PURDUE UNIVERSITY | Extension

FNR-558-W

EXPERT REVIEWED

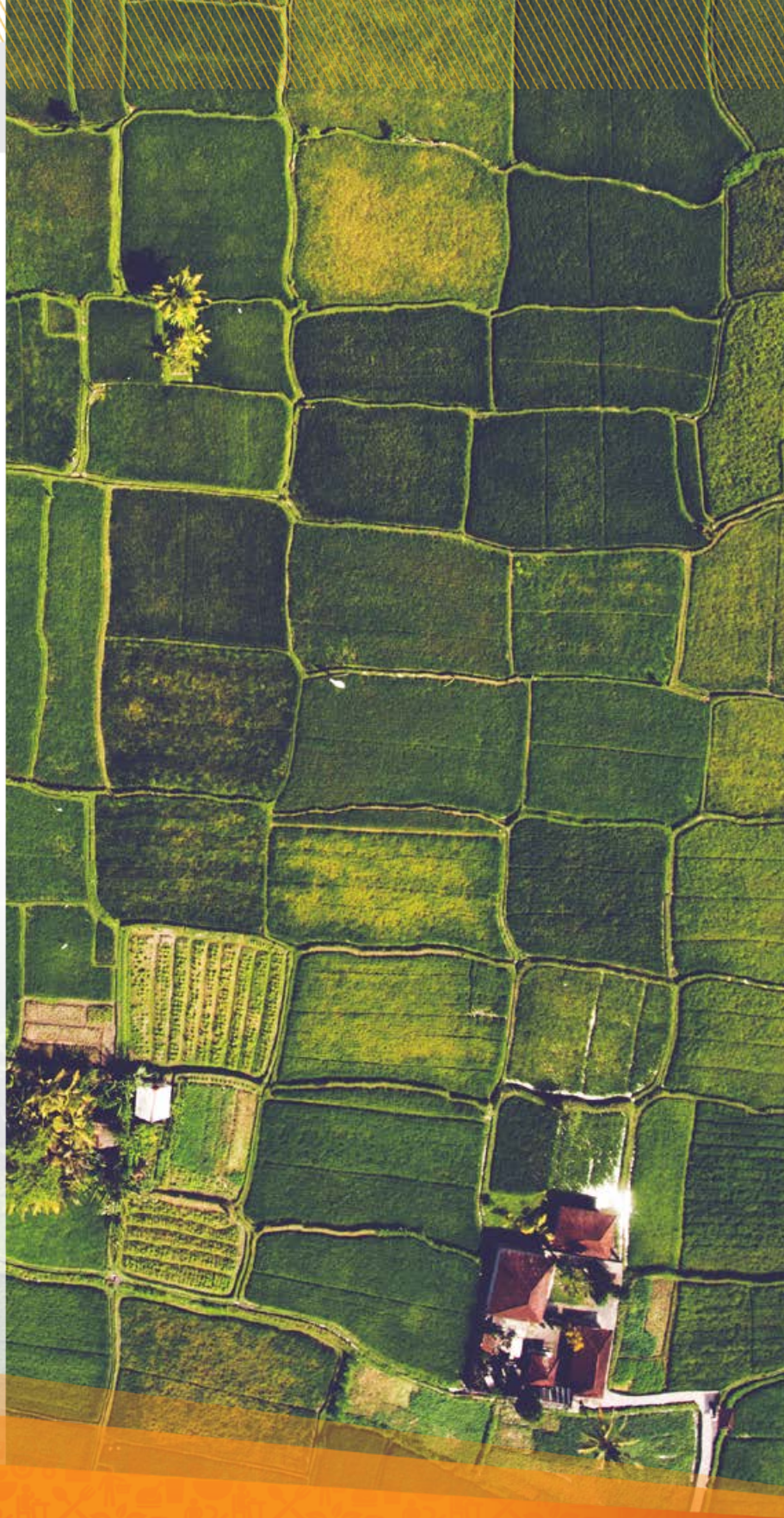
The NATURE OF TEACHING

FOOD WASTE

Food Waste and Natural Resources

LESSON PLAN

This unit highlights the resources required to produce food and the food wasted along each step of the food production system.



AUTHORS / CONTRIBUTORS

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OVERVIEW

ESTIMATED TIME

Two 45-minute lessons

VOCABULARY

- Agriculture
- Natural Resources
- Producer
- Consumer
- Food Production System
- Post-harvest
- Food Processing

UNIT OBJECTIVES

Students will be able to:

1. Understand that natural resources are limited.
2. Describe the natural resources consumed during the production of different foods.
3. Describe the amount of food wasted and resources used throughout the food production process.

LESSON STANDARDS

Lesson 1

Next Generation Science Standards

5-LS1-1

Math

5.NBT.B7

Lesson 1 and 2

English/Language Arts

RF.2.3	W.2.8	L.3.3	SL.4.4	L.5.1
RF.2.4	RF.3.4	L.3.4	L.4.1	L.5.3
SL.2.1	SL.3.1	L.3.6	L.4.4	L.5.4
SL.2.2	SL.3.2	W.3.3	RF.5.3	L.5.6
SL.2.4	SL.3.3	RF.4.3	RF.5.4	
SL.2.6	SL.3.4	RF.4.4	SL.5.1	
W.2.3	L.3.1	SL.4.1	SL.5.2	

Lesson 2

Math

2.OA.A.1	3.OA.C.7	4.NBT.B.4	5.NBT.B.5

MATERIALS

- Video: "Who Made Your Breakfast?"
- Optional Video Worksheet
- 2 Producers and Consumers Pre- / Post-Tests per student
- 1 writing utensil per student
- 4 copies of each Food sheet per student
- 4 copies of each Resource Cards sheet per student
- 3 sheets of Food Money per student
- 2 boxes of cereal
- 1 plastic bag per 2 students (15 in a class of 30)
- 1 napkin per 2 students (15 in a class of 30)

ACTIVITY ICONS

Use these icons — located at the top of each lesson plan — to indicate the disciplines to which certain activities belong. These disciplines include:

READING | WRITING | MATH | SCIENCE | STEM (science, technology, engineering, math) | STEAM (science, technology, engineering, art, math)

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EXPERT REVIEWED

October, 2018

Lesson 1:
Producers, Consumers, and Natural Resources

This lesson helps students understand that natural resources are limited and teaches them about natural resources consumed during the production of different foods.

