**.

AGRICULTURE APPLICATION

MATERIALS NEEDED

- ☐ *Farm Tour Guide (*Appendix A1.4), one per group
- ☐ Clipboards, one per group (recommended)
- ☐ Writing utensils
- ☐ Transportation to an agricultural system, if applicable
- ☐ Agriculture maintenance equipment

Materials provided in curriculum

TIME REQUIRED

20 to 30 minutes

SUGGESTED GROUPINGS

Small groups of 3 to 4

GETTING READY

- ☐ Coordinate with a local producer to have the youth tour their agricultural system or to have the producer visit your agricultural space.
- ☐ Make copies of *Farm Tour Guide* (Appendix A1.4), one for each group.
- ☐ Supply enough materials to allow each youth to maintain their designated area in the agricultural space.
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These can be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.

PROCEDURE (EXPERIENCING)

1. Provide each group with *Farm Tour Guide*, writing utensils, and a clipboard (if using).
2. Provide a brief introduction for the producer and explain to the youth that they will be completing the *Farm Tour Guide* while the producer discusses their role in the food supply chain and how their products get to consumers. If applicable, the youth will also be touring the producer's agricultural system.
3. With any time remaining, lead youth in maintaining their designated growing section. This may include discarding weeds, supplying additional nutrients, and watering plants.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their their *Farm Tour Guide* and discuss the operation they learned about from the producer and how it fits into the food supply chain. Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share what they discovered about the producer's agricultural system.

HOME CONCEPT APPLICATION

MATERIALS NEEDED

- ☐ *Interview* (Appendix A1.5), one per youth

TIME REQUIRED

5 to 10 minutes

Materials provided in curriculum

GETTING READY

☐ Make copies of *Interview* (Appendix A1.5), one for each youth.

PROCEDURE (EXPERIENCING)

1. Provide each youth with a copy of *Interview*.
2. Ask youth to identify someone they know who has a role in the food supply chain.
3. Ask youth to use *Interview* to ask that person about their role in the food supply chain.

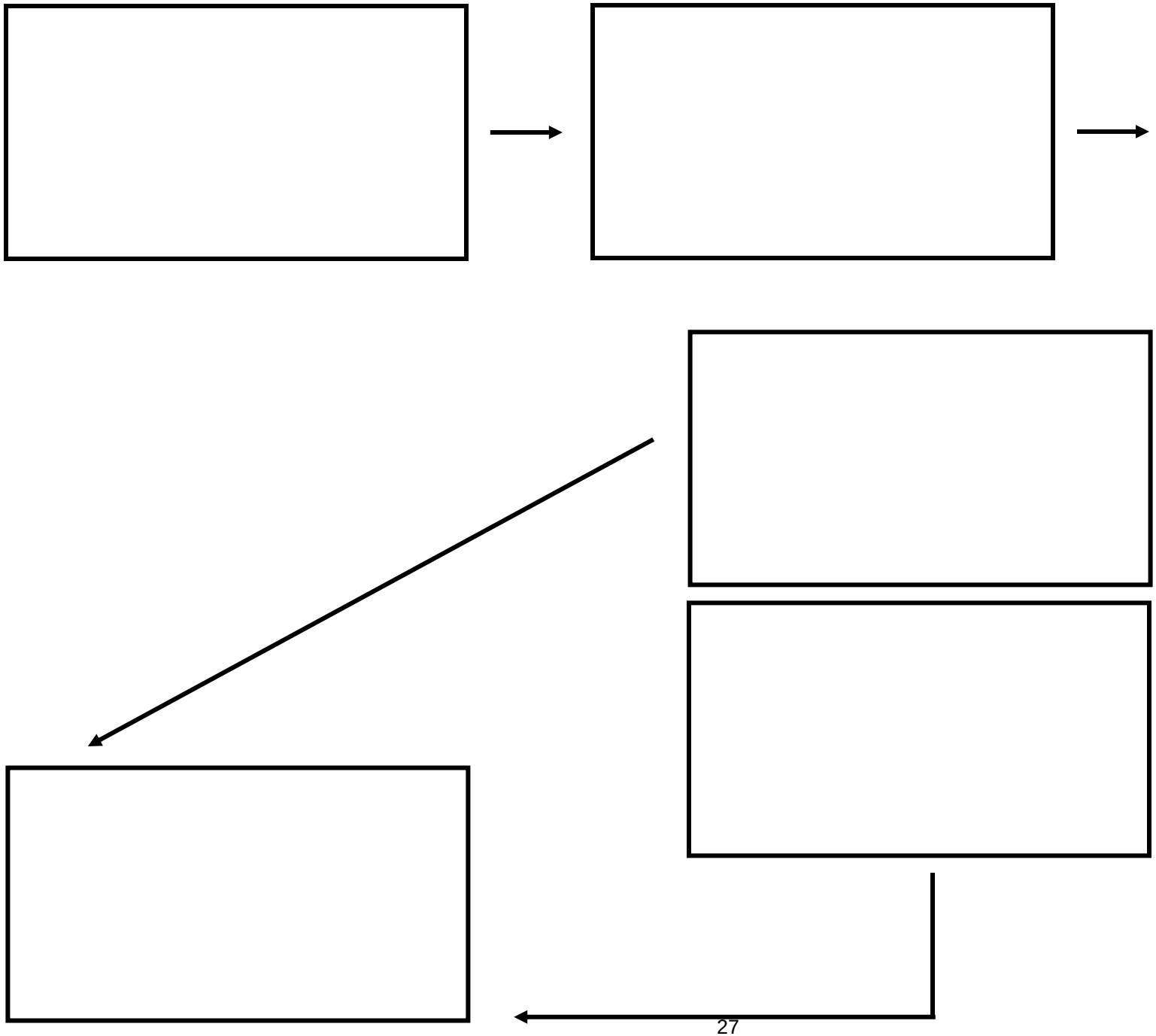
SHARING, PROCESSING, AND GENERALIZING

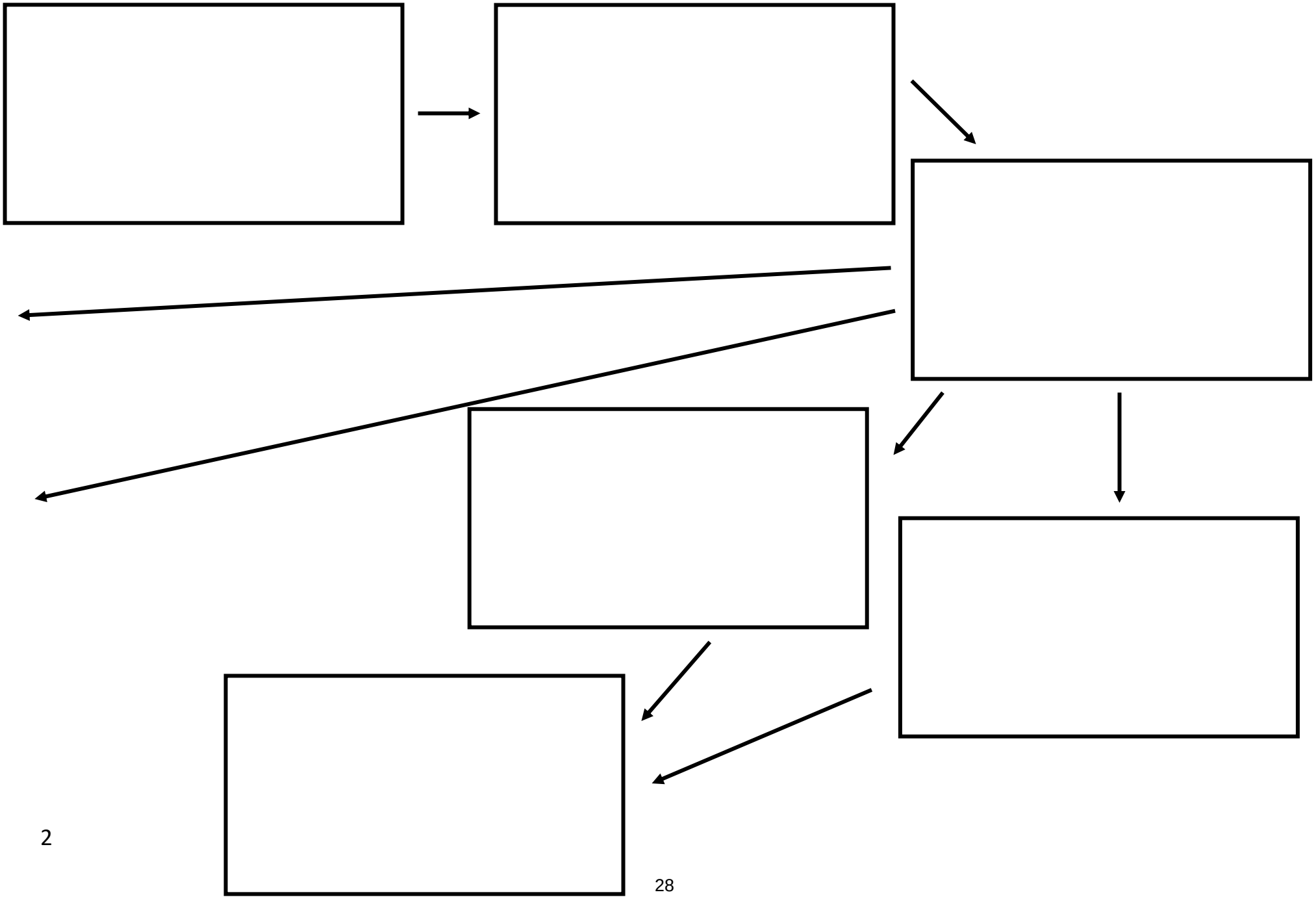
Have the youth share their *Interview* and discuss how the person they interviewed fits into the food supply chain. Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share what they discovered about the various roles in the food supply chain.

