

STEM Connections

Colorado State University

Extension



Connecting Science, Technology, Engineering, and Math concepts to our everyday lives.

4-H Project Connection

- Food Culture and Reading
- Geospatial

4-H Science Abilities:

- Use Tools
- Collaborate
- Measure

4-H Life Skills:

- Teamwork
- Cooperation
- Learning to Learn

Colorado Standards:

High School: 21st Century Skills

Employ data-collection technology such as geographic mapping systems and visualization tools(3. Earth Systems Science, I. Relevance and Applications)

Life Science

2. The size and persistence of populations depend on their interactions with each other and on the abiotic factors in an ecosystem.

8th Grade: Life Science:

1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency

7th Grade: Life Science:

1. Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment

6th Grade: 21st Century Skills:

1. Natural resources come from a variety of locations and have to be mined or harvested, depending on the type (3. Earth Science Systems Science, Relevance and Applications)

5th Grade: 21st Century Skills:

2. Resources are not distributed evenly and require transportation systems to move them to where they are needed. (3. Earth Systems Science, Relevance and Applications)

Earth Systems Science:

1. Earth and Sun provide a diversity of renewable and nonrenewable resources

Where in the World?...

Where does our food come from?

How far does it travel to get to our tables?

How have plants moved from where they originated to where they are grown now?



Arvind Balaraman / FredDigitalPhotos.net

EXPLORE IT - DESIGN IT - DO IT

An investigation of cookbooks from around the world reveals that people in other countries enjoy lots of different foods. Here in the U.S., we are especially influenced by a variety of traditions because our country was settled by people from many cultures. In this activity you will use a GPS device to explore the exports of countries that produce the ingredients for the “*Top It Piz̧za*” recipes.

Many plants have also traveled from their native habitats and are now grown in lands that have similar climates. For example, vanilla has a fascinating history - having evolved in Mexico along with its only pollinator, the Melipona bee, it is now primarily grown in Madagascar where it has to be hand pollinated. Importing foods from distant lands uses fuel for transportation and refrigeration. We can often conserve resources by buying foods that are grown locally and in season. Many stores now feature Colorado produce, dairy products and meats.

Like the early explorers who traveled the globe using compasses and sextants, we will explore faraway continents with the aid of a navigational tool. Today we have a new technology called Global Positioning System, or GPS, that uses satellites instead of the Earth’s magnetic field or stars to orient a traveler. A GPS unit can tell you not only where you are, but also how far away you are from another point on Earth and its direction relative to your position.

GPS devices need to connect with at least three satellites in space. The time it takes for a signal to travel between the satellite and the GPS unit can be converted to a distance. Using trilateration, a mathematical technique, the four distances are used to precisely locate the position of the GPS device. The location is expressed as **latitude**, the angular distance north or south of the equator and **longitude**, the angular distance east or west of the Prime Meridian, an imaginary line that runs from pole to pole through the Royal Observatory in Greenwich, England.

Ages:

4th grade - 9th grade

Time:

One hour

Prep time: One hour

Materials:

4 or more GPS units (E-trex H)

One **IMPORT!** sheet per team

Food Cards

10 plastic containers (small)

Pencils

Power Words:

Equator - An imaginary line around the earth that separates the Northern Hemisphere from the Southern Hemisphere. It is the 0° line of latitude. The equator is almost 25,000 miles around.

Lines of latitude - These imaginary circles lie parallel to the equator and become smaller as they get closer to the poles. Colorado lies between latitudes of 37°N and 41°N, almost 3000 miles from the equator.

Lines of Longitude - The imaginary lines that run from pole to pole along great circles. Colorado is between about 102° and 109° west of the Prime Meridian or about 5000 miles west of 0°.

Satellite - A device designed to be launched into orbit around Earth that can collect and transmit data



Experience / "What to Do"

LET'S PLAY "IMPORT!": We are going to play a game in which teams will compete to be the first to gather all the ingredients they need for their Top It Pizza. Teams will use the GPS unit to travel the "world" (really the playground) to collect their ingredients (food cards). Your teacher has hidden the food cards all around the playground. He or she will give you a list of countries where you will find your foods. You will use your GPS units and your chart of waypoints to navigate to the "country" where you can collect your ingredients and bring them back to your home. When you have collected all your ingredient cards, be the first to bring them to your teacher and win the game!