VOCABULARY

- **Agriculture:** The practice of farming, including growing crops and rearing animals.
- **Natural Resources:** Limited materials that occur in nature and can be used for economic gain, such as water and land.
- **Producer:** A person or company that grows or raises food.
- **Consumer:** A person who buys food.

Calculations for 5th grade interactive response to video: "Who Made Your Breakfast?"

The teacher should have students watch the video and pause the video at each place where the narrator asks how many gallons of water are needed to produce that food.

- 193 gallons of water x 0.1 lb of wheat bread = 19 gallons of water
- 665 gallons of water x 0.03 lb of butter = 20 gallons of water
- 122 gallons of water / 2 glasses of milk = 61 gallons of water
- 13.8 gallons of water x 4 oranges = 55 gallons of water
- 2,300,000,000 acres of land in the U.S. x 40% = 920,000,000 acres of land used for agriculture

RESOURCES

Geography Statistics<Land Acreage<Total (most recent) by state. *http://www.statemaster.com/graph/geo_lan_acr_tot-geography-land-acreage-total* Statemaster.com.

J. L. Capper, R. E. Caddy, and D. E. Bowman. 2014. The environmental impact of dairy farming: 1944 compared with 2007. Journal of Animal Science.

Mekonnen, M. M., and A. Y. Hoekstra. 2010. The green, blue and gray water footprint of farm animals and animal products. UNESCHO-IHE Institute for Water Education. Volume 1 Main Report. Value of Water Research Report Series No. 48.

Mekonnen, M. M., and A. Y. Hoekstra. 2010. The green, blue and gray water footprint of crops and derived crop products. UNESCHO-IHE Institute for Water Education. Volume 1 Main Report. Value of Water Research Report Series No. 47.

Putnam, A. H. 2011. Florida citrus statistics 2009-2010. Florida Department of Agriculture and Consumer Services.

United States Department of Agriculture (USDA). 2012 Census of Agriculture. 2014. USDA 1: part 51.

U.S. Environmental Protection Agency (EPA). 2016. Water trivia facts. *https://www3.epa.gov/safewater/kids/water_trivia_facts.html*

USGS. 2010. Water Use in the United States. U. S. Department of the Interior. *http://water.usgs.gov/watuse/wuto.html*

Lesson 2
Food Waste from Farm to Fork

This lesson teaches students the amount of food wasted and resources consumed throughout the food production system.

VOCABULARY

- **Food Production System:** All processes and infrastructure involved in feeding a population.
- **Post-harvest:** The cooling, cleaning, sorting, and packing that happens after harvest.
- **Food Processing:** Turning raw food into something new, prepared, and easy for the consumer to use.

3rd-5th Grade Life of an Apple Story Calculations

Have students use these calculations to calculate the gallons of water consumed by the wasted apples at each stage of food distribution.

- *Production*:
  20 x 36 = 720 gallons of water
- *Post-harvest*:
  3 x 36 = 108 gallons of water
- *Processing / packaging*:
  1 x 36 = 36 gallons of water
- *Grocery store*:
  12 x 36 = 432 gallons of water
- *Consumers*:
  28 x 36 = 1,008 gallons of water

Total apples wasted:
20 + 3 + 1 + 12 + 28
= 64 apples

Total apples left after food waste:
100 – 20 – 3 – 1 – 12 – 28
= 36 apples

More resources to teach students about food waste can be found at **purdue.edu/nature**.

LESSON 1 PRODUCERS, CONSUMERS, AND NATURAL RESOURCES

This lesson plan teaches students the natural resources consumed in food production by having them interact as producers and consumers, exploring the limitations and values of those resources.

ESTIMATED TIME

45 minutes

REQUIRED MATERIALS

- Video: "Who Made Your Breakfast?"
- 1 Optional Video Worksheet per student
- 2 Producers and Consumers Pre- / Post-Tests per student
- 1 writing utensil per student
- 4 copies of each Food sheet per student
- 4 copies of each Resource Cards sheet per student
- 3 sheets of Food Money per student

PROCEDURE

1. Have students complete the *Producers, Consumers, and Natural Resources Pre-Test*.
2. Introduce the terms **Agriculture** and **Natural Resources** (see Teachers' Notes).
3. Have students watch the video "Who Made Your Breakfast?".
   a. For 5th grade classes, have students use their calculators or pencil and paper to perform the calculations to answer the questions proposed in the video (see Teachers' Notes). Students can use the Optional Video Worksheet or just notebook paper.
2. Explain **Producers** and **Consumers** to the students (see Teachers' Notes).
3. Have the students complete the activity: Producers, Consumers, and Natural Resources (see directions on pages 6-7).
4. Review concepts by asking students:
   - What resources go into producing and purchasing food?
   - What kinds of foods require the most natural resources to produce?
   - What happened when there was a natural disaster, like a chemical spill or erosion?
   - Are natural resources limited, or are they unlimited?
   - What can we do to keep from running out of natural resources?
5. Remind students that natural resources are limited, so they can run out — especially in the event of a natural disaster. The take-home points would be to reduce food waste and eat less resource-consumptive food to conserve natural resources.
6. Have students complete the Producers, Consumers, and Natural Resources Post-Test.

ACTIVITY PRODUCERS, CONSUMERS, AND NATURAL RESOURCES

In this activity, students will learn about the money and resources that go into producing and purchasing food as producers and consumers. Each round of this game is 5 minutes. It is recommended that 2-3 rounds be played so that every student gets to be a producer and a consumer.

FOOD CARDS

Consumers purchase food from **Producers**

RESOURCE CARDS

Producers use resources to make **food**

FOOD MONEY

Consumers use money to purchase **food**

FOOD SIGNS

Producers and **Consumers** can see cost of the **food**

Activity cards can be found starting on page 16.

LESSON 1 PRODUCERS, CONSUMERS, AND NATURAL RESOURCES

Before this activity:

Place Food Signs at different locations around the room. These indicate the farm stands where farmers will sell their food. Place piles of water and land Resource Cards next to farm stands. The producers will need to use these to grow food. Place all of the food next to their corresponding food stand.

1. Divide the class into two groups. Up to eight students are farmers who will be producing food, and the remaining students are consumers who will be purchasing food.
2. Give each consumer $12 in Food Money and have the producers stand at the farm stand of their choosing.
3. Consumers will have 5 minutes each round to purchase food from the producers using their Food Money. Each time a consumer makes a purchase, the producer must remove the required land and water Resource Cards from their resource piles next to their farm stands and give the consumer the food items they purchased.
4. At the end of the round, producers should count the number of land and water Resource Cards used. Ask producers which foods required the most land and water resources. Ask students what might happen if resources run out. The instructor can graph the change in resources left per round on the board as a visual.
5. Give each student some new Food Money and let different people be producers and consumers. Try randomly introducing obstacles such as chemical spills and erosion during a round, taking away some of the available land and water resources. Explain to students that erosion is when soil is moved by water or wind. Soil that moves into water can contaminate the water, making it unsafe to use. A chemical spill would be if a substance like oil spilled in the water or soil, making it unsafe to use or grow food.