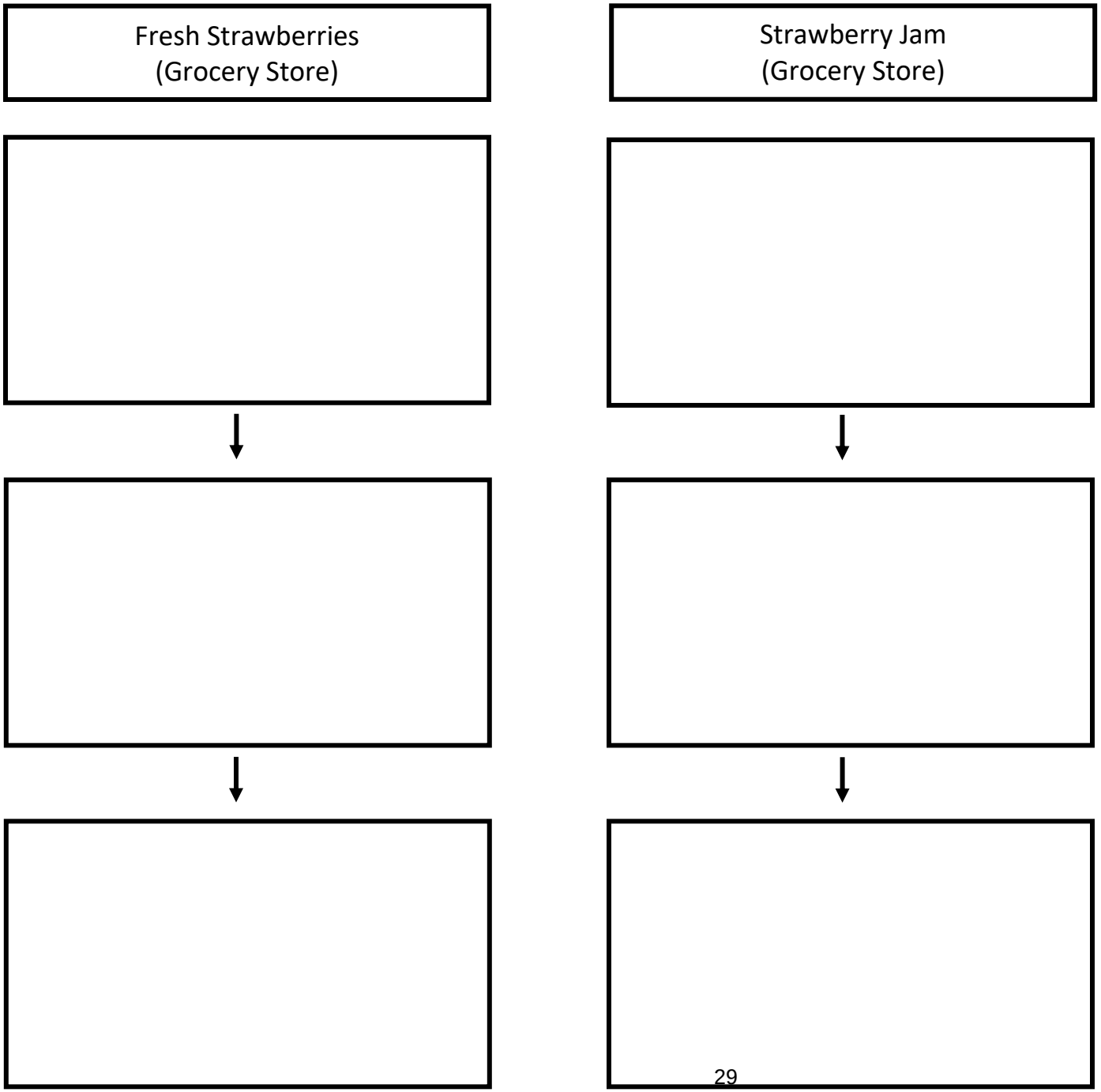
Directions: It is your task to figure out how fresh strawberries make it from the strawberry field to your plate. To do this, cut and paste the following boxes onto the Food Supply Chain worksheet

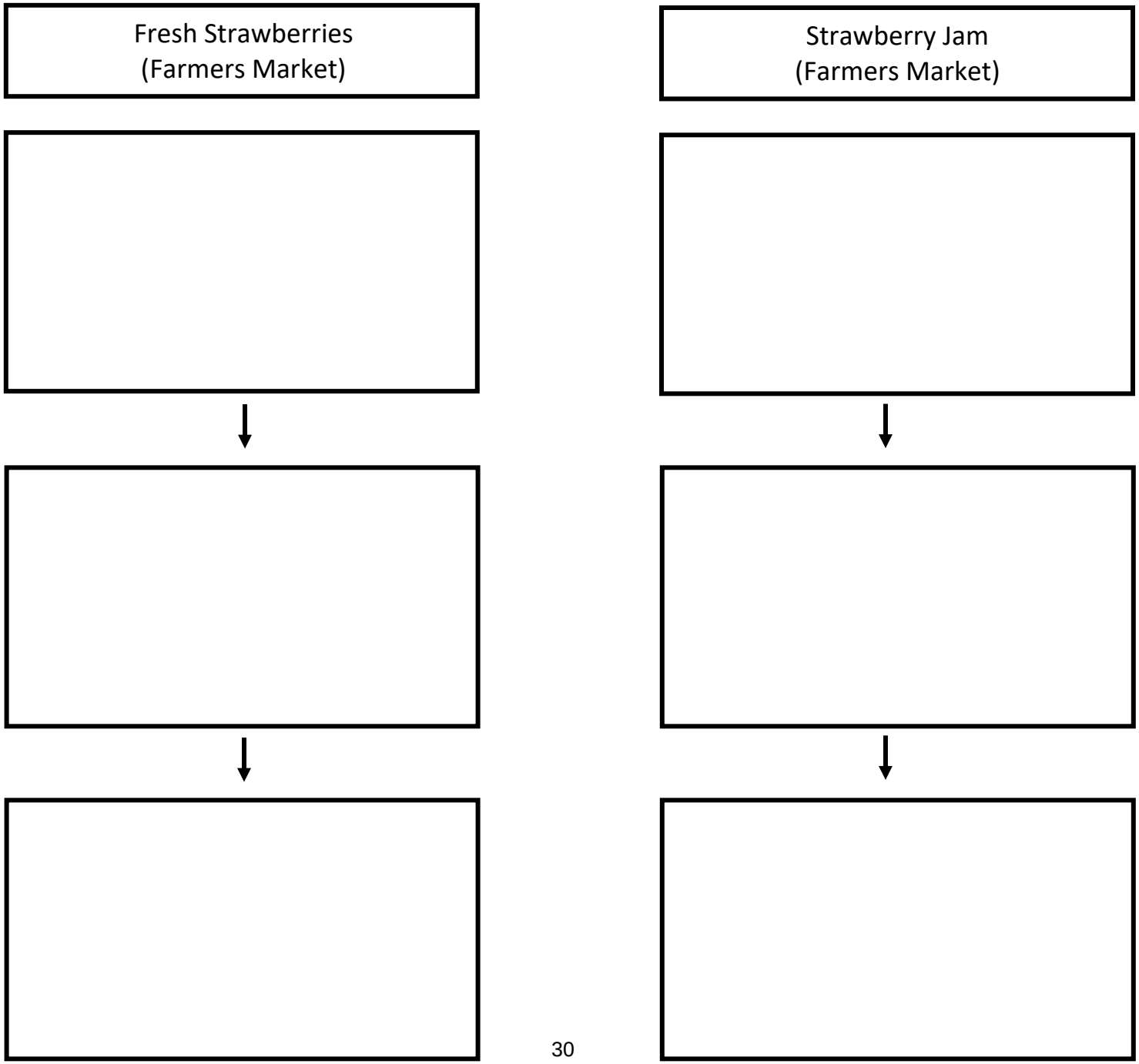
Strawberries are fully ripe	Fresh strawberries are packaged to be sold at the farmers market	After purchasing strawberries, wash them and enjoy!
Strawberry jam is purchased by consumers and taken home to enjoy	Fresh strawberries are transported to the distribution center to be packaged and refrigerated	Ripe fresh strawberries arrive at the grocery store
Fresh strawberries are handpicked, which requires a lot of physical labor	It’s 6am! It’s time for labor workers to go to work to harvest	Strawberry jam is priced, labeled with an expiration date (~6–9 months), recorded into inventory, and stocked
Fresh strawberries and homemade strawberry jam are transported to the farmers market	Fresh strawberries are locally made into jam and packaged for sale	Fresh strawberries and strawberry jam are packed onto a truck and transported to the grocery store

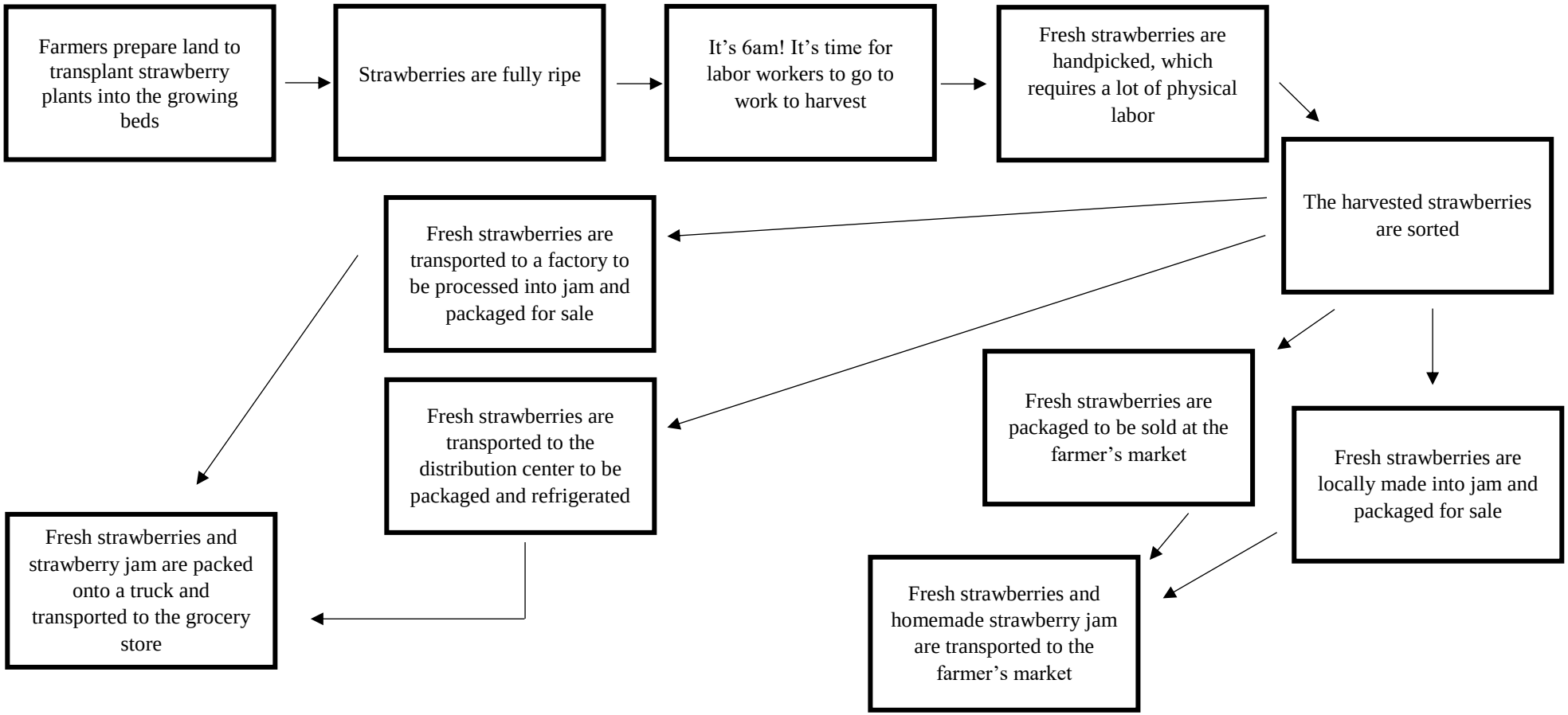
Strawberry jam arrives at the grocery store	Homemade strawberry jam arrives at the farmer's market	Fresh strawberries are transported to a factory to be processed into jam and packaged for sale
Fresh strawberries are displayed and labeled for sale	Fresh strawberries are priced, labeled with an expiration date (~1-week shelf life), recorded into inventory, and stocked	After purchasing strawberries, wash them and enjoy!
Farmers prepare land to transplant strawberry plants into the growing beds	Strawberry jam is purchased by consumers and taken home to enjoy	Strawberry jam is displayed and labeled for sale
The harvested strawberries are sorted	Ripe fresh strawberries arrive at the farmer's market	

