DETAILED PROJECT PLAN

The project. In this project, students will learn about carbon sinks and build a carbon sink that will offset the carbon emissions in their community *(home, school, local, or island).*

TEACHER TIP || Questions to ask when planning to roll-out this project*:

	Prior Knowledge: *What prior knowledge (if any) do my students have about carbon's impact on warming temperatures and climate change?*
Authentic Audience: *Who will be the authentic audience for this project? Will I coordinate and collaborate with a local organization or already existing event? Or will my students work on this project at school, with the community as their authentic audience?*	
	Context in Place: *What types of carbon sinks exist most frequently in our community? Are the school grounds heavily manicured? Are there heavily forested areas nearby? Are wildfires common? Is the ocean close to school and accessible? Are there any operating fishponds nearby?*
Project Management: *Will students work alone or in teams? If students work in teams, how will they be assigned? How will they be assessed individually vs. in a team?*	

***Project-based learning vs. traditional lesson planning:** *In the midst of project-based learning, students are actively doing the work, learning, creating, and inquiring - eventually heading towards their end goal or product. Often misunderstood is that the organized chaos of what you might see in a PBL environment is carefully and intentionally designed by the teacher well before the project begins. The questions above should allow you to set the stage for student learning to unfold in the following project. Anticipating student questions and areas of need will help you to feel planned and ready in advance of a project.*

Carbon Sinks

Climate Action Project Planner

Essential Question:	How can carbon sinks offset carbon emissions in our community?

Skills and content needed to answer the Driving Question: *Refine these skills and content standards to the scope and need of your project. This project is designed to be interdisciplinary - but if you don't teach a subject, it doesn't mean that that skill or standard can't still play a role in the experience! - These selected skills and content will be supported throughout the project with activities, formative assessments, and additional resources.*

Skills	Content/Standards
• Reflection • Collaboration • Communication • Research • Data Collection • Observation • Self-management • **Add other skills to practice in this project*	**CCSS.ELA-LITERACY.WHST.6-8.1** Write arguments focused on discipline-specific content. **CCSS.ELA-LITERACY.WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. **CCSS.MATH.CONTENT.7.RP.A.2** Recognize and represent proportional relationships between quantities. **CCSS.MATH.PRACTICE.MP4** Model with mathematics. **NGSS MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. **NGSS MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **NGSS MS-ESS3-5.** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **Add or remove standards to practice and assess in this project*

Activities, Products, and Assessments: *Below you will find the proposed activities, student products and assessments for this project. Refine them to match the scope and need of your project, making sure that they align with the skills and content you chose to drive from in the previous section.*

Final project & summative assessments:

Create a carbon sink and scale the impact over time.

Teacher Tip: Present the project calendar early on to show students where they are headed. *Students should know what is expected at the end from the beginning of the project. Use the templates provided to plan out the scope and sequence of the project. Include students in this process.*

Take a Walk - Data Collection

What surrounds us?

Explore this question and expose students to the concept of a carbon sink before learning the definition. Students will "take a walk", virtually or physically, to collect data on existing carbon sinks and non-carbon sinks in their area. *Since this is the launch of a project, it is not necessary for students to have prior knowledge of these terms to complete the activity.*

- **Virtual walk:** Use Google Earth for students to explore their island community.
  - Work independently, in groups or as a whole class
  - Search for your school's location
  - Using the Virtual Data Collection sheet, have students collect information on the various carbon sinks and non-carbon sinks on the school property and surrounding areas.
  - Share observations and conclusions with the whole class.

- **Physical walk (optional):** Take students for a walking field trip around the school property and nearby surrounding area.
  - In groups of 3-4, assign students to a specific carbon sink or non-carbon sink to identify and count during the walk.
    - *I.e. Group 1 counts number of trees, Group 2 counts number of city blocks with pavement and sidewalks*

Launch the project by introducing the essential question, the project calendar and the final product that students will be working towards. Generate questions that students might have about the project and write them on the board or on chart paper. **Revisit these questions throughout the project.**

What to collect from students:
-Students complete the Data collection sheet during the physical or virtual walk

Type of assessment:
-Formative

Skills and content:
-Data Collection

-Observation

-Collaboration

Trees as Carbon Sinks

How do trees act as carbon sequesters? Are trees the most effective carbon sink?