PRODUCERS, CONSUMERS, AND NATURAL RESOURCES

NAME: _____

Is the sentence true or false? Select thumbs-up for true and thumbs-down for false.

1	Producers grow or raise food.		
2	Water is needed to grow food.		
3	Natural resources will last forever.		
4	It does not take water to produce eggs.		
5	Consumers buy food.		

PRODUCERS, CONSUMERS, AND NATURAL RESOURCES

Is the sentence true or false? Select thumbs-up for true and thumbs-down for false.

1	Producers grow or raise food.		
2	Water is needed to grow food.		
3	Natural resources will last forever. ***Natural resources are limited.***		
4	It does not take water to produce eggs. ***It takes about 4 bathtubs of water to produce 2 eggs.***		
5	Consumers buy food.		

VIDEO – WHO MADE YOUR BREAKFAST?

NAME: _____

Do the math problems below as you follow along with the video.

WHEAT BREAD

193 gallons of water x 0.1 lb of wheat bread

ORANGES

13.8 gallons of water x 4 oranges

BUTTER

665 gallons of water x 0.03 lb of butter

ACRES OF LAND

2,300,000,000 acres of land in the U.S. x 40%

MILK

122 gallons of water ÷ 2 glasses of milk

VIDEO – WHO MADE YOUR BREAKFAST?

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ACRES OF LAND

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= 920,000,000 acres of land used for agriculture

LESSON 2 FOOD WASTE FROM FARM TO FORK

This lesson teaches students the amount of food wasted and resources used throughout the food production system.

ESTIMATED TIME

45 minutes

REQUIRED MATERIALS

- 2 boxes of cereal
- 1 plastic bag per 2 students (15 in a class of 30)
- 1 napkin per 2 students (15 in a class of 30)

PROCEDURE

1. Tell students that they will learn about the food production system, or the steps food takes to get from producers to consumers. Some of those steps are post-harvest, food processing and packaging, and the grocery store (see Teachers' Notes).
2. Lead students through Activity 2: The Life of an Apple Story (directions for activity 2 below). There are 2nd grade and 3rd-5th grade versions of the story below.
3. Review with students by asking them questions like:
   - What are some reasons that food is wasted from the farm to our homes?
   - At what points along the food production system is food wasted the most?
   - At what points along the food production system is food wasted the least?
   - What are some ways we might be able to reduce food wasted from the farm to our homes?

ACTIVITY THE LIFE OF AN APPLE STORY

This is an activity that guides students through the life of an apple traveling from the orchard to consumers' homes and teaches students the amount of land and water resources that are consumed for agriculture.

1. Find "The Life of an Apple" story below. Cut each paragraph of the story out for students to read.
2. Divide students into pairs.
3. Give each pair of students one cup with ~100 pieces of cereal (~1.5 cups), and one napkin. Have each student take out a piece of paper and a pencil. Instruct students to pay attention to the "Life of an Apple" story and write down the numbers they hear.
4. Have students take turns reading paragraphs from the "Life of an Apple" story. At each stage, have students remove the correct amount of cereal from their cup and put the cereal on their napkin. When the story asks students to make calculations (3rd-5th grade students), have students make the calculations using their paper and pencil.

Optional

Walk students through calculations on the board. For 2nd grade students, the teacher should write the number of apples wasted at each stage on the board. Students will subtract these numbers from the original 100 apples to determine the total number of apples wasted.

Optional

Symbolize a gallon by bringing in a gallon of water from home. Have students take turns lifting the gallon to help them visualize what a gallon of water looks like. You can help younger students visualize large numbers by making a drawing of a gallon jug or other visual equal to 36 gallons.

5. Tell the students: No matter the reason for food waste, food waste is expensive. The U.S. uses more than 126 million gallons of water every day for agriculture. Forty percent of U.S. land (920 million acres) is currently used for U.S. agriculture.

ACTIVITY THE LIFE OF AN APPLE –2ND GRADE

This story guides students through the life of an apple from the orchard to consumers' homes. Students will have bags of cereal that will represent apples. Teachers will have students read the story aloud. Certain parts of the story will have students remove cereal from their bags, symbolizing apples wasted, and students will have to use math to determine how many gallons of water was wasted with those apples.

➡ = action item

THE LIFE OF AN APPLE 1

There once was a crop of 100 happy apples living in an orchard. One day, those apples were picked and put on a truck to go to the post-harvest station. Sadly, only 80 of the 100 apples made it onto the truck from the orchard. Twenty of the apples were left in the orchard to rot.

➡ ***Remove 20 "apples" from your bag.***

THE LIFE OF AN APPLE 2

Apples are left in the orchard if 1 the grocery store does not need all of the apples; 2 there are not enough people to harvest the apples; and 3 the apples do not look perfect. If 20 apples were wasted at this station, and each apple needed 36 gallons of water, that is a lot of water that just went to waste!

THE LIFE OF AN APPLE 3

Next, the 80 remaining apples arrived at the post-harvest station. Three more apples were wasted because they were the wrong size, shape, or color, or had too many bruises.

➡ ***Remove three more "apples" from your bag.***

THE LIFE OF AN APPLE 4

If three apples were wasted during post-harvest, and each apple needed 36 gallons of water, that is a lot of water that just went to waste!

THE LIFE OF AN APPLE 5

At the processing and packaging station, some bruises were removed, and stems and cores were removed from some apples so the apples could be included in fruit trays. Only one apple was lost at this station.

➡ ***Remove one "apple" from your bag.***

THE LIFE OF AN APPLE 6

If one apple was wasted during processing and packaging, and that apple needed 36 gallons of water, that is a lot of water that just went to waste!

THE LIFE OF AN APPLE 7

Next, the apples went to the grocery store, where they looked perfect and ready to be purchased. But after a while, some of the apples that had been there a long time started to look dull. Their colors changed, and some bruises appeared on their skins. The grocery store had ordered too many apples.