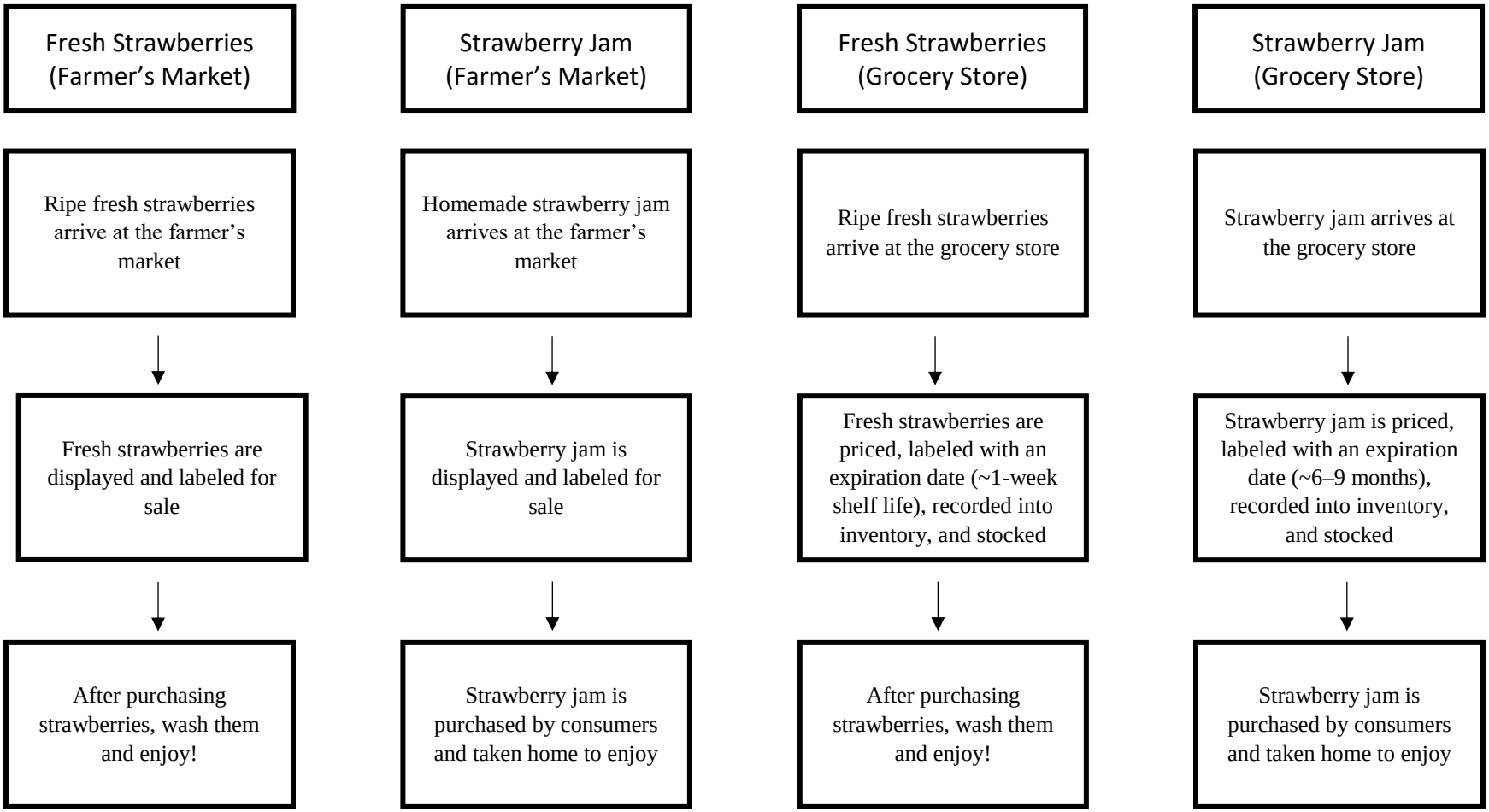





Fresh Strawberries
(Grocery Store)
Strawberry Jam
(Grocery Store)


Fresh Strawberries
(Farmers Market)
Strawberry Jam
(Farmers Market)


Farmers prepare land to transplant strawberry plants into the growing beds
Strawberries are fully ripe
It's 6am! It's time for labor workers to go to work to harvest
Fresh strawberries are handpicked, which requires a lot of physical labor
The harvested strawberries are sorted
Fresh strawberries are transported to a factory to be processed into jam and packaged for sale
Fresh strawberries are transported to the distribution center to be packaged and refrigerated
Fresh strawberries are packaged to be sold at the farmer's market
Fresh strawberries are locally made into jam and packaged for sale
Fresh strawberries and strawberry jam are packed onto a truck and transported to the grocery store
Fresh strawberries and homemade strawberry jam are transported to the farmer's market


Fresh Strawberries (Farmer's Market)
Ripe fresh strawberries arrive at the farmer's market
Fresh strawberries are displayed and labeled for sale
After purchasing strawberries, wash them and enjoy!
Strawberry Jam (Farmer's Market)
Homemade strawberry jam arrives at the farmer's market
Strawberry jam is displayed and labeled for sale
Strawberry jam is purchased by consumers and taken home to enjoy
Fresh Strawberries (Grocery Store)
Ripe fresh strawberries arrive at the grocery store
Fresh strawberries are priced, labeled with an expiration date (~1-week shelf life), recorded into inventory, and stocked
After purchasing strawberries, wash them and enjoy!
Strawberry Jam (Grocery Store)
Strawberry jam arrives at the grocery store
Strawberry jam is priced, labeled with an expiration date (~6–9 months), recorded into inventory, and stocked
Strawberry jam is purchased by consumers and taken home to enjoy

Directions: Complete the following tables for the producer's agricultural system.

Producer name:
Producer occupation:
Site name:
Type of agricultural system:

Products grown:	Steps needed to produce products:
Steps needed to transport products:	Steps needed to distribute products:
Places products are sold:	Uses of products:

Interview Questions

Directions: Identify someone who has a role in the food supply chain. Ask that person the following questions to learn more about their effect on the food supply chain.

1. What is your role in the food supply chain?

2. Why do you think your role in the food supply chain is important?

3. What steps do you think need to happen before your role for the food supply chain to work effectively?

4. What steps do you think need to happen after your role for the food supply chain to work effectively?

Agriculture Module 2: **Exploring Agricultural Systems**

BACKGROUND INFORMATION

The cultivation and production of foods are more varied and complex than one might think. There are many **agricultural systems**, which involve growing crops or livestock for the purposes of food, fuel, fibe , and feed. Different agricultural systems have aspects that make them beneficial for di ferent locations. These aspects can include the resources available that make the different growing methods possible. Each system can also contribute to cultural, environmental, and economic aspects of society.

Aquaponic systems feature a combination of aquaculture with **hydroponics**, allowing for the growing of fish as well as plants in a closed system. The waste from the fish feeds the plants, while the plants provide clean water for the fish. This symbiotic and self-regulated system mimics nature by recycling water and nutrients, making it an example of sustainable agriculture. Aquaponics can be implemented using **vertical farming**. This innovative form of farming is typically set in an urban environment and includes crops and plants being grown inside or on top of a building. With space sometimes being a limited resource, this method is an effective way of farming almost anywhere. Another agricultural system that can be found in an urban setting is **school gardens**. These types of gardens are located on the school campus and are operated by the teachers, students, volunteers, and other school community members. Sometimes the produce grown in this system is included in the school cafeteria offerings or harvested and sold to school community members. School gardens can also be incorporated into the school curriculum and be utilized to educate students about nutrition, science, and the environment among other subjects.

Unlike these more recently developed agricultural systems, the **Hopi tribe** has displayed more traditional farming techniques for centuries. They are a sovereign nation known for their history of respecting the earth with their farming and treatment of natural resources. The Hopi people utilize a technique called “dry farming.” Rather than irrigation systems that add water to a system, this technique relies solely on rain and runoff to cultivate crops, which reflects their tradition of following Masaw (a way of simplicity and humility). Corn is the most significant crop for the Hopi tribe, as it is used for consumption and ceremonial purposes, and is tended to in a sacred manner by blessing, talking, and singing to the seeds and ears. The Hopi tribe methods are just one example of indigenous growing practices, which vary tribe to tribe and largely depend upon the climate of the land. In contrast to the Hopi tribe’s manner of farming corn, **conventional corn farming** is the mass production of corn that utilizes seeds that have typically been genetically altered in order to produce larger quantities with lower production costs. Unlike other systems, conventional corn farms grow most corn to sell as livestock feed or to produce biofuel, instead of for human consumption. Conventional corn produced on a large-scale that does go towards food for humans is typically not the same as the sweet corn that we eat

fresh on the cob. Instead these systems grow “field corn,” which is generally processed into other foods like cereal, oil, or high fructose corn syrup.

These agricultural systems are just a few examples of the vast variety of agricultural systems implemented across the United States. Different agricultural systems benefit society in di ferent ways by providing communities, small and large, food to eat while balancing use of **natural resources**. These natural resources include materials provided by the environment that people are able to use, such as water, oil, wood, wind, iron, coal, and soil. With the vast importance of natural resources for maintaining agricultural systems, **agroclimate** scientists study how climate can affect agriculture. Within this field of stud , researchers are assessing techniques to create agricultural processes that are resilient to climate change. Consequently, by accounting for the climate, these new processes will hopefully benefit the environment and agricultural systems by providing better water quality, fewer greenhouse gas emissions, and less soil erosion.