Explore the answers to these questions by first, watching the film clip that inspired this project *(Professor Mora Tree Planting).*

- Students will learn about the role of trees in sequestering carbon emissions and the impact of people coming together to achieve a goal.

Carbon Sink: a forest, ocean, or other natural environment viewed in terms of its ability to absorb carbon dioxide from the atmosphere.

After the film, lead students through a group investigation of the following supporting articles. In teams, students will complete the *Group Investigation: Trees* activity.

Options for setting up this activity -

- Run a **Jigsaw** in groups of 4 - each student will read a different article, report back to their group, and work together to complete the *Group Investigation.*
- Set up **Stations**, with each article/resource at a different station. Students can move around the room to complete the *Group Investigation.*

Resources for *Group Investigation:*

- American Forests - Forest Carbon Sinks
- The Guardian - Planting Billions of Trees to Tackle the Climate Crisis
- Nasa - Examining the Viability of Planting Trees to Help Mitigate Climate Change
- Hawaii's Push to Plant Millions of Trees
- Grist - Leaving Trees Standing Might be More Important
- Civil Beat - Neutralizing Our Carbon Footprint, One Tree at a Time

***Tip**: Modify and adapt texts to your students' reading levels as needed. It's important to maintain the thread of authentic resources, but it is also important to make them accessible!*

Students conduct a Socratic class or table discussion using evidence from their group investigation.

- Question: *Are trees the most effective carbon sink?*
- Use Socratic discussion stems to support students in communicating effectively

Students complete an Exit Ticket to help them reflect on new learning from the Group Investigation and discussion with peers. Use the exit ticket to gauge student understanding and gaps in knowledge moving forward.

What to collect from students:
-Students complete the Group Investigation: Trees to prepare for the Socratic Discussion

-An Exit Ticket is a good way for students to reflect independently after the Socratic discussion

Type of assessment:
-Formative

Skills and content:
-Communication

-Draw evidence from informational texts (CCSS.ELA-LITERACY.WHST.6-8.9)

Not All Carbon Sinks Are Equal

What other kinds of carbon sinks exist? What are the most efficient carbon sinks?

Explore the answers to these questions by introducing students to other types of carbon sinks (beyond forests). In this section, students will learn and practice new vocabulary and content to prepare them to brainstorm and ideate their own ideas. They will also dig deeper into the factors that cause global temperature rise, and the impacts that humans and the use of natural resources have had on the Earth's systems.

Choose from the options below to create a lesson to teach new content. This content should be learned in service of further understanding *what carbon sinks are, what types of carbon sinks exist, and what types of carbon sinks that students might be able to help create.* Students can complete the Guided Notetaker assignment to document their new learning

Options for introducing new content:

- Direct Instruction
- Stations

Key Vocabulary and concepts:

- Carbon cycle
- Carbon emissions
- Carbon sink

Hands-on Activities and Labs:

- **Understanding Carbon - Dinosaur Breath Lab**

Resources to learn about Global Temperature rise and Carbon Emissions:

- Our Climate, Our Future videos

Resources to learn about other types of Carbon Sinks*:*

- Coastal and Ocean Sinks - Project Drawdown
- How to Turn your Backyard into a Carbon Sink - Landscape News
- Kids Gardening: Carbon Basics
- Visuals on Carbon Sources and Carbon Sinks - Socratic QA
- The Ocean, A Carbon Sink - Ocean and Climate Platform
- Seaweed as a Carbon Sink - KEAP
- How to be a Backyard Carbon Farmer - Sustainable America

As a way for students to start making deeper connections to the content, students can complete the Deeper Thinking Questions writing assignment.

