**Carbon Culprits: The Relationship Between Food and Climate**

**Lesson Time:** 20 minutes with optional extension activity

**Supplies**: PowerPoint with video

**Background:**

Organic matter makes up 39% of San Diego’s Miramar Landfill. In anaerobic conditions (without oxygen), such as those of waste buried in the landfill, the decomposition of organic waste produces carbon dioxide (CO2) and methane (CH4) as byproducts. Both are potent greenhouse gases contributing to climate change. The methane gas is actually released from the ground (through pipes) to be used to partially power the Miramar military base or to be burned off in a flare as carbon dioxide. According to Project Drawdown, combating food waste ranks as one of the top solutions to tackling climate change. Since wasted food makes up the largest percentage of any one material sent to the landfill, composting is one of the best ways to decrease atmospheric carbon emissions.

Composting involves the natural decomposition of organic material, such as food and yard waste. The aerobic nature (with oxygen) of composting produces very little methane or carbon dioxide and represents a closed-loop breakdown system in which nutrients and carbon return to the soil, instead of being emitted into the atmosphere.

**Sources:**

<https://www.drawdown.org/solutions/table-of-solutions>

<https://www.epa.gov/lmop/basic-information-about-landfill-gas>

<https://www.sandiego.gov/sites/default/files/legacy/environmental-services/pdf/recycling/ZWPlan.pdf>

**Goal**: Students will gain a global understanding of how everyday actions, particularly relating to food waste, impact climate patterns and environmental health. Students will explore solutions, mainly composting, and see the connection and feedback-loop of the carbon cycle.

**PowerPoint Talking Points:**

*What is Climate?*

* I want you to reflect on the two statements on the screen. What is similar about these measurements? What is different? Which is a more accurate way to measure long-term environmental health? Which are you more likely to pay attention to/notice in your regular life? *Students may type answers in the chat or be unmuted.*
* The first statement represents weather, whereas the second statement represents the longer, more gradual patterns of climate. Weather can change from day-to-day or even within a day and says little about the overall health of the environment. Trends in climate take years of monitoring to see, but are crucial indicators of environmental developments and future projections.

*Our Climate is Changing*

* Raise your hand if you have heard of climate change before. What about global warming? What about greenhouse gas? Comparing the images on the left and right, can you make an educated guess about what is happening on a global scale? *Students may type answers in the chat or be unmuted.*
* The image on the left represents the natural greenhouse effect on our planet, where just enough heat remains in the atmosphere to sustain life and promote a healthy carbon cycle. On the right, excessive amounts of greenhouse gases (primarily carbon dioxide CO2, methane CH4, and nitrous oxide N2O) have entered the atmosphere and allow less heat to escape back into space. How do you think this has happened (ex. fossil fuels, increased production, landfill decomposition)? *Students may type answers in the chat or be unmuted.*
* While carbon is crucial for life on earth, releasing excessive carbon into the atmosphere has thrown the cycle off balance and caused the average temperature over time to rise, often referred to as climate change or global warming.

*Climate Change*

* There is a lot of data to support this idea. This slide is a little science heavy, but stick with me. The first graph is known as the Keeling Curve, and it has shown that since the 1960s, atmospheric carbon has been on the steady rise.
* The second graph shows that average temperature has been steadily increasing as well (especially since the 1960s), signifying the relationship between carbon and climate through the greenhouse gas effect.

*Food Waste in Landfills*

* Does this image look familiar? As we learned during I Love A Clean San Diego’s presentation, organics, primarily food waste, rotting and breaking down in the landfill release greenhouse gases.
* These pipes are installed all throughout the landfill to capture the gas that is building up underground. This gas is either used to partially power the Miramar military base or is burned off in a flare.

*Composting*

* *W*hat do you remember about composting from the presentation with I Love A Clean San Diego? *Students may type answers in the chat or be unmuted.*
* Composting is when food breaks down in a natural, aerated system, meaning the nutrients return to the soil and very little carbon is released to the air. How is this different than breaking down in the landfill (no oxygen to aerate the system, carbon released through carbon dioxide and methane)? How can this have global environmental impacts (carbon has been tied to global climate change, so keeping it in the soil is better than releasing it into the atmosphere)? *Students may type answers in the chat or be unmuted.*

*Video*

* In this video, we’re going to hear from someone who is spreading the word about composting and being part of the solution to our climate crisis.
* Post-video questions: *Students may type answers in the chat or be unmuted.*
  + Why are soil and composting so important?
  + Do you agree with Pashon that it’s a solution to climate change?

*Composting at Home*

* As you can see, carbon links many aspects of our environment together, and soil is one piece of the puzzle that can help restore balance. The good news is that composting is becoming more and more popular both on an individual and regional level. There are many resources and organizations locally that can help you get started, such as the Solana Center and San Diego County’s composting bin program.
* One of the greatest things about composting is that it comes in many shapes and sizes. Once you have your supplies, you can set up a ready-to-go compost bin in 20 minutes and start adding food to it!

*Composting at the Miramar Greenery*

* Many areas of the US are starting to catch on to the potential and necessity of composting, including San Diego County. Does anyone remember what California’s goals are for decreasing organic waste (50% reduction by 2020 and 75% reduction by 2025, compared to 2014 levels)? *Students may type answers in the chat or be unmuted.*
* To further limit organics going into the landfill, the Miramar Greenery began a program of implementing large-scale, static pile composting in 2019. Each pile is 100 feet long and covered with a green tarp, under which air is pumped to promote a healthy micro-organism breakdown process that takes about 45 days. This is a unique program that will hopefully be implemented near other landfill sites around California in the future. What are some challenges you see in that? What are the benefits? Have you heard of other areas in California or the US implementing large-scale composing? *Students may type answers in the chat or be unmuted.*

Optional Extension:

Follow this lesson plan, found on I Love A Clean San Diego’s website, to build a vermicompost bin as a class: <https://www.ilacsd.org/wp-content/uploads/2016/07/ClassroomComposting.pdf>

If you create a class compost bin, take a picture and tag I Love A Clean San Diego on social media!

Facebook: I Love A Clean San Diego

Instagram: @iloveacleansd

Twitter: @iloveacleansd