CONCEPTS AND VOCABULARY

Agricultural systems: Systems that involve the growing of crops or livestock for the purposes of food, fuel, fibe , and feed

Agroclimate: The concept used to describe the relationship between changes in climate and agricultural production

Aquaponics: A sustainable system that involves using fish waste to provide nutrients to plants while the plants provide clean water and food for the fis

Conventional corn farming: Mass production of corn at fast rates to predominantly produce livestock feed or biofuel

Hopi tribe: Sovereign nation known for their history of traditional farming practices and respecting natural resources

Hydroponics: The growing of plants using water instead of soil as the growing medium and source of nutrients

Natural resources: Materials provided by the environment that can be used by humans, including in agriculture

School gardens: Garden at school sites that can be used for educational purposes and also to provide produce for the school

Vertical farming: An innovative form of farming typically set in urban environments in which crops and plants are grown inside or on top of a building

MATERIALS NEEDED

- Flip chart paper
- Writing utensils
- *Ag System Cards* (Appendix A2.1)

Materials provided in curriculum

TIME REQUIRED

45 to 60 minutes

SUGGESTED GROUPINGS

Small groups of 3 to 4

GETTING READY

- ☐ Make one copy of the *Ag System Cards* (Appendix A2.1). Cut the *Ag System Cards* apart and organize them into the appropriate four agriculture systems.

  Facilitator tip: It is recommended that the Ag System Cards be laminated to allow them to be more easily handled by youth and reused.

- ☐ Fold the flip chart paper for each group into a trifold
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These can be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.

- ☐ Provide each group with one sheet of folded flip chart paper and writing utensils to answer opening questions.

OPENING QUESTIONS

Ask the youth to respond to each question/prompt below by recording their responses in the first third of the flip chart paper provided and sharing their ideas verball .

- Explain what you know about different methods of growing produce.
- Explain what you know about the differences between small-scale and large-scale food production.

PROCEDURE (EXPERIENCING)

1. Ask youth to use the middle section of their folded flip chart paper to describe or draw wher they think food originally comes from.
2. Ask each group to share one or two aspects of where they think food originally comes from.
3. Provide each group with one of the four agricultural systems represented on the *Ag System Cards*: Aquaponics, School Garden, Conventional Corn Farm, or Hopi Tribe.
4. Ask the youth to use the remaining section of their folded flip chart paper to create representation of the agricultural system described in their *Ag System Cards*.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their representation of their *Ag System Cards* and discuss how it compares to their original idea of where food originally comes from.

Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share what they discovered about different agricultural systems. If necessary, ask more targeted questions:

- Explain what similarities you noticed between the agricultural systems.
- Explain what differences you noticed between the agricultural systems.
- Explain why you think we have so many different types of agricultural systems.
- Describe the benefits of a large-scale agricultural system
- Describe the benefits of a small-scale agricultural system

CONCEPT AND TERM DISCOVERY/INTRODUCTION

Make sure youth understand the importance of different **agricultural systems** such as **aquaponics, school gardens, conventional corn farming**, and dry framing techniques used by the **Hopi tribe**. Youth should also be able to compare and contrast agricultural systems and methods as well as recognize that agriculture includes a large and diverse range of methods, stakeholders, **natural resources**, and **agroclimatic** conditions. Additionally, youth should understand that the agricultural systems presented in this activity only represent a few of the many agricultural systems implemented around the United States. Make sure that key vocabulary terms are either discovered by the youth or introduced to them: **hydroponics** and **vertical farming**.

AGRICULTURE APPLICATION

MATERIALS NEEDED

- ☐ *Garden Friend or Foe (*Appendix A2.2), one per group
- ☐ *Critter Glossary (*Appendix A2.3), one per group
- ☐ Clipboards, one per group
- ☐ Agricultural maintenance equipment

Materials provided in curriculum

TIME REQUIRED

10 to 15 minutes

GETTING READY

- ☐ Make copies of *Garden Friend or Foe* (Appendix A2.2), one for each group
- ☐ Make double-sided copies of *Critter Glossary* (Appendix A2.3), one for each group

  Facilitator tip: It is recommended that the Critter Glossary be laminated to allow it to be more easily handled by youth and reused.
- ☐ Supply enough materials to allow each youth to maintain their designated area in the agricultural space.
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These can be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.

PROCEDURE (EXPERIENCING)

1. Explain to youth that agricultural systems are comprised of multiple smaller systems and include animals and insects that make up a complex food web required for the survival of any agricultural system.
2. Provide each group with *Garden Friend or Foe*.
3. Ask the youth to walk around the agricultural space and investigate some of the living elements present in the system. While youth tour the agricultural space, they should record the name of each animal or insect they encounter and whether they think that animal or insect benefits or

harms the system on *Garden Friend or Foe*.

4. Provide each group with the *Critter Glossary* and ask youth to compare their *Garden Friend or Foe* with the information provided in the glossary.
5. With any time remaining, lead youth in maintaining their designating growing section. This may include discarding weeds, supplying additional nutrients, and watering plants.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their *Garden Friend or Foe* and discuss the types of animals and insects that were found in the agricultural space. Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share the smaller systems they discovered and how they think each animal or insect affects their agricultural space.

HOME CONCEPT APPLICATION

MATERIALS NEEDED

- ☐ *My Critter Card* (Appendix A2.4), one per youth

TIME REQUIRED

5 to 10 minutes

Materials provided in curriculum

GETTING READY

☐ Make copies of *My Critter Card* (Appendix A2.4), one for each youth.

PROCEDURE (EXPERIENCING)

1. Provide each youth with a copy of *My Critter Card.*
2. Ask youth to complete the *My Critter Card* by adding an image and description about an animal or insect found in agricultural systems.
3. Encourage youth to decorate the *My Critter Card* however they would like.

   Facilitator tip: It is recommended that the completed cards be laminated and displayed in the agricultural space by attaching them to craft sticks and putting them in the ground or zip tying the cards to fencing (if present).

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their *My Critter Card* and discuss what they learned about the animal or insect of their choosing. Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share what they discovered about an animal or insect and whether it is beneficial or harmful to an agricultural system.

Aquaponics – Definition	Aquaponics – Labor	Aquaponics – Plant Crops	Aquaponics – Animals
An aquaponic system combines aquaculture (raising aquatic animals such as fish in tanks) with hydroponics (cultivating plants in water) in an environment where they rely upon each other for necessary nutrients.	If in a commercial setting where products are grown for profit, the growers will be the main laborers. If run for educational purposes, community members may also help.	Crop choices are based on community needs/desires and what may be profitable. Possible crop choices include cabbage, leafy green vegetables, herbs, cucumbers, peppers, onions, and tomatoes.	Fish are incorporated into this system and their waste is used to provide nutrients to plants. Pests and parasites are possible and include worms, leaches, protozoa, copepods, and mollusks. Pesticides should not be used to control insects on aquaponic plant crops because they pose a threat to fish.
Aquaponics – Funding Sources	**Aquaponics – Land**	**Aquaponics – Water**	**Aquaponics – Inputs**
Commercial systems usually combine grants and private investments. Educational systems tend to rely upon grants and private investments.	Soil is not needed, so this system can be done anywhere. Aquaponic systems require open space with at least some covering, such as greenhouses, and a light source, which can be either natural or artificial.	The system requires water to begin the cycling process. Aquaponic systems usually do not need to be replenished as frequently as hydroponic systems and, if everything is functioning normally, do not need to be emptied.	This system needs fish, fish feed, seeds or seedlings, containers for plants and fish, water pumps or wicking systems, energy for pumps, pH monitoring, and growth media.

Aquaponics – Purpose	Aquaponics – Outputs	School Garden – Definition	School Garden – Labor
If running commercially, the system provides food for consumers. If running for educational purposes, the system is used to teach communities about aquaponics.	Community members and other consumers receive or purchase fish and crops. The community may also receive lessons if the system is predominantly run for education.	A school garden is a space on a school site, most often outside, that can be used to feed school members and provide students with hands-on education about many subjects.	School gardens often rely upon the volunteer labor of parents, students, teachers, interns, and other community members.
School Garden – Plant Crops	**School Gardens – Animals**	**School Gardens – Funding Sources**	**School Gardens – Land**
Crops frequently grown include carrots, corn, peas, beans, squash, melons, cucumbers, broccoli, cauliflower, cabbage, tomatoes, peppers, lettuce, kale, chard, potatoes, radishes, and beets.	Small animals such as chickens or bees can be raised if there is space and if school or local policies permit. Butterflies, worms, and lady bugs tend to be in the garden space. Worm castings can be used to fertilize plants and lady bugs provide some pest control. Potential pests include wild animals, aphids, beetles, and slugs.	School gardens often rely on grants. However, funds can also be raised by hosting events, getting support from local businesses, crowdfunding, selling merchandise, hosting plant sales, or selling garden produce in a farm stand or at a farmer's market.	Flat well-drained healthy soil is recommended for gardens. Healthy soil has good texture and structure, adequate beneficial organisms, and a sufficient supply of nutrients. The garden should receive at least six hours of sunlight a day and should also be accessible for all students. School garden land varies depending on what is available at the school.

School Gardens – Inputs	School Gardens – Water	School Gardens – Purpose	School Gardens – Outputs
School gardens need seeds, fertilizers, hand tools, signage for identifying crops, and water. Additionally, wood for raised beds, transplanting pots, large containers or pots, row covers for pests, compost, wheelbarrows, rakes, shovels, and fencing may also be used.	School gardens usually rely on drip irrigation systems, which are very efficient, but hand watering can be used as a way to get youth involved.	School gardens are primarily run for education, and secondarily run to produce fruits and vegetables. Harvested crops may be sold or given to students and volunteers free of charge.	Along with student education as an output, harvested crops can be sold to community members in a farm stand and also may be used in school lunches, cooking classes, and tastings.

Conventional Corn Farm – Definition	Conventional Corn Farm – Labor	Conventional Corn Farm – Plant Crops	Conventional Corn Farm – Animals
A conventional corn farm grows corn on a large plot of land for commercial production and is used for animal feed, fuel, or human consumption.	This system relies upon farmers and farmworkers. The number of employed farmworkers depends on the size of the farm and level of mechanization.	Corn production mostly uses a monocropping system, meaning that the farm plants and harvests only corn.	Animals are not usually raised in this system, though the corn grown is often used for animal feed.

Conventional Corn Farm – Land	Conventional Corn Farm – Funding Sources	Conventional Corn Farm – Inputs	Conventional Corn Farm – Water
Large-scale commercial corn production requires a large plot of land and healthy soil. Healthy soil is well-drained and has good texture and structure, adequate beneficial organisms, and a sufficient supply of nutrients.	The farmer will usually pay for expenses with their own money, loans from the bank, and subsidies from the government. These subsidies allow farmers to earn a certain price for their corn.	Inputs include corn seeds, large tractors, large trucks, machinery fuel, combined harvesters, water, and synthetic fertilizers, pesticides, and herbicides.	Corn requires large amounts of water. This system relies upon heavy use of irrigation systems, such as overhead sprinklers and rainfall to water the corn.
Conventional Corn Farm – Purpose	**Conventional Corn Farm – Outputs**	**Hopi Tribe Food Ways – Definition**	**Hopi Tribe Food Ways – Labor**
Corn production is almost always for profit when it is a large-scale commercial business. The corn grown is most often used for ethanol-based fuel, livestock feed, and for human consumption.	Corn is the only crop produced. This can go on to become ethanol-based fuel, livestock feed, and produce for human consumption.	The Hopi tribe has a rich history that includes cultural traditions and ceremonies involving agriculture. The Hopi Reservation is located in northeastern Arizona in a semiarid climate.	Work among tribal members is separated by gender. Cultural knowledge is passed from female generation to female generation. Women determine which crops should be grown and men plant the seeds. Overall, it is a shared community effort.