BUT FIRST YOU HAVE TO LEARN HOW TO USE THE GPS!:

First you need to turn your GPS on and wait for it to connect to the satellites. The power button is the bottom one on the right hand side. When your GPS is ready, it will look like this:



Since you will only be using the Waypoints and the GOTO function today, you need to go to the menu page. To do that, push the PAGE button, above the power button,

four times until the screen looks like this:

On the left side of the GPS, there are three buttons. The top two move the cursor up and down. The bottom one is the ENTER button. Push the down button once to highlight WAYPOINTS, then push ENTER. This will bring up a list of waypoints organized in six files, one numbered, the rest alphabetic.



You will find the waypoint for the country you need to visit by using the up and down buttons on the left side of the GPS. For instance, suppose you are looking for China. Move the cursor to the category "A-D" and push ENTER. Any waypoint that begins with A-D will appear in the column. Go up or down until you have the one you need - in this case, CN (for China), then push ENTER.

WAYPOINTS	
0-9	-----
A-D	CN
E-H	-----
I-L	-----
M-P	-----
Q-T	-----
U-Z	-----

Your waypoint will appear on a flag and you will see the op-

tion GOTO is highlighted. Pushing ENTER again will bring up the screen on the right. Now you are ready to navigate to China! Start walking and you will notice the arrow moves and the distance at the top of the screen changes. You want to follow the arrow and keep decreasing the distance until you have reached your goal. When the distance is down to about 10 ft. or less, look around for your food card.



Share/Reflect/Generalize/Apply

Use your GPS to find out how far China really is from where you are. Simply select "CN" from the waypoints. Instead of clicking on GOTO, arrow down to the bottom where the latitude and longitude information is. Push ENTER and the edit location screen will appear. Follow the directions to enter the real lat/long data for the capitol of China, Taipei and push OK. Now when you select GOTO you will see the real distance to China at the top of the navigation screen. Try it for all the countries! How far did your meal have to travel to reach the top of your pizza?

Often where a crop is grown is different from where it originated. The countries chosen for the Import! game came from the UN list of top exporters for each food. Research the foods in *Travelling Foods (FCR, p.96)* to see where they are grown today.

Career Connections: Geographers work in many fields. Check out careers at http://www.aag.org/cs/about_aag

References: Learn all about food production from the U.N. website, <http://faostat.fao.org/site/339/default.aspx>.

This STEM Connection was developed by: Anne Casey. To find out more about 4-H STEM activities, contact your local county Extension office. <http://www.ext.colostate.edu/cedirectory/countylist.cfm> More activity sheets can be found at http://www.colorado4h.org/k12/activity_sheets/activity.php

TIPS FOR TEACHERS

There's a bit of prep work for you, but you'll find GPS is fun and the kids will have a ball! So let's get started:

First spend a little time getting familiar with the GPS unit by skimming through the manual. For this activity you only need to look at **Getting Started**, pp.1-6, **Mark Waypoints Page**, p. 11, and **Waypoints Page (GOTO)**, p. 12. Make sure you clear any waypoints you may have entered while exploring the GPS. It will make the next activity easier. (For the E-Trex H by Garmin)

Go over the following quick exercise with your students to allow them to become familiar with using the GPS:

- A. With your students, take all the GPS's outside and break up into four groups. Have the students turn on the GPS units and watch the screens as they connect with the satellites. Talk with them about how GPS works and watch as the accuracy improves. This is a good time to discuss the fact that the GPS will get them close to a location, but can only bring them to within the level of accuracy of any point, so they could be anywhere from 15 feet away from their goal to right on top of it.
- B. Have all the students page to the MENU screen. Use the up/down buttons to choose MARK and push ENTER. An explorer with a flag labeled 001 will appear and the **OK** will be highlighted. For this practice exercise, just call your waypoint **001** and push the ENTER button. Now you have a waypoint called 001 that marks the spot where you are all standing. The screen will return to the MENU screen.
- C. Have the groups, one GPS per group, move about 50 feet away from the marked spot, so they can still hear and see you. Talk them through the directions to move down to highlight WAYPOINT, ENTER, ENTER again to choose 0-9, ENTER again to choose 001. They will see the Review Waypoint page with GOTO highlighted. ENTER again to choose GOTO. Now the Navigating screen will show up. Show them how to use it to navigate back to the marked location. You should all end up together again as the students follow the arrow and watch the distance decrease. Point out to them that the distance will probably not go to zero when they return to the spot, but rather it will start to jump around a lot. Remember the accuracy issue. This exercise should take 10-15 minutes and will prepare them for the game IMPORT!.