THE LIFE OF AN APPLE 8

The apples went on sale, but some of them were never purchased because people want their apples to look perfect. Sometimes overripe apples can actually be sweeter than perfect-looking apples and can be used to make baked goods and applesauce. Twelve apples were wasted at the grocery store.

➡ ***Remove 12 "apples" from your bag.***

THE LIFE OF AN APPLE 9

If 12 apples were wasted at the grocery store, and each apple needed 36 gallons of water, that is a lot of water that just went to waste!

THE LIFE OF AN APPLE 10

Some of the apples that were purchased from the grocery store were wasted by consumers. Twenty-eight apples were wasted by people like you and me.

➡ ***Remove 28 "apples" from your bag.***

THE LIFE OF AN APPLE 11

Consumers waste food because they buy too much, they do not store the food properly, or sometimes think they cannot eat food that looks "ugly." If 28 apples were wasted by consumers, and each apple needed 36 gallons of water, that is a lot of water that just went to waste!

THE LIFE OF AN APPLE 12

Now that the apples have gone through the food production system from producer to consumer, look at your notes and add the total number of apples wasted at each station to find the total number of apples wasted. Then, subtract this number to find the total number of apples remaining after food waste.

➡ ***How many apples were not wasted?***

THE LIFE OF AN APPLE 1

There once was a crop of 100 happy apples living peacefully in an orchard. One day, those apples were picked and loaded into a truck to be taken to the post-harvest station. Sadly, only 80 of the 100 apples made it onto the truck from the orchard. Twenty of the apples were left in the orchard to rot.

➡ *Remove 20 "apples" from your bag.*

THE LIFE OF AN APPLE 2

Apples are left in the orchard if 1 the grocery store decides that it does not need all of the apples; 2 there are not enough people to harvest the apples; and 3 the apples do not look perfect. About 36 gallons of water are used to produce one apple. If 20 apples were wasted at the orchard, how many gallons of water were wasted?

➡ *Multiply 20 apples by 36 gallons of water to see how much water was used with the wasted apples.*

THE LIFE OF AN APPLE 3

Next, the 80 remaining apples arrived at the post-harvest station, where the apples were checked for quality. Three more apples were lost at this station because they were the wrong size, shape, or color, or had too many bruises.

➡ *Remove 3 more "apples" from your bag.*

THE LIFE OF AN APPLE 4

If three apples were wasted during post-harvest, how many gallons of water were wasted?

➡ *Multiply 3 apples by 36 gallons of water.*

THE LIFE OF AN APPLE 5

At the processing and packaging station, some bruises were removed, and stems and cores were removed from some apples so the apples could be included in fruit trays. Only one apple was lost at this station.

➡ *Remove 1 "apple" from your bag.*

THE LIFE OF AN APPLE 6

If 1 apple was wasted during processing and packaging, how many gallons of water were wasted?

➡ *Multiply 1 apple by 36 gallons of water.*

THE LIFE OF AN APPLE 7

Next, the apples were transported to the grocery store. Once at the grocery store, the apples felt like they were perfect and ready to be purchased. But after a while, some of the apples that had been there a long time started to look dull. Their colors changed, and some bruises appeared on their skins. The grocery store had ordered too many apples. The apples went on sale, but some of them were never purchased because people want their apples to look perfect. Sometimes overripe apples can actually be sweeter than perfect-looking apples and can be used to make baked goods and applesauce. Nonetheless, 12 apples were wasted at the grocery store.

➡ *Remove 12 "apples" from the bag.*

THE LIFE OF AN APPLE 8

If 12 apples were wasted at the grocery store, how many gallons of water were wasted?

➡ *Multiply 12 apples by 36 gallons of water.*

THE LIFE OF AN APPLE 9

Some of the apples that were purchased from the grocery store were wasted by consumers. Twenty-eight apples were wasted by people like you and me.

➡ *Remove 28 "apples" from the bag.*

THE LIFE OF AN APPLE 10

Consumers waste food because they buy too much, they do not store the food properly, or sometimes think they cannot eat food that looks "ugly." If 28 apples were wasted by consumers, how many gallons of water were wasted by consumers?

➡ *Multiply 28 apples by 36 gallons of water.*

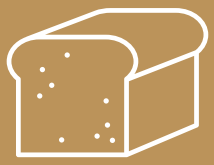
THE LIFE OF AN APPLE 11

Now that the apples have gone through the food production system from producer to consumer, look at your notes and add the total number of apples wasted at each station to find the total number of apples wasted. Then, subtract this number to find the total number of apples remaining after food waste.