Hopi Tribe Food Ways – Plant Crops	Hopi Tribe Food Ways – Animals	Hopi Tribe Food Ways – Land	Hopi Tribe Food Ways – Funding Sources
Corn is the primary crop produced, but beans, melons, and squash are also grown. Tree crops such as peaches, apples, and apricots are grown as well.	Cattle, sheep, goats, and horses are often raised along with crops. Animal manure can be used to provide nutrients to plants.	Hopi land is often highly elevated with little rainfall. To cultivate crops, the Hopi find areas near flood plains, channels, and natural springs. Most Hopi farms are very small compared to large-scale commercial farms.	The Hopi are allotted money from the US government through laws such as the Navajo/Hopi Land Dispute Settlement Act of 1996. Additionally, most Hopi tribal members rely on nonfarm jobs for income.

Hopi Tribe Food Ways – Inputs	Hopi Tribe Food Ways – Water	Hopi Tribe Food Ways – Purpose	Hopi Tribe Food Ways – Outputs
Traditional hand tools such as the Hopi planting sticks are used along with hand planting. Other inputs include water, seeds, and livestock.	As the area is dry and can face extreme climate fluctuations such as droughts and floods, the Hopi rely on groundwater and have become successful in diverting water to their crops by use of channels, springs, and slopes to naturally capture water.	Crops are grown both for general consumption, as well as to be used in ceremonies, for offerings, in rituals, and for special occasions, such as weddings.	This system allows for the passing of cultural knowledge. It also generates crops and livestock to be used by the community, seeds for future use, and the use of the crops in traditional practices.

Explore the agricultural space and record any animals or insects you come across. Think about how those animals or insects interact with the plants being grown.

Name and/or picture of the critter	**Explain how you think the critter benefits or harms the garden.**

Critter	Description
Bee 	Bees are pollinators. Pollinators help flowers produce more seeds, which causes more flowers to grow. Many plants rely on bees for pollination.
Worm 	Worms increase the quality of the soil by decomposing organic matter and leaving castings. Castings, also known as worm poop, is a beneficial fertilizer that helps plants grow.
Ladybug 	Ladybugs consume other insects that may harm a garden. Ladybugs are commonly introduced into a garden or greenhouse by a farmer to work as a natural pest control.
Butterfly 	Butterflies and moths are pollinators, which help to increase flower and seed production. However, some caterpillars kill plants by consuming the leaves.
Snail 	Snails can be detrimental to the garden because they like to chew on the leaves of the plants.
Grasshopper 	Grasshoppers are herbivores and therefore eat the stems and leaves of plants. Small populations of grasshoppers tend to be harmless, but an infestation can cause the plants to die.

Critter	Description
Earwig 	Earwigs, or pincher bugs, are omnivorous. They prey on small, undesirable insects and help with decomposing. However, some earwigs destroy plants by eating leaves and fruit.
Hummingbird 	Hummingbirds feed on the nectar of flowers. This helps to cross-pollinate the plants and helps the flowers grow. In addition, hummingbirds also eat small insects.
Ant 	Ants dig tunnels under the soil, which helps plant roots get nutrients and water. Ants may also attract insects that are harmful to a farm or garden.
Fly 	Flies appear in the garden when things begin to decay. Certain types of flies, such as white flies, feed on leaves, but most flies are not harmful to plants. Flies are common when a garden has a compost pile.
Squirrel 	Squirrels help to spread and plant seeds by storing them in the soil. Squirrels like to dig holes, which can sometimes destroy the roots of plants.
Chicken 	Chickens act as pest controllers in the garden. Chickens eat insects, such as snails, which normally destroy the garden. Sometimes, chickens can eat the plants, but they prefer insects.

Directions: Learn more about an agricultural system critter of your choosing by visiting https://earthbox.com/bug-chart. Then complete the card below with an image and description of that critter.

Critter Image

Critter Description

Agriculture Module 3: **Innovating Agriculture**

BACKGROUND INFORMATION

There are a series of past inventions that are essential to the development of current agriculture systems. In 1698, the steam engine was invented and was one of the first innovations to greatly impact agriculture. After several innovators refined this invention, it was then implemented in carriages, locomotives for trains, and boats. Another invention that impacted the industry was the iron plow with interchangeable parts, patented in 1819. This improved tool was easier to repair and effective at breaking up rocks and tough soil to enhance farming efficiency. This invention created a solution to the poor **soil health** in many parts of the United States, but had a particular impact on areas with rocky compacted ground. As time progressed, more inventions increased the production of food, which created a concern for food storage. In 1834, the Mason jar was created and patented. Before his invention, food waste was very common because food was often exposed to oxygen for long periods of time and not shelf-stable. Mason's invention consisted of a glass jar, zinc screw on cap, and rubber ring, which provided an air-tight option for storing food. With the Mason jar, food safety was enhanced because all types of produce could be easily preserved for longer periods of time in these glass containers.

Over the next century, agriculture advanced as scientific understanding progressed. For instance, plants rely on nitrogen to grow, and farmers often add additional nitrogen to the soil using different methods. One such method is **nitrogen fixation**, which involves moving nitrogen from the atmosphere into the soil so it can be used by plants. Farmers can help nourish their crops by companion planting and including nitrogen-fixing plants, like beans, alfalfa, and peanuts, into a strategic crop rotation. The scientific process of nitrogen fixation was discovered in 1901, but the method of planting mutually-beneficial crops together has been used for hundreds of years.

Although its history dates back to 600 BC, vertical farming is another alternative method to traditional farming that gained popularity around 1920. Modern vertical farming is a process of growing produce indoors where the light, temperature, and water are all controlled, and the plants are stacked in concentrated rows. In this way of farming, produce can be grown within urban settings, such as cities, to compensate for **urban sprawl**.

As man-made inventions progress, manual labor for certain tasks has become less essential, as represented by the invention of the mechanical tomato harvester in 1959. Instead of having workers pick tomatoes, a tractor-like machine was invented to harvest the entire tomato plant and sort out the tomatoes all at once. Patented in 1952, the automated irrigation system also made agricultural systems more efficient and less reliant on laborers. Through automated irrigation systems, such as drip irrigation and sprinkler systems, sensors measure the amount of moisture in the soil and dispense

water based on the precise amount of water required. By practicing this method, farmers use water more efficiently.

In 1978, the first **Global Positioning System (GPS)** was launched, which made farming more precise and efficient. Using GPS has also been beneficial for locating, suppressing, and extinguishing fires. Using this navigation also allows farmers to accurately measure the land to guide tractors and other equipment while also determining the number of crops needed to enhance their yield. Another way to enhance product yield is through use of **Genetically Modified Organisms (GMOs)**. Although scientists developed GMOs beginning in the 1970s, the United States Department of Agriculture approved the first genetically modified food crop in 1992. GMOs have different features such as **pesticide resistance**, enhanced nutrition, and **drought** tolerance, which increase the viability of a plant. Thus, some farmers choose to plant genetically modified crops to reduce the need to apply inputs like pesticides and to increase yields.

As agriculture continues to evolve to become more environmentally and economically sustainable, a return to more traditional and holistic practices has been observed. For example, **agroecology** is an approach to agriculture that aims to work with nature rather than against it. Agroecological systems may include fruits and vegetables, tree crops, livestock, and humans. It calls upon traditional knowledge and practices as well as modern science to solve problems related to sustainability and social justice in food production methods. Different time periods have contributed to the concept of agroecology through the invention of key innovations and practices that have revolutionized the agricultural industry.

CONCEPTS AND VOCABULARY

Agroecology: An approach to farming that blends agriculture with the natural ecosystem to promote environmental sustainability and social justice

Drought: A condition of water scarcity that can happen due to inadequate rainfall, which may affect the water supply

Genetically Modified Organisms (GMOs): A plant or other organism whose genetics have been scientifically altered, typically to encourage favorable characteristics that may improve production

Global Positioning System (GPS): A digital tool that utilizes satellites to map land and can be used by farmers to produce crops through navigation and field measurement

Nitrogen fixation: A method of increasing the amount of nitrogen in soil to help plants grow

Pesticide: An organic or synthetic substance that is put on plants in order to kill, prevent, or control insects, weeds, mold, rodents, harmful bacteria, and other unwanted organisms that may harm the plant

Pesticide resistance: A genetic tolerance to pesticides built up by a population of pests over time when they are continuously treated with the same pesticides

Soil health: The ability of soil to perform essential functions, such as regulating water, providing nutrients, and giving the plant to have physical stability and support

Urban sprawl: Poorly planned expansion characterized by scattered buildings and the need for cars for transportation

MATERIALS NEEDED

- Flip chart paper, one sheet per group
- Writing utensils
- *Agricultural Innovation Cards* (Appendix A3.1), one per group
- *Timeline* (Appendix A3.2), one per group
- *Elements that Affect Agriculture* (Appendix A3.3), one per group
- Art supplies, such as construction paper, markers, glue, tape, and scissors

Materials provided in curriculum

TIME REQUIRED
45 to 60 minutes

SUGGESTED GROUPINGS
Small groups of 3 to 4

GETTING READY

- ☐ Make copies of *Agricultural Innovation Cards* (Appendix A3.1), one set for each group. Cut the cards out along the dashed line.
- ☐ Make copies of *Timeline* (Appendix A3.2), one for each group.
- ☐ Make one copy of *Elements that Affect Agriculture* (Appendix A3.3). Cut the cards out along the dashed line.

  Facilitator tip: It is recommended that the above appendices be laminated to allow them to be more easily handled by youth and reused.
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These are recommended to be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.
- ☐ Provide each group with one sheet of flip chart paper and writing utensils to answer opening questions.

OPENING QUESTIONS

Ask the youth to respond to each question/prompt below by recording their responses on the flip chart paper provided and sharing their ideas verbally.

• Explain what you know about how technology can be used for growing food.
• Explain what you know about how the environment can affect growing food.

PROCEDURE (EXPERIENCING)

1. Provide each group with a set of *Agricultural Innovation Cards*, ensuring that the innovations are not handed to the groups in chronological order.
2. Ask youth to read about each of the innovations and discuss the main points of each one within their group, using their flip chart paper to take notes if needed.
3. Ask youth to determine the chronological order of the innovations and organize them by placing the *Agricultural Innovation Cards* in the order they were invented.