Getting ready for IMPORT!: You will have to lay out the course ahead of time by taking the food cards and hiding them in whatever outside area you have available. The chart below will help you find the cards you will need. The cards should be placed in the plastic containers with the appropriate flag taped on top. Now you need to hide the containers, but not *too hidden* - Remember the accuracy of the GPS only brings them to within 10-15 feet of their goal. Here's what you do:

- A. Turn on the GPS and wait for a signal, head to a good place for one of the countries and hide the food card container for that country. (The food cards chosen for each country are some of the top exports from that country. The students will not use all of the cards.) Mark the location on the GPS by paging to the menu screen, selecting Mark, and pushing the ENTER button.
- B. Do not choose OK when the flag shows up. Instead arrow up and edit the waypoint name, following the directions on the screen. When you have entered the country's abbreviated name, use the down button to highlight OK and push ENTER. Do this for all the GPS units. The naming process is a little tedious. If you want to skip this step, keep track of what country represents each waypoint number and give the students a chart of numbers and countries (for example 001 = China, 002 = USA, etc.)
- C. Repeat this process for each country and its food cards, marking each location and naming it. Now the field is set!

When you are ready to play IMPORT!, group the children by pizza and give them a GPS unit and an IMPORT card which will tell them where they need to go to collect their food items. Start everyone together at the same spot. On the count of three have them turn on the GPS and get started. The winning team is the one that brings all their food cards in the fastest, **using the GPS**.

Below is a chart of the cards you will need for each country:

New Zealand (NZ)	USA (US)	China (CN)	India (IN)	Spain (SP)	Mexico (MX)	Greece (GR)	Turkey (TR)	Indonesia (ID)	Italy (IT)
Onions	Monterey Jack Cheese	Apples	Chili Powder	Olive Oil Olive Oil	Peppers	Olives	Raisins	Cinnamon	Feta Cheese
Milk	Mozzarella Cheese	Honey	Onions	Tangerines	Tomatoes Tomatoes	Oranges	Lemons	Palm Oil	Macaroni
Sheep Meat	Spinach	Garlic	Rice	Lettuce	Cucumbers	Water	Pastry	Tea	Fruit Juices
Kiwi	Wheat	Dried Beans	Sugar	Peaches	Watermelons	Grapes	Hazelnuts	Coffee	Potatoes

Ingredients for the: Mexican Pizza in red Italian Pizza in green Greek Pizza in blue German Pizza in orange

IMPORT!



Mexican Pizza

The capitol of Mexico is Mexico City.

Mexico City - N 19° 03', W 99° 22'

You need to collect:

Onions, Chili Powder, Peppers, Monterey Jack Cheese

IMPORT!



Italian Pizza

The capitol of Italy is Rome.

Rome - N 41° 54', E 12° 29'

You need to collect:

Olive Oil, Olives, Tomatoes, Mozzarella Cheese

IMPORT!



Greek Pizza

The capitol of Greece is Athens.

Athens - N 38° 00', E 23° 43'

You need to collect:

Spinach, Olive Oil, Tomatoes, Feta Cheese

IMPORT!



German Pizza

The capitol of Germany is Berlin.

Berlin - N 52° 31', E 13° 23'

You need to collect:

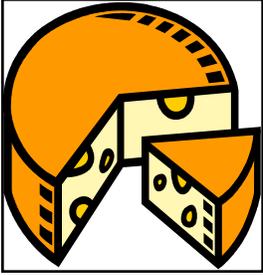
Apples, Honey, Raisins, Cinnamon

use the table below to find the countries where you will find your ingredients

Country	Lat/Long (Cap.)	Exports			
China (CN)	N25°02', E121°38'	Apples	Honey	Garlic	Dried Beans
Greece (GR)	N38°00', E23°43'	Olives	Oranges	Water	Grapes
India (IN)	N28°37', E77°13'	Chili Powder	Onions	Rice	Sugar
Indonesia (ID)	S6°11', E106°50'	Cinnamon	Palm Oil	Coffee	Tea
Italy (IT)	N41°54', E12°29'	Feta Cheese	Macaroni	Fruit Juice	Potatoes
Mexico (MX)	N19°03', W99°22'	Peppers	Tomatoes	Cucumbers	Watermelon
New Zealand (NZ)	S41°17', E174°27'	Onions	Milk	Meat	Kiwi
Spain (SP)	N40°26', W3°42'	Olive Oil	Tangerines	Lettuce	Peaches
Turkey (TK)	N39°55', E32°50'	Raisins	Lemons	Pastry	Hazelnuts
USA (US)	N38°53', W77°01'	Monterey Jack Cheese	Mozzarella Cheese	Spinach	Wheat

Then use the lat/long information to calculate your total food mileage.