➡ *How many apples were not wasted?*

RESOURCES

ACTIVITY CARDS



Wheat Bread – $2

RESOURCES

The NATURE OF TEACHING

FNR-558 Food Waste and Natural Resources

Water

Land

Land

Land

Land

The NATURE OF TEACHING

Butter – $4

RESOURCES

The NATURE OF TEACHING

FNR-558 Food Waste and Natural Resources

Water

Water

Water

Water

Land

Land

Land

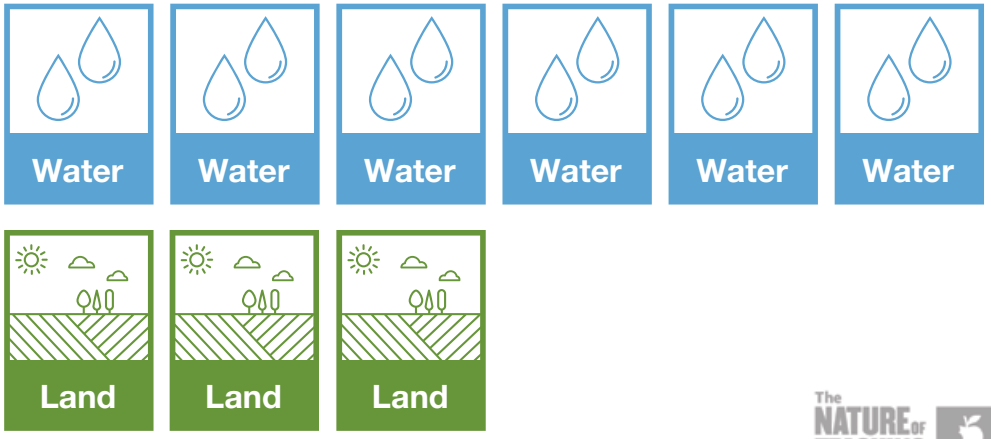
The NATURE OF TEACHING

Bacon – $5

RESOURCES

The NATURE OF TEACHING

FNR-558 Food Waste and Natural Resources



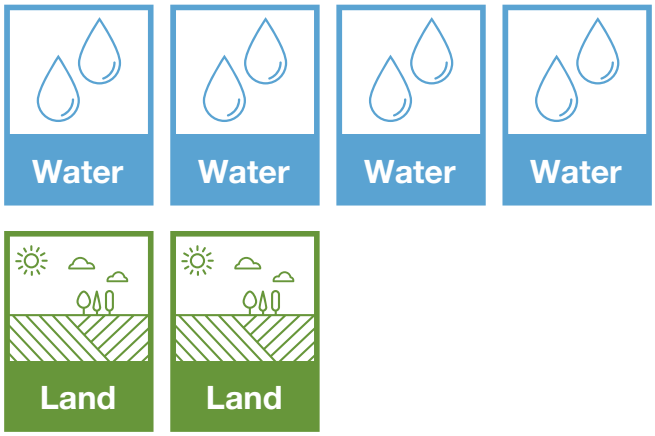
The NATURE OF TEACHING FOOD WASTE

Eggs – $3

RESOURCES

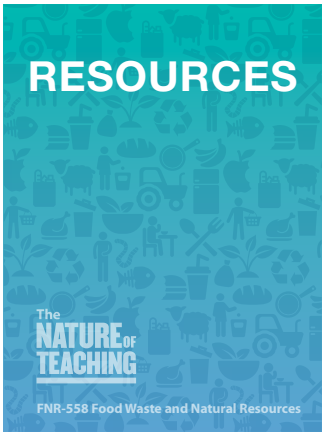
The NATURE OF TEACHING

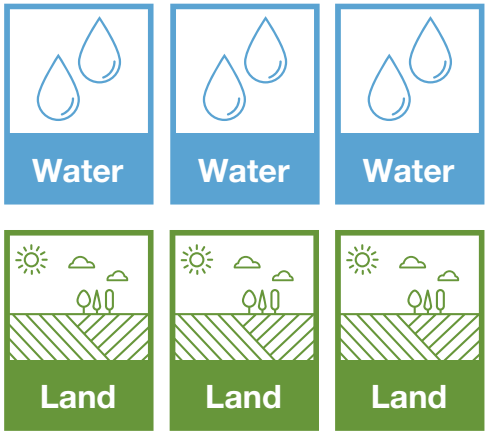
FNR-558 Food Waste and Natural Resources



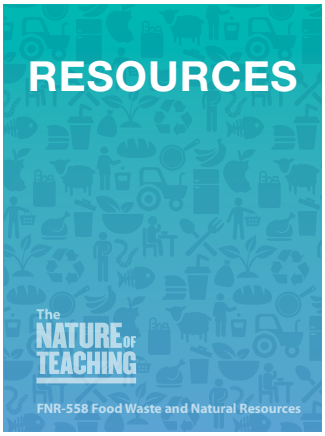
The NATURE OF TEACHING FOOD WASTE

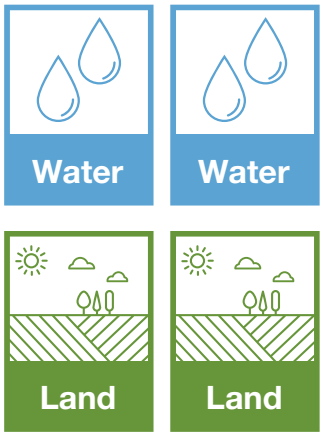
Milk – $3



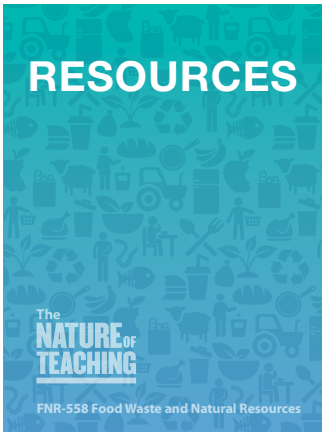


Oranges – $4

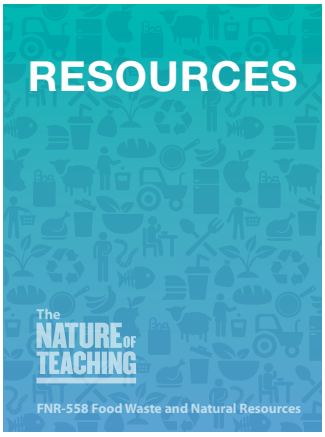


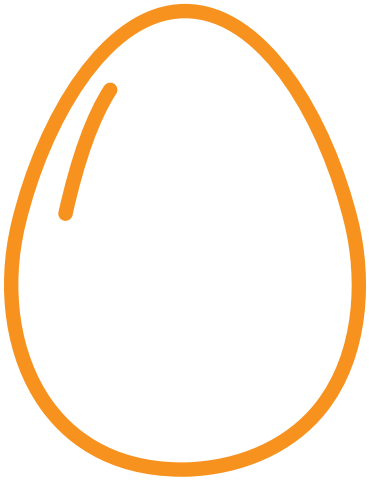


Spinach – $1

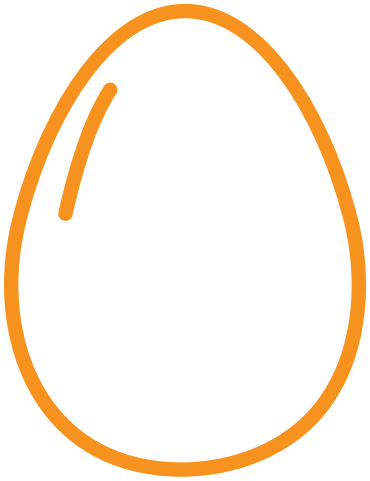


Strawberries – $3





Egg



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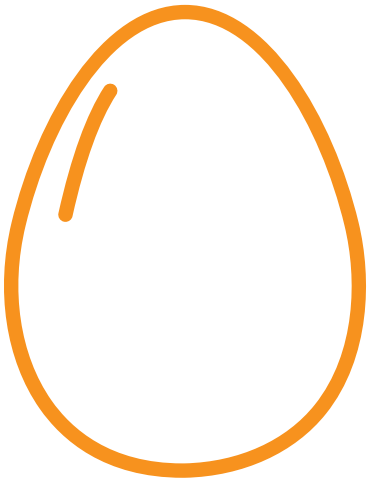