4. Have the youth share their completed timelines. Ask youth to describe how they chose the chronological order and how the earlier innovations helped develop future innovations seen in the agricultural industry.
5. Provide each group with a *Timeline* and allow groups to revise the order of their *Agricultural Innovation Cards*.
6. Provide each group with one of the *Elements that Affect Agriculture* and art supplies. Each group should have a different element.
7. Explain to the youth that each of the *Elements that Affect Agriculture* can have a negative impact on agriculture and that they have been tasked with creating and selling a new innovation to address their assigned problem.
8. Ask youth to use the art supplies to plan and create a depiction of their modern-day innovation.
9. Ask youth to also come up with a sales pitch for potential investors of their modern-day innovation. Youth should consider how much their innovation would cost, where it would be used, how it will operate, and who would benefit from it.

SHARING, PROCESSING, AND GENERALIZING

Have each group pitch their modern-day innovation and discuss the logistics of making it a reality.

Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share how their innovation can help alleviate their assigned problem. If necessary, ask more targeted questions/prompts:

• Explain how the problem you were assigned can negativity impact agriculture.
• Describe the process you used to create your modern-day innovation.
• Explain how your innovation could help your assigned problem.
• Describe how your modern-day innovation could affect other aspects of agriculture.
• Explain how your modern-day innovation could be implemented in the real-world.

CONCEPT AND TERM DISCOVERY/INTRODUCTION

Make sure that the youth understand how key events throughout history have influenced the evolution of **agroecology**. Youth should also understand that agricultural production is a global system that is significantly impacted by and has significant impacts on society and the natural environment. Additionally, make sure that key vocabulary terms are either discovered by the youth or introduced to them: **drought, genetically modified organisms (GMOs), Global Positioning System (GPS), nitrogen fixation, pesticide, pesticide resistance, soil health,** and **urban sprawl.**

AGRICULTURE APPLICATION

MATERIALS NEEDED

- ☐ Seeds or seedlings, at least two per youth
- ☐ Agricultural maintenance equipment
- ☐ Craft sticks, popsicle sticks, or plant markers, at least two per youth
- ☐ Permanent markers

TIME REQUIRED

15 to 20 minutes

GETTING READY

- ☐ Place all materials in a central location.
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These can be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.

PROCEDURE (EXPERIENCING)

1. Explain to youth that they will be planting one seed or seedling without using any agricultural innovations and one seed or seedling using agricultural innovations.
2. Lead youth in preparing their “no agricultural innovations” area by doing tasks, such as discarding weeds and tilling the soil, to prepare for planting without the assistance of modern agricultural equipment. For example, youth should not use shovels, hoes, hoses, or other equipment.

   Facilitator tip: Youth may need some encouragement to complete their tasks without modern equipment. Lead the way by digging into the soil yourself with your hands. Natural tools, such as sticks or vessels for transporting water, can also be used.
3. Ask youth to select one plant to grow from seed or seedling. Ask youth to work together with their group members to plant their seeds or seedlings by hand without the assistance of any agricultural innovations.
4. Lead youth in preparing their “agricultural innovations” area by doing tasks, such as discarding weeds and tilling the soil, to prepare for planting with the assistance of modern agricultural equipment.
5. Ask youth to select another plant to grow from seed or seedling. This selection can be the same as their “no agricultural innovations” plant or a different one. Ask youth to work together with their group members to plant their seeds or seedlings using the assistance of agricultural innovations.
6. Provide youth with markers and craft sticks to create labels for the seeds or seedlings they just planted.
7. Ask the youth write on the craft sticks their name, what they planted, and either “no” or “yes” to signify whether that plant was planted using agricultural innovations.

8. Explain to the youth that anything marked with a “no” should be maintained over time without agricultural innovations. Anything with a “yes” can be maintained using modern agricultural equipment.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share how the process of planting changed with the inability to use any agricultural innovations in comparison to when they were able to use agricultural innovations. Follow the lines of thinking developed through the youth’s thoughts, observations, and questions as they share what they discovered about agricultural innovations.

HOME CONCEPT APPLICATION

MATERIALS NEEDED

- ☐ *At-Home Ag* (Appendix A3.4), one per youth
- ☐ Funding permitting, materials to build one of the home agricultural systems outlined in *At-Home Ag*, one set per youth

Materials provided in curriculum

TIME REQUIRED

5 to 10 minutes

GETTING READY

- ☐ Make double-sided copies of *At-Home Ag* (Appendix A3.4), one for each youth.
- ☐ If providing, gather materials for the at-home agricultural kits.

PROCEDURE (EXPERIENCING)

1. Provide each youth with a copy of *At-Home Ag*.
2. Ask the youth to follow along with the *At-Home Ag* guide to build their own agricultural system at home. This guide provides an option for germinating seeds that can then be transferred into soil or a hydroponic system. The options for growing produce at home use low cost and household items.

   Facilitator Tip: If providing materials, it is recommended to demonstrate the setup of the provided option from At-Home Ag.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their experience building their at-home agricultural kit and discuss their intended process for maintaining the kit. Follow the lines of thinking developed through the youth’s thoughts, observations, and questions as they share what they experienced when building their at-home agricultural kit.

Steam Engine

Problem: All agriculture was done by hand which took a lot of time and limited the amount of crops that could be produced. In addition, transportation of people and goods to the un-colonized west coast was expensive and took a very long time.

Solution: The steam engine creates energy using pressurized steam to power things, including agricultural machinery and the railway steam locomotive.

Plow with Interchangeable Parts

Problem: The traditional iron plow was expensive, heavy, difficult to repair, and physically hard to use.

Solution: This innovation to the iron plow allows farmers to turn and break up soil, to bury crop residues, and to help control weeds with ease. If a part of the plow breaks, it can be fixed with a simple exchange of the broken piece for a functional one. This saves farmers time, money, and makes the land ready for planting new crops quicker.

Mason Jars

Problem: Fresh food was hard to get in the winter months and food spoiled quickly.

Solution: Mason jars are glass jars with airtight lids; invented to help preserve foods, such as fruits, vegetables, and meats. The airtight lids keep food from spoiling by preventing bacteria from growing. This product helps to reduce foodborne illnesses.

Farmers Using Nitrogen Fixation

Problem: Plants need nitrogen molecules in the soil to grow. The soil did not always provide enough nitrogen for the plants to grow.

Solution: Farmers are able to add nitrogen to the soil using man-made fertilizers. Farmers can easily add nitrogen to the existing land in a powder form or spray large areas using a liquid form. Farmers can also grow nitrogen-fixing crops, like beans. Soil high in nitrogen allows plants to grow faster and produce larger yields.

Modern Vertical Farming

Problem: Farm land was being transformed into homes, apartment complexes, malls, and other urban developments. There was less land to farm and farmers had to still keep up with producing crops for buyers.

Solution: Vertical farming includes rooftop gardening, hydroponics, aquaponics, and other methods that allow farmers to grow upward. This uses much less land and environmental resources.

Mechanical Tomato Harvester

Problem: The process of picking and sorting tomatoes was very expensive and time consuming. It required many workers at once to pick the tomatoes before spoiling.

Solution: The tomato harvester allows farmers to produce and quickly pick massive quantities of tomatoes. This also decreases labor costs.

Automated Irrigation Systems

Problem: Farmers needed to water crops regularly and quickly instead of having to water multiple acres by hand. Farmers were also unable to access water for their crops during droughts.

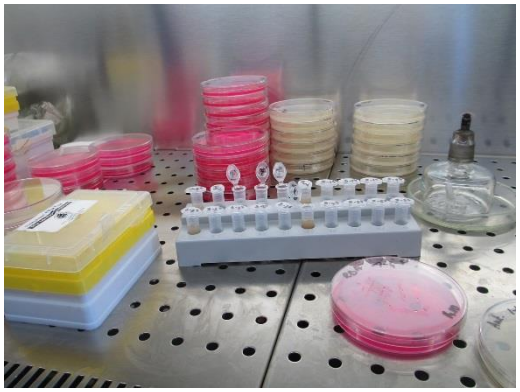
Solution: Automated irrigation systems allow farmers to control the amount of water distributed to their plants. These systems also allow farmers to retrieve water from other locations during droughts or water shortages.

Global Positioning System (GPS)

Problem: Large scale farms were so big that farmers and workers were unable to maintain the area without technical help.

Solution: GPS helps farmers with planning and organizing the farm land, testing the soil, tractor guidance, and even allows farmers to work in low visibility or dangerous weather conditions.

Genetically Modified Organisms (GMO's)



Problem: Food could not be produced fast enough naturally to feed the number of people in the world.

Solution: Genetically modified organisms are plants or animals that have been genetically engineered to improve production, including speeding up the growing process and increasing resistance to chemicals and pests.

Steam Engine
(1698)

Plow with Interchangeable Parts
(1819)

Mason Jars
(1858)

Farmers Using Nitrogen Fixation
(1901)

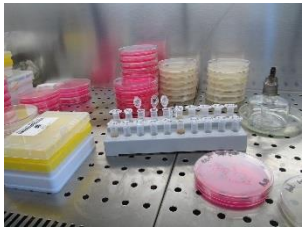
Modern Vertical Farming
(1920)

Mechanical Tomato Harvester
(1951)

Automated Irrigation Systems
(1952)

Global Positioning System
(1978)

Genetically Modified Organisms
(1992)



Water Shortage and Drought

Fires

Pesticide Resistance

Urban Sprawl

Flooding

Food Safety

Food Waste and Imperfect Produce

Poor Soil Health

Germinating Seeds

Supplies needed:

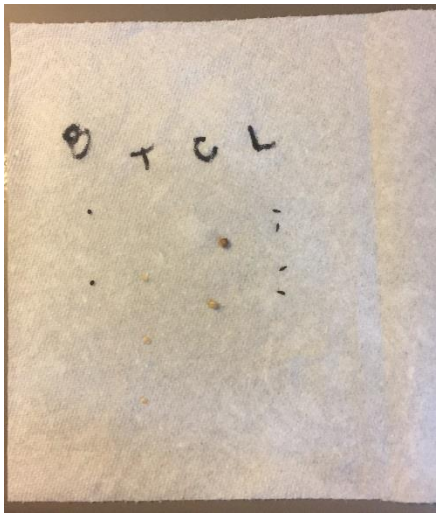
- Paper towel
- Seeds
- Water
- Spray bottle, recommended
- Sealable plastic container (recommended) or bag
- Ruler (recommended)

Directions:

1. Moisten paper towel so that it is damp, but not dripping wet.
2. Put seeds on one half of paper towel about 1 inch apart.
   - ► Optional: You can label the seeds if doing different types, as shown in the image below.
3. Fold other half of paper towel over so that seeds are covered and stay moist.
4. Gently press down on seeds in the paper towel.
5. Put folded paper towel into a plastic container or resealable plastic bag and partially close it, leaving a small space open to allow air to circulate.
   - ► For example, leave about 1 inch of the plastic bag unsealed or one corner of the container lid open.
6. Put container or bag in bright area in indirect sunlight that is about room temperature (on counter top is fine).
7. Occasionally check the container and add moisture if the paper towel begins to dry.