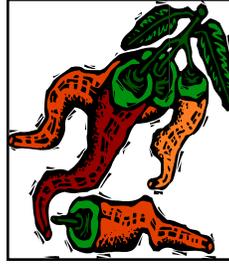
Food Card Sheet



Monterey Jack Cheese



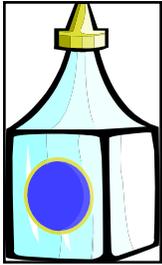
Honey



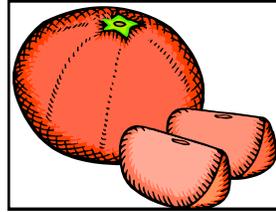
Chili Powder



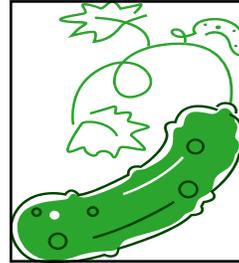
Olive Oil



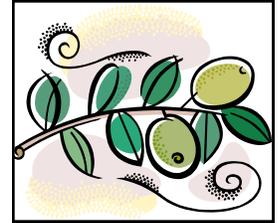
Palm Oil



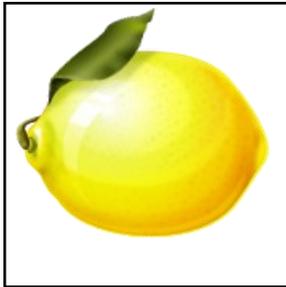
Tangerines



Cucumbers



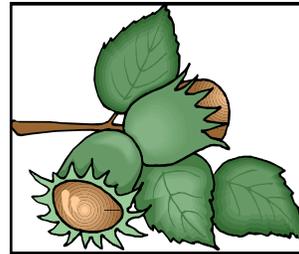
Olives



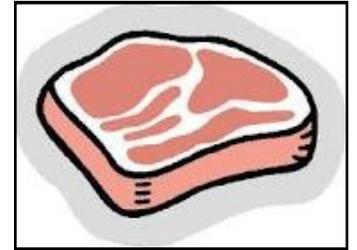
Lemons



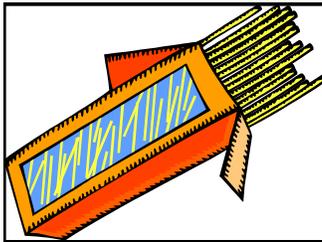
Pastry



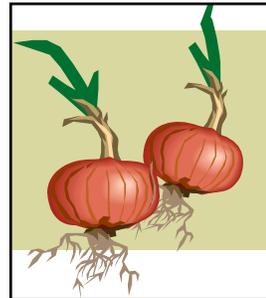
Hazelnuts



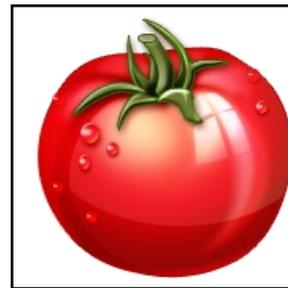
Meat



Macaroni



Onions



Tomatoes



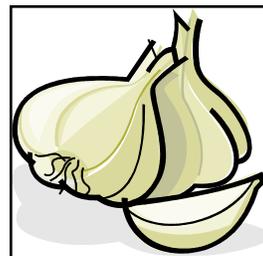
Water



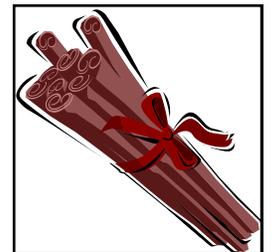
Olive Oil



Sugar



Garlic



Cinnamon

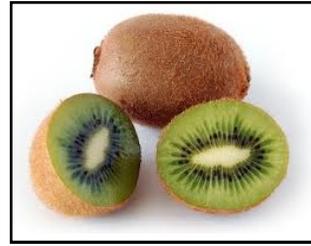
Food Card Sheet



Feta Cheese



Coffee and Team



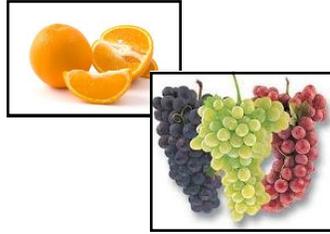
Kiwi



Mozzarella Cheese



Lettuce



Oranges and Grapes



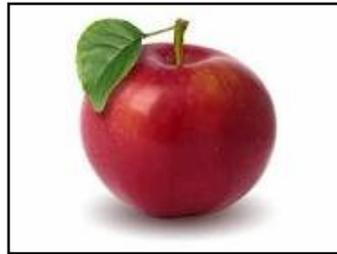
Peaches



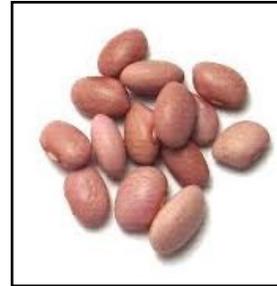
Spinach



Raisins



Apples



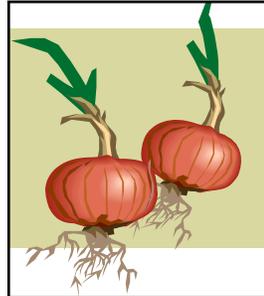
Dried Beans



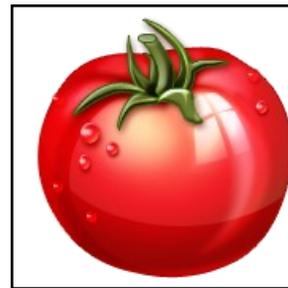
Milk



Rice



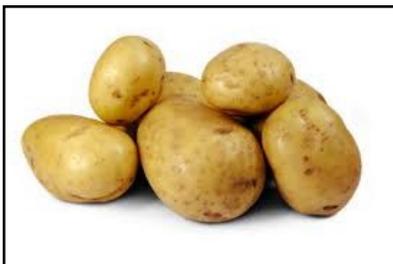
Onions



Tomatoes



Wheat



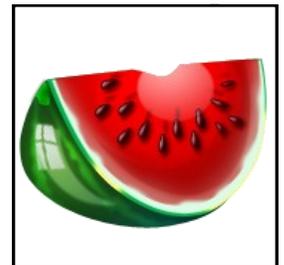
Potatoes



Fruit Juice



Peppers



Watermelon

IMPORT!