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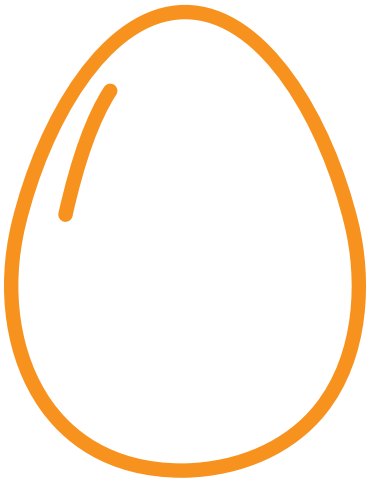

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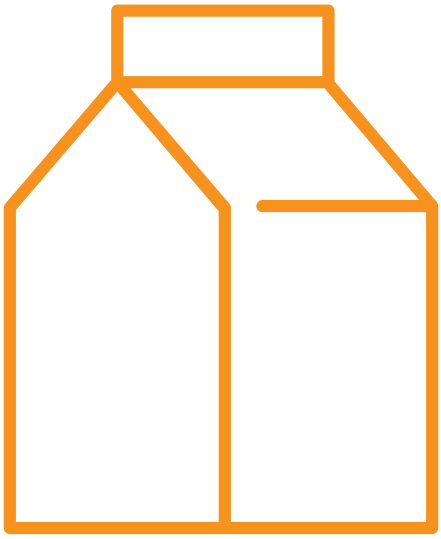
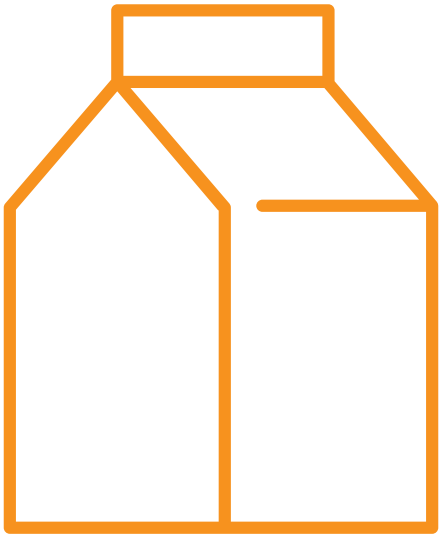


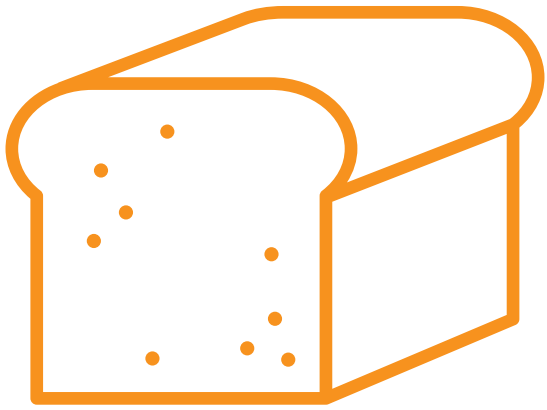
Milk

Milk



Milk

Milk



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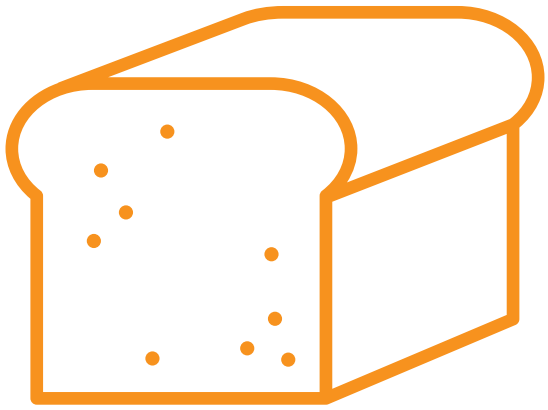

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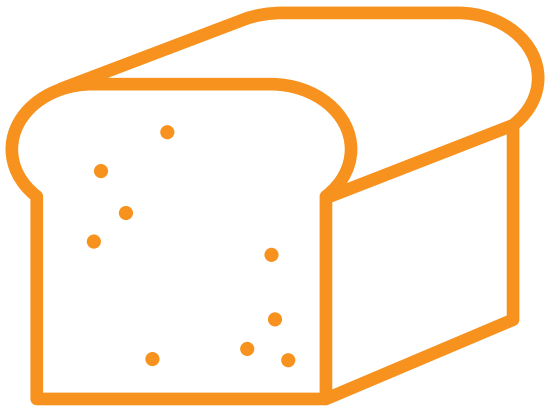

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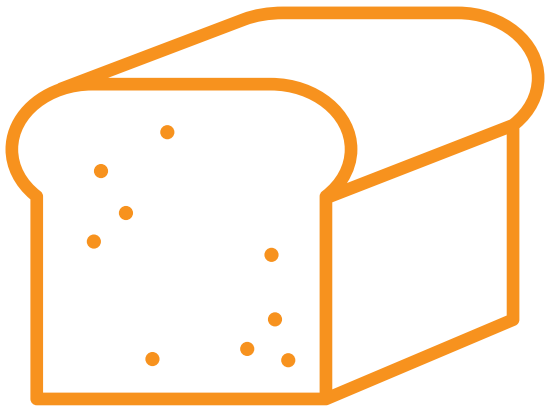

Bread

Orange

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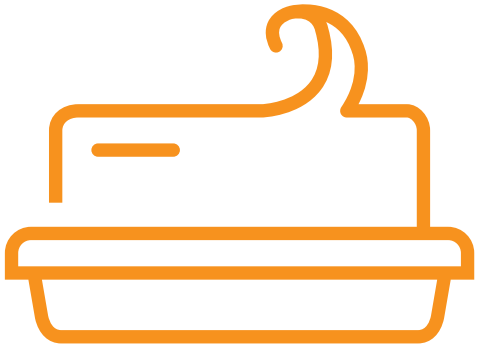

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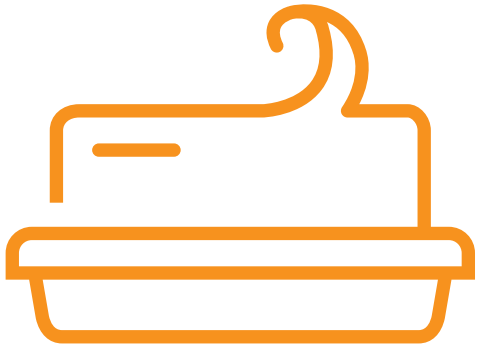