Once you see a root that is at least 1 cm long (about 4 – 7 days depending on the seed), move to soil or hydroponic setup. Carefully remove seedlings so that you do not damage the roots.

Steps 1 – 2



Steps 3 – 4

Steps 5 – 6

Hydroponic Setup

Supplies needed:

- Seedling (leafy greens work well)
- Container, such as a mason jar
- Net pot, or container with holes cut into it (yogurt cups work well)
- Growing media, such as clay pebbles, pellet, or rockwool
- Large pitcher, bowl, or washed milk jug
- Hydroponic plant food, 3-1-2 NPK ratio
- pH meter or litmus paper
- Hydrogen peroxide
- Measuring cups and spoons
- Paper
- Tape

Directions:

1. In a large pitcher, mix together 1 gallon (or 16 cups) room temperature water and 2 tsp. plant food to make the water solution.
2. Check the pH of the water by dipping a pH strip into it. Compare the wet pH strip to the scale immediately after pulling it out of the water. The water should be slightly acidic (pH 5.5 – 6.5, yellow or yellow-orange color*)
   - ► If pH is too high (too basic), add ¼ tsp. hydrogen peroxide and re-test.
   - ► If pH is too low (too acidic), add ¼ cup water and re-test.
3. In a separate medium-sized bowl, soak clay pebbles in water solution for a few minutes.

4. Remove the lid from the mason jar (if it has one) and then replace the metal ring. Place net pot into mason jar.
5. Fill up jar with water solution until water covers the bottom ½ cm of the net pot.
6. If using a pellet seed starter or rockwool, put it directly into the net pot on top of the clay pebbles.
   or
   If using clay pebbles, line the bottom of the net pot with the pre-soaked clay pebbles, carefully place seedling into net pot so that the root is touching the water. Add a few more layers of clay pebbles to the net pot to help support the plant as it grows

7. Wrap paper around the jar and tape in place. This will help prevent algae from growing in the water.
8. Place jar in an area that gets good sunlight for 6-8 hours a day.

You only need to add more water solution if the roots can no longer reach the water.

Step 2

pH Scale*

*Note: Coloring of the pH scale may vary

Steps 4 – 6

Steps 7 – 8

Agriculture Module 4:

Food Desert Overhaul

BACKGROUND INFORMATION

The purchase of healthy food is greatly influenced by **food availability, access**, and **affordability**. Many individuals, especially those with low incomes, may face obstacles to obtaining healthy and affordable food. **Food deserts** are areas usually in impoverished areas of the country that lack access to healthy foods, such as fresh fruits and vegetables. Despite urban areas appearing to have an abundant amount of food options, food deserts can still be present. Commonly found simultaneously with food deserts are **food swamps**. Food swamps are places in which the local food retailers predominantly sell food lacking nutritional value. Examples of food swamps include areas surrounding highway exits where an abundance of fast food establishments are found. Both food deserts and food swamps can lead to the surrounding community having few options for purchasing healthy food.

Another barrier to purchasing healthy food is the price of food. Price influences purchases because individuals with low incomes are more likely to buy cheaper foods, which are frequently less nutritious. In order to assist in the purchase of food, the United States government implemented the Supplemental Nutrition Assistance Program (SNAP). Formerly known as food stamps, SNAP provides benefits on a monthly basis to eligible individuals and families. With the development of the Electronic Benefit Transfer (EBT) system, these benefits come in the form of a card similar to a debit card. Every month, the money on the card is refilled and can be used specifically to purchase foods at various stores and markets. SNAP users are also able to use their money from this program at some local **farmers markets**.

The government has also taken steps to increase healthy food access through **health zoning laws**. These laws allow for land to be allocated for more access to healthy food. This increase can be accomplished through designating land for **community food gardens**, which are fruit and vegetable gardens created and managed by local neighborhood residents, and farmer's markets, limiting the number of fast food retailers, and promoting businesses that sell healthy food. Steps have been taken to assist in making healthier food available, accessible, and affordable to Americans, but food deserts and food swamps are still prevalent and potential remedies will likely require interdisciplinary collaboration.

CONCEPTS AND VOCABULARY

Community food gardens: Fruit and vegetable gardens created and managed by local neighborhood residents

Farmers market: A designated area where local farmers vend their products, primarily fruits, vegetables, meats, dairy products, and baked goods to consumers

Food access: The ability of an individual to reach local food-selling locations through convenient modes of transportation

Food affordability: The price of food which determines whether an individual is able to purchase certain food items

Food availability: The number of food-selling locations in a specific area and the types of foods that are sold or served at the locations

Food deserts: Areas, commonly impoverished, that are lacking access to healthy foods

Food swamps: Areas, typically found in conjunction with food deserts, in which the food retailers predominantly sell food lacking nutritional value

Health zoning laws: Laws that take steps to increase healthy food access through regulating and allocating land for the distribution of healthier foods, limiting the number of fast food retailers, or promoting businesses that sell healthy food

MATERIALS NEEDED

- ☐ Flip chart paper
- ☐ Writing utensils
- ☐ Calculators, one per group (optional)
- ☐ *Neighborhood Pieces* (Appendix A4.1), one set per group
- ☐ *Remedy Pieces* (Appendix A4.2), one set per group
- ☐ *Budget Sheet* (Appendix A4.3), one per group

Materials provided in curriculum

TIME REQUIRED
45 to 60 minutes

SUGGESTED GROUPINGS
Small groups of 3 to 4

GETTING READY

- ☐ Make copies of the *Neighborhood Pieces* (Appendix A4.1), one set for each group, and cut them out along the dashed lines.
- ☐ Make copies of the *Remedy Pieces* (Appendix A4.2), one set for each group, and cut them out along the dashed lines..

  Facilitator tip: It is recommended that the above appendices be laminated to allow them to be more easily handled by youth and reused.
- ☐ Make copies of *Budget Sheet* (Appendix A4.3), one for each group.
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These can be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.
- ☐ Provide each group with one sheet of flip chart paper and writing utensils to answer opening questions.

OPENING QUESTIONS

Ask the youth to respond to each question/prompt below by recording their responses on the flip chart paper provided and sharing their ideas verbally.

- Explain what factors influence the kind of food people eat.
- Explain what might limit someone from accessing healthy foods.

PROCEDURE (EXPERIENCING)

1. Ask the youth to flip their flip chart paper over so that they can use the back side for the activity.
2. Provide each group with one set of *Neighborhood Piece*s.
3. Explain to the youth that they will be constructing a neighborhood.
4. Ask the youth to read each of the *Neighborhood Pieces* and create their neighborhood on the flip chart paper.
5. Ask youth to share their neighborhoods and identify some of the issues that surround their pieces.

   Facilitator tip: Youth may need help identifying specific issues within their constructed neighborhoods. If needed, use the following prompts:
   a. *Describe what you notice about the neighborhood.*
   b. *Describe what is missing from the neighborhood.*
   c. *Describe how the characteristics of the neighborhood might affect the health of its residents.*
6. Explain to the youth that they will now have the opportunity to reconstruct their neighborhoods in an effort to improve them.
7. Explain to youth that each group will get a budget of $500,000 to purchase improvements for their neighborhood.
8. Provide each group with a set of *Remedy Pieces*, a *Budget Sheet*, and calculator (if using).
9. Explain to youth that they are responsible for developing a strategy within their group to use the *Remedy Pieces* most effectively while not going over budget.
10. Ask youth to reconstruct their neighborhoods using the *Remedy Pieces*. Youth should track the spending of their $500,000 budget with the *Budget Sheet*.

SHARING, PROCESSING, AND GENERALIZING

Have each group share their reconstructed neighborhood and discuss how they determined which *Remedy Pieces* to use.

Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share the changes they made to their neighborhoods and the logic used in their *Remedy Pieces* selections. If necessary, ask more targeted questions.

- Explain how you decided which *Remedy Pieces* to purchase.
- Explain how your selected *Remedy Pieces* changed your initial neighborhood.
- Explain why you did not use the other *Remedy Pieces*.
- Describe any considerations that had to be made in order to stay within the $500,000 budget.

CONCEPT AND TERM DISCOVERY/INTRODUCTION

Make sure youth understand that environmental factors, such as where someone lives, can shape

a person's food decisions and consequently health. Youth should understand what constitutes a **food desert**, and that food deserts are not only scarce in healthy food options, but can also be inundated with nutrient-poor foods, known as **food swamps**. Additionally, youth should understand the critical aspects and challenges of what can be done to help remedy some of these areas, including, but not limited to, **health zoning laws**, retailers accepting Supplemental Nutrition Assistance Program (SNAP) benefits, **community food garden** programs, innovative agriculture, transportation improvements, business outreach, and more. Make sure that key vocabulary terms are either discovered by the youth or introduced to them: **farmers market, food access, food affordability**, and **food availability.**

AGRICULTURE APPLICATION

MATERIALS NEEDED

- ☐ Flip chart paper
- ☐ Writing utensils
- ☐ Sticky notes
- ☐ Agricultural maintenance equipment

TIME REQUIRED

20 to 30 minutes

GETTING READY

- ☐ Coordinate with the necessary administration to determine a date and time to host a family night where youth can share their agricultural space and produce with family and community members.
- ☐ Title pieces of flip chart paper with logistical considerations for the event. For example, supplies, decorations, food, activities, and other.
- ☐ Affix the flip chart papers around the space so that youth can clearly see and access each one.
- ☐ Supply enough materials to allow each youth to maintain their designated area in the agricultural space.
- ☐ Organize youth into small groups of 3 – 4 youth.

  Facilitator tip: These can be the same groups that were formed in previous lessons. By doing so, the youth may continue developing teamwork skills with the same group members.

PROCEDURE (EXPERIENCING)

1. Orient youth to the flip chart papers around the space and explain that they will be planning a family night and need to determine the specifics of the event.
2. Assign each group to one of the flip chart papers and provide each group with sticky notes and writing utensils.
3. Explain to youth that each group will have 5 minutes to write down their ideas, one idea per sticky note, for their assigned topic. Youth should also affix their ideas to the flip chart paper.
4. After 5 minutes, rotate groups rotate to the next topic and allow them another 5 minutes to

record and affix their ideas to the flip chart paper. Continue with this process until all groups have had a chance to brainstorm ideas for each topic.

5. Lead youth through a review of their ideas and come to a consensus on which ideas are feasible.
6. With any time remaining, lead youth in maintaining their designating growing section. This may include discarding weeds, supplying additional nutrients, and watering plants.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their plan for a family night and discuss next steps for implementing their plan. Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share how they plan to move forward with hosting a family night.

HOME CONCEPT APPLICATION

MATERIALS NEEDED

- ☐ *My Neighborhood* (Appendix A4.4), one per youth

TIME REQUIRED

5 to 10 minutes

Materials provided in curriculum

GETTING READY

☐ Make copies of *My Neighborhood* (Appendix A4.4), one for each youth.