Mexican Pizza

The capitol of Mexico is Mexico City.

Mexico City - N 19° 03', W 99° 22'

You need to collect:

Onions, Chili Powder, Peppers, Monterey Jack Cheese

Use the table below to find the countries where you will find your ingredients

Country	Abbreviation	Exports			
China	CN	Apples	Honey	Garlic	Dried Beans
Greece	GR	Olives	Oranges	Water	Grapes
India	IN	Chili Powder	Onions	Rice	Sugar
Indonesia	ID	Cinnamon	Palm Oil	Coffee	Tea
Italy	IT	Feta Cheese	Macaroni	Fruit Juice	Potatoes
Mexico	MX	Peppers	Tomatoes	Cucumbers	Watermelon
New Zealand	NZ	Onions	Milk	Meat	Kiwi
Spain	SP	Olive Oil	Tangerines	Lettuce	Peaches
Turkey	TK	Raisins	Lemons	Pastry	Hazelnuts
USA	US	Monterey Jack Cheese	Mozzarella Cheese	Spinach	Wheat

IMPORT!



Greek Pizza

The capitol of Greece is Athens.

Athens - N 38° 00', E 23° 43'

You need to collect:

Spinach, Olive Oil, Tomatoes, Feta Cheese

use the table below to find the countries where you will find your ingredients

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Italy	IT	Feta Cheese	Macaroni	Fruit Juice	Potatoes
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IMPORT!



Italian Pizza

The capitol of Italy is Rome.

Rome - N 41° 54', E 12° 29'

You need to collect:

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The capitol of Germany is Berlin.

Berlin - N 52° 31', E 13° 23'

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