Butter

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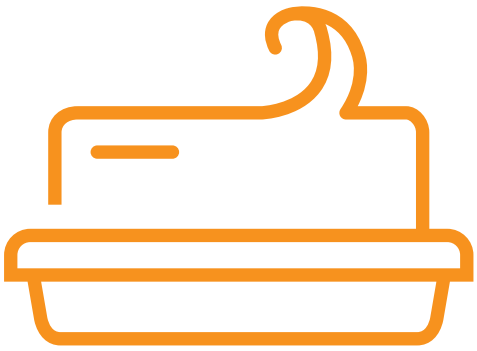

Butter

Bacon

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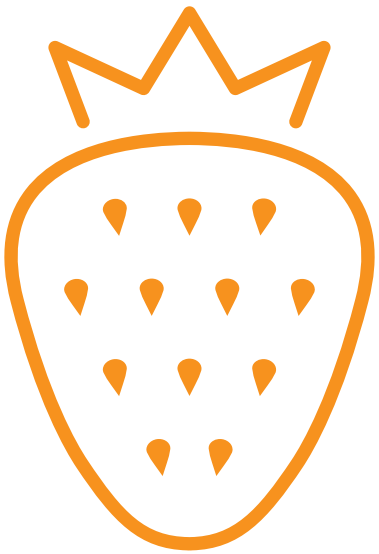

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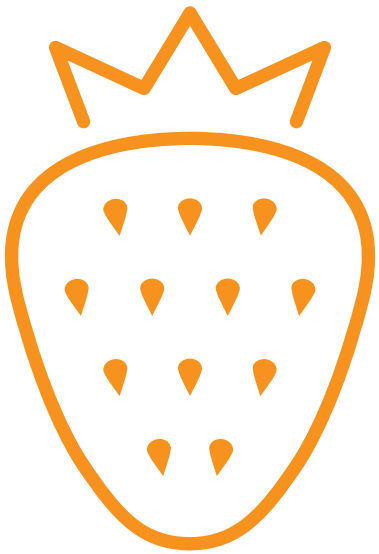

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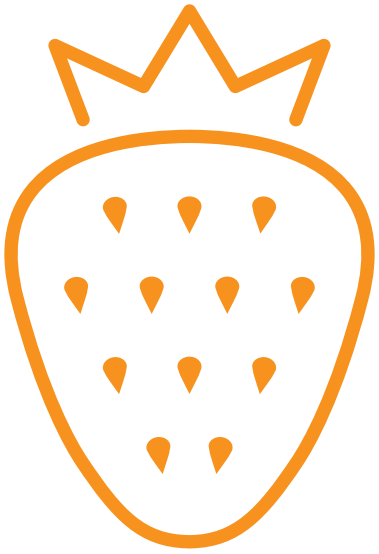

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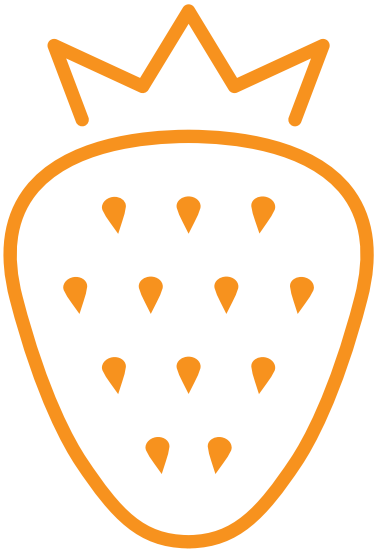

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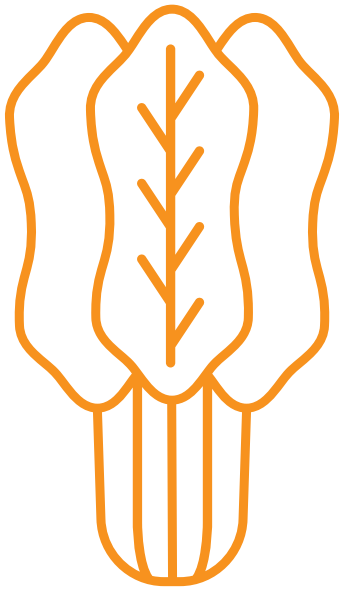

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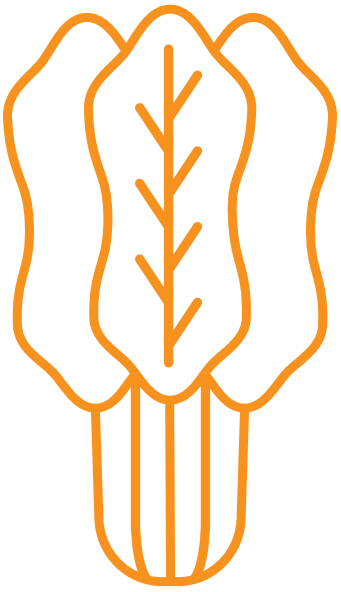

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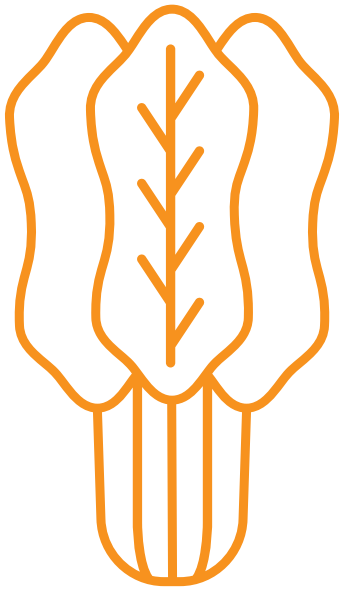

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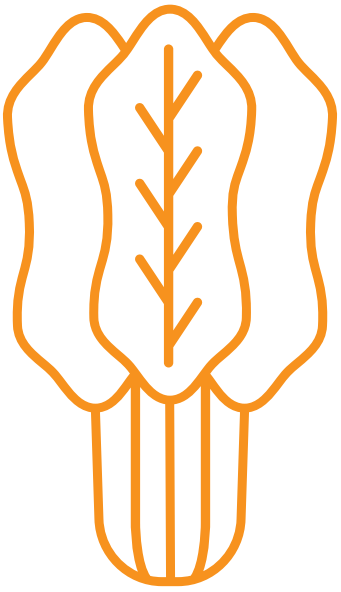