PROCEDURE (EXPERIENCING)

1. Provide each youth with a copy of *My Neighborhood*.
2. Explain to youth that they will create a basic map of their neighborhood and the surrounding city.

SHARING, PROCESSING, AND GENERALIZING

Have the youth share their *My Neighborhood* and discuss the components of their neighborhood depiction. Follow the lines of thinking developed through the youth's thoughts, observations, and questions as they share their surroundings and what they discovered about the food access in their city.

Dewey's Burgers

Food: Beef burgers on white bread buns, French fries, fried chicken sandwiches on white bread buns, soda, milkshakes, chicken nuggets, chipotle-ranch bacon salad

Average meal cost: $5.00

Workers: Make minimum wage and have no employer-provided health insurance; there are about 1 million workers nationwide

Environmental impact: Their number one product includes beef, which emits 5x more greenhouse gases, uses 28x more land, and 11x more water than other animal-based foods

Nutrition:
Options can be:
- High in – Saturated fat, oils, sugar, salt, refined grains
- Low in – Fiber, potassium, vitamin D

The Sand Witch

Food: Turkey, chicken, and roast beef sandwiches on white bread, chips, juice, soda, milk, chicken noodle soup

Average meal cost: $7.00

Workers: Make minimum wage and have no employer-provided health insurance

Environmental impact: Produce used on the sandwiches travels an average of 750 miles to one of their locations, utilizing lots of fuel and energy along the way

Nutrition:
Options can be:
- High in – Salt, refined grains, sugar
- Low in – Fiber, potassium, vitamin D

Cluckity Cluck

Food: Fried chicken, French fries, BBQ chicken, cheese bread, macaroni and cheese, coleslaw, bacon mashed potatoes, soda

Average meal cost: $6.00

Workers: Make minimum wage and have no employer-provided health insurance; there are about 1 million workers nationwide.

Social impact: Farmers that produce the chicken barely make enough money to run the farm, even though Cluckity Cluck is a large company with thousands of locations

Nutrition:
Options can be:
- High in – Saturated fat, oils, sugar, salt, refined grains
- Low in – Fiber, potassium, vitamin D

Burrito Wiz

Food: Cheesy beef or chicken burritos, beef tacos, quesadillas, bean and cheese burritos, nachos, soda

Average meal cost: $4.00

Workers: Make minimum wage and have no employer-provided health insurance; there are about 1 million workers nationwide

Environmental impact: Their number one product includes beef, which emits 5x more greenhouse gases, uses 28x more land, and 11x more water than other animal-based foods

Nutrition:
Options can be:
- High in – Saturated fat, oils, sugar, salt, refined grains
- Low in – Fiber, potassium, vitamin D

Pizza Shack

Food: Pizza, bread sticks, buffalo wings, soda

Average meal cost: $5.00

Workers: Make minimum wage and have no employer-provided health insurance; there are about 1 million workers nationwide.

Environmental impact: Large-scale cheese production can significantly contribute to greenhouse gas emissions and environmental pollutants

Nutrition:
Options can be:
- High in – Saturated fat, oils, sugar, salt, refined grains
- Low in – Fiber, potassium, vitamin D

High School

Food: Chicken nuggets, pizza, bean and cheese burrito, beef burgers, chips, fruit cups, raisins, chocolate milk, milk, sandwiches

Availability: Limited fresh fruits and vegetables, whole grains, plant-based proteins, dairy alternatives, and variety

Supply: Receives some food products from the distribution center Food Nationals

Space: The school has empty land that is currently unused

Stu's Liquor

Food: Chips, soda, alcohol, ice cream, candy, canned foods, energy drinks

Business: Sells liquor and tobacco to the community; accepts EBT

Supply: Receives food products from the distribution center Food Nationals

Nutrition:
Options can be:
- High in – Saturated fat, oils, sugar, salt, refined grains
- Low in – Fiber, potassium, vitamin D

Celia's Naturals

Food: Organic grocery store with a large selection of fresh, nutrient-dense foods such as seasonal and local (within 200 miles) fruits and vegetables, whole grains, beans, dairy and dairy alternatives, meats, nuts and seeds, and fish.

Prices: Items cost 30% more than Bargain Grocery Mart

Business: Does not accept EBT

Workers: Make 25% more money than other grocery store workers

Location: At least 10 miles away from most residents; it is difficult for residents to get there

Advertisements

Purpose: Promote the price, taste, and convenience of Dewey's Burgers, Burrito Wiz, and Cluckity Cluck

Television: Ads occur during commercial times for family shows

Online: Ads take place on videos popular with teenagers

Billboards: Ads are primarily near schools and at bus stops

Imperfect Bus System

Transportation: Due to a low city budget and several broken buses, the bus system does not allow for dependable transportation

Resident Complaints:

- Buses have hour and a half wait times
- Buses are too crowded
- Buses do not go to Bargain Grocery Mart
- Buses are really old and pollute the air, contributing to breathing problems

Bus Driver Complaints:

- The bus company fails to fix broken buses and invest in zero-emission bus technology
- Bus routes are outdated and do not cover the entire city

*30% of residents do not own a car

Empty Lot #1

Space: Large empty lot owned by the city

Location: Near to the Community Center

Empty Lot #2

Space: Large empty lot owned by the city

Location: Near to Celia's Naturals

Community Center

Programs: Has had programs that aim to improve the health of residents in the past through nutrition education, exercise, gardening, and cooking classes, but all programs have not existed for 2 years due to lack of funding

Health: Residents have a 25% increased risk for diet-related diseases such as heart disease, type 2 diabetes, and high-blood pressure compared other neighborhoods

Residents: 75% are low-income and eligible for SNAP benefits; 50% have SNAP benefits; there are 5,000 residents total

Bargain Grocery Mart

Food: Budget grocery store with a good selection of fresh, nutrient-dense foods such as fruits and vegetables, whole grains, beans, dairy and dairy alternatives, meats, nuts and seeds, and fish.

Prices: Items cost 30% less than Celia's Naturals

Business: Accepts EBT

Location: 10 miles away from most residents; it is difficult for residents to get there

Gas Station

Food: Chips, soda, alcohol, ice cream, candy, canned foods, donuts, hot dogs, energy drinks

Business: Accepts EBT

Supply: Receives food products from the distribution center Food Nationals

Nutrition:
Options can be:
- High in – Saturated fat, oils, sugar, salt, refined grains
- Low in – Fiber, potassium, vitamin D

Advertisements

Purpose: Promote the price, taste, and convenience of Dewey's Burgers, Burrito Wiz, and Cluckity Cluck

Television: Ads occur during commercial times for family shows

Online: Ads take place on videos popular with teenagers

Billboards: Ads are primarily near schools and at bus stops

Imagination Piece

Think: This piece is up to you! Implement any idea you want as long as you can explain how it could be done

Cost: $250,000

Community Garden

Action: Starts construction of a community garden in an empty lot *or* school; place this piece on top of whichever you choose

Benefit: Provides space for community members to grow their own fruits and vegetables

Disadvantage: Rent costs of neighboring houses increase 10% per month

Cost: $100,000 to put in empty lot; need to purchase the private land, get the zoning, and start building

*Must purchase Health Zoning Law as well for this option

or

Cost: $50,000 to set up at the school; the land is not private so there is no additional cost

Farmers Market

Action: Establishes a weekly farmers market for local farmers within 150 miles

Location: Community Center or Community Garden (if you have one)

Benefit: Provides seasonal access to fresh fruits and vegetables at an accessible location

Disadvantage: Rent of neighboring houses increases 10% each month

Cost: $75,000

Health Zoning Law

Action: Works with government to create laws that can promote health based on location of businesses and health services

Benefit: Will establish long-term framework to promote change; companies need to obey laws, which may improve the health of residents

Disadvantage: Can take a long time to put into action; may reduce some jobs in fast food or other large operations

Cost: $50,000

Corner Store Conversion

Action: Redesigns Stu's Liquor to add nutrient-dense food options, which may involve having a small section of fresh fruit and healthy snacks, and increasing signage to promote these options

Benefit: Improves healthy food options at a popular store

Disadvantage: Options cannot change very much because Stu's Liquor does not want to sell less of the other products and is limited on what they have due to distribution

Cost: $75,000

"Produce for Us" Program

Action: Contacts grocery stores and local farms for donations of unsold surplus fruits and vegetables; all food gathered will be given out for free at the Community Center in an effort to promote their programs

Benefit: Gives free produce to members of the community while reducing food, energy, water, and soil waste

Disadvantage: Need to hire staff to coordinate this effort and establish relationships with farmers and stores; people need to go to the Community Center to receive benefits

Cost: $125,000

Improve Food Advertisements

Action: Replaces fast food advertisements near schools and bus stops with public health messages, including information on SNAP eligibility, healthcare, workers' rights, and community resources

Disadvantage: Advertisements on TV and online still exist; unsure if messages will promote change

Cost: $100,000

Community Center Overhaul

Action: Reinstates nutrition education, exercise, gardening, and cooking classes

Benefit: Gives central location for community to access health-improving programs; may reduce disease rates in active participants

Disadvantage: Difficult to recruit people to join programs; participants need to pay a small fee to take classes; continued funding depends on participation

Cost: $150,000

Transportation Makeover

Action: Updates bus system by fixing broken buses, purchasing two zero-emission buses, and updating the route to allow transport to Groce-Save

Benefit: Buses will be more reliable and routes will cover more of the city

Disadvantage: Traffic may increase

Cost: $250,000

Health Insurance

Action: Requires every fast food restaurant to provide health insurance for all employees

Benefit: Employees may address health issues that they otherwise could not by seeing healthcare professionals; may decrease disease rates

Disadvantage: Food prices at fast food restaurants will increase and employees will likely be laid off to balance the cost of health insurance

Cost: $200,000

Fast Plant

Action: Replaces Dewey's Burgers with a predominantly vegetarian fast food restaurant owned by Dewey's Burgers called Fast Plant

Benefit: Fast Plant's most popular product is a black bean burger; beans use much less water, energy, and emit less greenhouse gases during production compared to beef

Workers: Paid 20% higher wages compared to other fast food employees

Disadvantage: Average meal price increases to $7.00; unsure about consumer acceptability of new options

Cost: $100,000

*Must also buy Health Zoning Law to use this piece

Twice as Nice EBT

Action: Enables EBT funds to be worth twice as much when purchasing fruits and vegetables

Benefit: People who receive SNAP benefits can potentially increase fruit and vegetable consumption due to decreased cost; may decrease disease rates

Disadvantage: Only select places will participate: Farmers' Market (if chosen) and Groce-Save

Cost: $100,000

Budget: $500,000

Remedy Piece	Why Chosen	Price
	TOTAL:	

Directions: Create a map of your neighborhood. Include the nearest grocery store, places to eat, places to shop, schools, parks, and anything else that defines your neighborhood.

1 Square = 1 Block