Lesson 3: How can we understand waste and emissions in our school food system?

Previous Lesson….Where we have been: Students created initial models for the food waste system at their school and calculated estimated greenhouse gas emissions.

	This Lesson...What we are doing now: This lesson explores how to design and carry out an investigation to audit our school's food waste system.

Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and **Next Steps**
L3: How can we understand waste and emissions in our school food system? 1 week (4-5 class periods) *Building toward* ↓ <u>*NGSS PEs:*</u> *HS-ESS3-4*	Food Wastage Footprint Summary Report	**Plan and carry out an investigation** about food waste in the school. **Analyze data and use mathematical and computational thinking** to determine the amount of food wasted and the resulting greenhouse gas emissions and then examine the system model to understand where we could design a solution to our problem.	Last class we decided we could make a difference by reducing food waste in our school. We decided we needed to do a study to determine where food is being wasted in our current system and to figure out places we could change the system to reduce food waste. We examine our food system map to understand which aspects we may be able to change. We decide what questions we should ask and what our protocols should be. We carry out our investigation and compile our data for analysis. **We are wondering: What are the results of our investigation? What are possible approaches to reducing waste? What are the pros and cons of each approach (greenhouse gases saved, community benefits, feasibility, cost saved or spent)?**

Next Lesson….Where we are going: Next, we will explore the data that is collected and proposes solutions to mitigate food waste in our school.

Getting Ready: Materials Preparation

Materials For Each Group (or class)

- Discuss with each group what materials they need for their investigation.
- Tips for Designing your Investigation

Preparation of Materials

- Slides
- Students will need a variety of materials to complete their investigations, depending on how they decide to investigate.
- You can set constraints on their investigation based on the materials you have available.

Materials For Each Student

- Graphs and Background Information Handout
- Student Activity Sheet

Safety

- The safety issues depend on which aspect of the food system groups are investigating. Some groups may be measuring the amount of food waste and will need access to gloves, scales, bins, cleaning supplies, etc.

☁ Getting Ready: Teacher Preparation

Background Knowledge for Teacher Only	Alternative Student Conceptions	Linking Our Understanding to Scientific Terminology
ESS3 from the FRAMEWORK: **"Thus science and engineering will be essential both to understanding the possible impacts of global climate change and to informing decisions about how to slow its rate and consequences…"** Rate of and region of change matters for understanding climate change. Cities are changing faster because of characteristics of cities - localized amplification because of the nature of cities like black top, resulting in heat islands in cities. However, this is not the entire explanation for climate change. Overall regionally and globally human activities are increasing CO2 and greenhouse gases, which result in global warming. **ESS3.D from the FRAMEWORK:** By the end of grade 8: Activities such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely and decisions and activities.	Students may have different ideas of ways to investigate the food system in the school. They may have different experiences with the existing system (ranging from daily encounters to never eating food from the school).	

3

Learning Plan: How can we understand waste and emissions in our school food system?   (4-5 class periods)

☁ **Teacher Supports & Notes**

1. **(5 mins) Begin with a Consensus Building Discussion to re-orient the students to the storyline.**

   Suggested Prompts:
   ➜ What did we do last class?
   ➜ What did we figure out last class?
   ➜ What did we decide to do today?

   Listen for students responses that align with today's lesson plan:
   ➜ *Last class we read an article about the different components in the food system*
   ➜ *We figured out that food is wasted at many parts in the system*
   ➜ *We realized that we can't change most parts of the system but we do have some control over what happens at our school*
   ➜ *We decided we wanted to design an investigation to see what the food waste situation is at our school in order to come up with solutions to minimize the food waste.*
   ➜ *We also want to share our results with people who can have a bigger impact (school administration, people from the district)*

2. **(15 mins) Direct students to look at the graphs and background information handout. Have them complete the notice and wonderings table in their Student Activity Sheets to themselves, and then discuss with a partner.**

   Suggested prompts:
   ➜ Take a look at this graph, what do you notice?
   ➜ What terms are unfamiliar to you?
   ➜ What questions do you have from this graph?
   ➜ What does this graph tell us?
   ➜ What are the trends/patterns?

   Listen for student responses such as:
   ➜ *Cereals have both the highest food waste and the highest carbon footprint.*
   ➜ *Meat has a high carbon footprint but low food waste. Why is the carbon footprint of meat so high?*
   ➜ *Milk has equal food waste and carbon footprint.*
   ➜ *Meat and vegetables have the same carbon footprint, but vegetables have a much higher food waste.*
   ➜ *What are oil crops and pulses?*

➔ *What are starchy roots, why is their food waste so high compared to their carbon footprints?*
➔ *Do all types of food give off the same amount of methane when they are decomposing?*
➔ *According to figure B, the most food is wasted at the agricultural level.*
➔ *The biggest carbon footprint occurs at the consumption level.*

➔ What is important for our design challenge from these graphs?

➔ *We can't control the food waste at any of the levels except consumption, however the food wasted and carbon footprints are relatively high at this level so our work could have an impact.*
➔ *There is a variety of food types being wasted and these different types have different carbon footprints. We may need to understand which of these types are wasted the most at our school.*

3. (15 mins) Now that students have an understanding of their place and potential impact on the issue of greenhouse gas emissions and food waste, guide students in an initial ideas discussion[A] to help determine how they want to go about assessing the situation at their school.

    Suggested Prompts:
➔ What data do we need to collect at our school?
➔ How are we going to collect this data?

Accept all students responses that are realistic and will contribute to the understanding of the food waste system, such as:
➔ *What types of food are we eating at lunch? As individuals? As a school?*
➔ *What types of food are we wasting? How much of these foods are we wasting? As individuals? as a school?*
➔ *Why are we wasting food? (survey created for consumer habits)*

4. (1 hour) Divide students into groups[B] to tackle different aspects of the design challenge. Once students are in their groups, have them work together to come up with a detailed plan for how they plan to collect and analyze the data for the question they are working towards. Give students the "Tips for Designing your Investigation" handout to help facilitate the planning of their investigation.

5. (2-3 days) Once students have an approved plan, allow the appropriate amount of class time to collect and analyze data as well as create visual representations of their results (posters, slides, etc.).

Strategies for this Initial Ideas Discussion

A: The purpose of this discussion is to get students to start thinking through what this investigation will look like. If students are struggling to come up with ideas, use questions to guide their thinking such as "what systems from the model we drew exist at our school?" "What do we need to learn about our school's food system?" "Who are the people we should talk to?" "What kind of information will we need to collect?"

You can organize these thoughts on a paper or the board. The more thorough this discussion, the better the plans will be, as more students will have thought through the different aspects of this investigation.

Differentiation Strategies

B: Depending on your students, you could let them choose these groups or assign groups. If you have a wide range of abilities in your class, it may be a good idea to group students by still homogeneously and assign tasks that are more challenging to the higher performing students. Then you can focus your attention on the groups that need more support. You could also group students heterogeneously and assign roles.

⚑ Alignment With Standards

Building Toward Target NGSS PE

- **HS-ESS3-4:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Building Toward Common Core Standard(s)

- **WHST.9-12.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- **HSN.Q.A.1:** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays
- **HSN.Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.