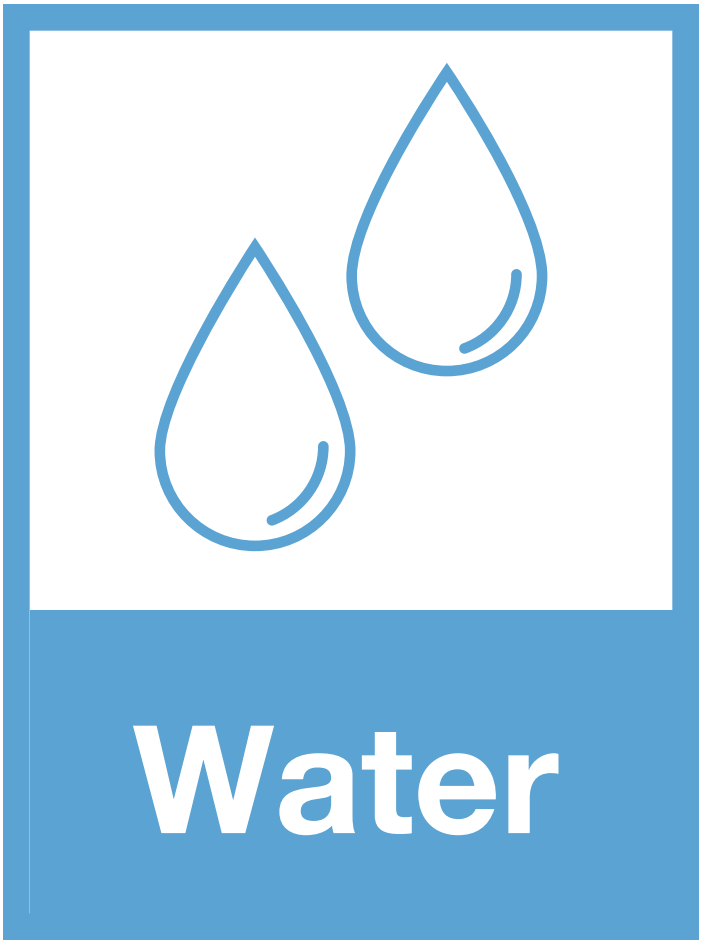
Spinach

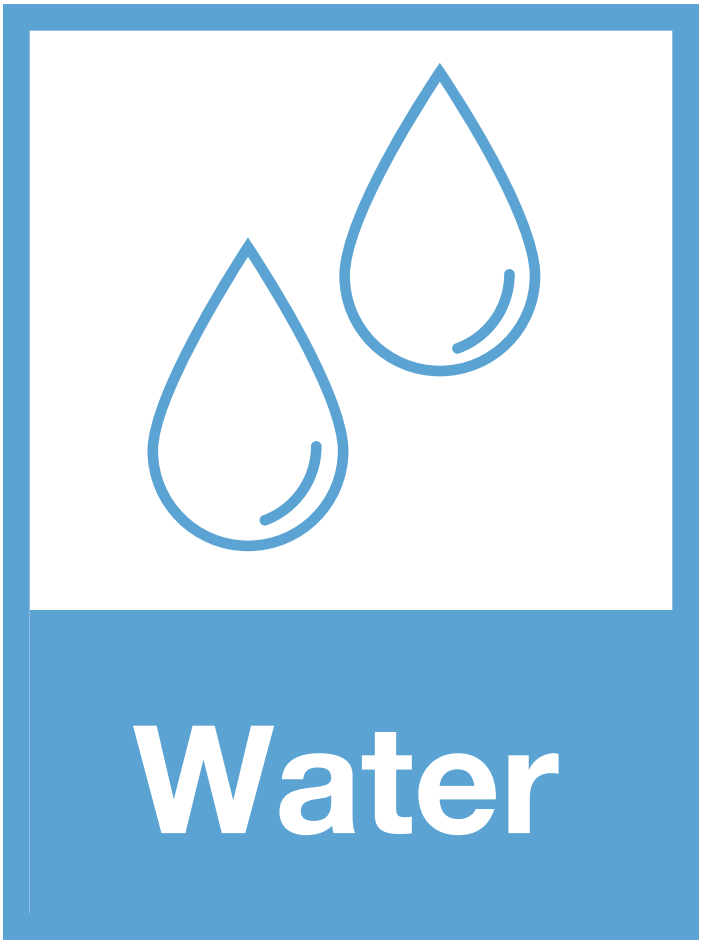

Land

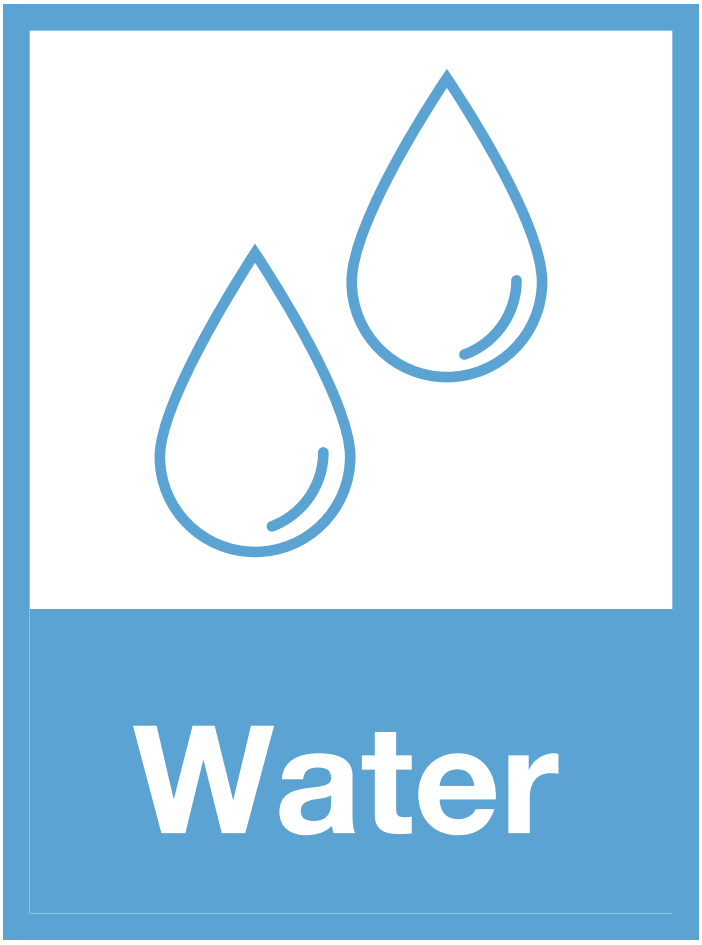

Land


Land


Land


Water


Water


Water


Water

Food Money

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