**Lesson Five: Where Does Our Food Come From?**

**Overarching Question:** How does our food get to us and what resources does it take to get it here?

**NGSS: HS-ESS1-3D, CC math**

**Introduction:** Most students have no idea how much it takes to get food from the very beginning as raw materials to their table. In this activity, students will get to see how chocolate is manufactured and will get to participate in a distribution system where they not only see how much it takes to get food to them, but the cost to the environment as well.

**Materials Needed:**

1. Download the website: <http://archive.fieldmuseum.org/Chocolate/manufacture_interactive/manufacture.html>
2. Several large bags of M&Ms
3. A roll of tickets
4. City cards and data/order forms for groups and students (not all cities need to be used)

**Lesson:**

1. Ask students to think about their favorite candy and do they know where it comes from or how its made?
2. Pull up the website and walk the students through the slides
3. Ask students to write a list of not only the direct resources being used, but the resources implied (power, water, etc). The slides only show the beginning, but stop at the actual making of the chocolate! 75% of the carbon footprint of a food product is generated not in the growing or packaging, but the transport movement needed to get that food product to market!
4. Ask:  What steps do they think come next? Do these steps have negative or positive effects on the environment?  Let’s look!
5. Have students form 6 groups of 4-6 people each.  Each group moves to a “city” card, which have been laid out in different places in the classroom to indicate relative distance from the distribution center. Once there, each group decides what they will put in as an “order” for different colors of m&m’s-up to 60 total. *(The distributor is the color green, and it is 1 student per color.)*
6. The group sends 1 student to the distribution center to deliver, process and return the order to the consumers in the city. Along with the m&m’s order, each group gets a number of tickets, too. The greater the number of tickets a group accumulates, the higher the carbon foot print and monetary and environmental cost to get the good delivered.

**Distribution Center and Cities:**

* Seattle (distribution center)
* Redmond (11mi) 1 ticket
* Tacoma (26 mi) 3 tickets
* Port Angeles (61 mi) 6 tickets
* Portland, OR (146 mi) 15 tickets
* Boise, ID (406 mi) 41 tickets
* Olympia (48 mi) 5 tickets

7. The distributor takes an order from each member of their group, but the total order may not be less than 5 or more than 50 units total, one member of the group per color.

8. The distributor goes to the distribution center and fulfills each order by counting out the number of each color and putting them into little baggies, picking up the tickets and returning to the group.

9. Each member gets their order and the city group must decide how to best split up the tickets among the members. 0 candy=0 ticket, all candy =all tickets.

10.  Once students have their order and their tickets, they need to fill out a class chart with the number of M&Ms ordered, the number of tickets received, and record the city.

11. The group must next do the calculations and analyze the data.

**Student Order Form**

**City:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Color** | **Number Ordered** | **Tickets Received** |
|  | **red** |  |  |
|  | **brown** |  |  |
|  | **yellow** |  |  |
|  | **orange** |  |  |
|  | **blue** |  |  |
|  | **Green (distributor)** |  |  |
| **City:** | **TOTAL Units:** |  | **Total Tickets:** |

**Instructions for Distributor:**

* Take your order from your group. Fill out the order form above:
  1. One color per student
  2. A student may order as little or as much as they wish, but the total order must be no less than 5 and no more than 60 units **total. (10 per student)**
* Take your order sheet to the distribution center and package each color in its own baggie.
* Pick up the number of tickets your teacher has laid out by city
* Distribute the order baggies to the consumers.

**Calculation Tables**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **City** | **Dist-ance**  **mi** | **Total #**  **tickets** | **KG of C produced** | **Total # candy pieces** | **CO2 produced by each m&m** | **# of days 1 tree need** | **# years 1 tree needs to transform CO2** |
| **Redmond** | **11** | **1** | **12** |  |  |  |  |
| **Tacoma** | **26** | **3** | **36** |  |  |  |  |
| **Portland** | **146** | **15** | **176** |  |  |  |  |
| **Boise** | **406** | **41** | **487** |  |  |  |  |
| **Olympia** | **48** | **5** | **58** |  |  |  |  |
| **Port Angeles** | **61** | **6** | **74** |  |  |  |  |

**Equations:**

kg of C produced =Total # tickets x 12 kg per ticket

CO2 produced by each candy=1 unit CO2 per 10 miles x# miles x # m&ms

# days 1 tree needs to transform Carbon= kg C produced x27.7

# of years 1 tree needs = # of days/365 days per year

**Analysis Question:**

1. If you think about the life cycle of a piece of chocolate, from raw materials to final disposal, where else do you think carbon emissions might occur?
2. Looking at your data, how is your consumption related to the number of trees it takes to make up for your carbon footprint as a consumer?
3. What relationships can you draw between distance traveled, carbon produced and potential food prices?
4. Take the steps you learned from the earlier powerpoint, the steps you experienced through the activity and draw out a model of the food supply chain of chocolate from raw materials to end consumer.
5. Where there any step left out in these activities that should be added to the chain?
6. Now think about the area we live in and our grocery stores…..during the winter time, we can still get fresh grapes from Chile. Predict the steps of a food supply chain for those grapes, from raw material to consumer. Use a Red colored marker and arrows to label all of the places in the chain where there is an input of energy into the system.
7. Looking at the energy use on the food production line could there ever be a time when it is actually more efficient to produce those grapes in Chile vs. here? Justify your answer.
8. Give 3 suggestions to make this chain more energy efficient and ecologically friendly.
9. Food supply chains data is difficult to obtain. Information such as packaged dates, production plants, expiration dates, etc are stamped on the packaging, but it is difficult to trace any other information about the food. What are some possible reasons for that, do you think?
10. Predict what might happen if one of the nodes on the supply chain were removed. What would the consequences be for consumers and producers?
11. Oh NO! There is a climate shift in Columbia, the home of Hills Brothers Mountain Grown Coffee! It doesn’t rain in a year and then they get 60 inches of rain in an hour. Then the temperature drops and there is a freeze! So much for the coffee bean plants! Explain the consequences of the ripple effect down the coffee supply chain, and some of the positive and negative feedback loops that occur in the chain as it its disrupted and then tries to stabilize.