What to collect from students:

-Students can use the guided notetaker to document what they learn

-Students apply scientific thinking skills to answer the Deeper Thinking Questions

Type of assessment:

-Formative
-Summative

Skills and content:

-Write arguments (ELA WHST.6-8.1)

-Construct an argument on the impact on Earth's systems (NGSS ESS3-4)

-Draw evidence from texts (ELA WHST.6-8.9)

-Ask questions on global temperature rise (NGSS ESS3-5)

Audience + Scope. As you move into the next stage of the project, start determining what scope you want to take for this project.

Consider the following *(use the planning document):*

A. **External:**
   a. **Work with a community organization or existing event.** *Is there a community organization or event that your students could attend and help support?* If so, this is an excellent opportunity for students to be involved in creating and maintaining a carbon sink without starting from scratch. Working alongside existing projects is a great way to alleviate the need for resources and materials, and make more of a lasting impact.
   b. **Examples might include:**
      i. *Work with a local fishpond*
      ii. *Attend an existing tree planting event*
      iii. *Attend an organized beach clean-up*
      iv. *Work with a local farm to tend to their garden, crops or kalo farm*

B. **Internal:**
   a. **Create the carbon sink on your own.**
      i. **Individual scope:** Students individually produce a final product.
      ii. **Group scope:** Students work in student teams to produce a carbon sink.
      iii. **Whole class scope:** Students work together towards a whole class product, *such as a class garden or tree planting event at their school.*
   b. **Considerations:**
      i. **Location:** Where will the location of the new carbon sink(s) be?
      ii. **Permissions:** What permissions do you need, and from who?
      iii. **Resources:** What resources do you need/have on hand? Who will request new resources? You? Your students?

Brainstorm and Ideate

How can we create a carbon sink that can offset our carbon emissions? What kind of carbon sink will we create?

Now that students have a deeper understanding of the role of carbon sinks and the types of carbon sinks there are, it is time to begin brainstorming how they can contribute to the increase and upkeep of them.

Follow a brainstorm protocol* such as the one below, to generate ideas.

Options:

1. **Determine student teams before the brainstorm –** if you choose this option, students can run the brainstorm protocol in their already chosen teams.
2. **Determine student teams after the brainstorm –** this allows you to create teams based on student interest. If you choose this option, run the brainstorm as a whole group activity.

If you've already determined that students will be participating in a local event or volunteering to support an already existing carbon sink (i.e. fishpond restoration),

What to collect from students:
-You may want to collect students' brainstorming so they can come back to it later in the project

Type of assessment:
-Summative

Skills and content:
-Design a method (NGSS ESS3-3)

this brainstorming activity can still be beneficial in helping students feel ownership over that idea. Help students come up with ideas that will eventually lead towards the final project.

Brainstorm Protocol* *(adapted from IDEO)*

1. **Silent Brainstorm:**
    a. Pass out post-it notes to tables (students should have between 3 and 7 post-it notes each)
    b. Set a timer for 3 minutes
    c. Give students 3 minutes to generate as many ideas as they can - **one idea per post-it note.**
        i. Answer the question: ***What kind of carbon sink will we create to offset the carbon emissions in our community?***
2. **Share-out Ideas:**
    a. In teams or as a whole group, take turns sharing out ideas. Ideas should be added to a whiteboard or surface by the student as they share their idea out.
3. **Categorize:**
    a. Once all of the ideas are posted on the surface, work together to categorize the ideas into groups.
    b. If students are working in teams, they can do this collaboratively.
    c. New ideas can be added during this time.
4. **Heat Map:**
    a. Give each student a chance to "vote" with 5 dots or asterisks on their favorite idea.
    b. Once all students have voted, the heat map should show the most interesting and popular ideas.
5. **Document and Decide on Next Steps:**
    a. Students should document the brainstorm so they can go back to it for other ideas later on.
    b. At this point, you may want to break students into teams (if you have not already done so) based on interest.
    c. Determine the next steps based on the results of the heat map.

***Source:** https://catlintucker.com/2017/09/brainstorms/

Teacher Tip: Managing work time. *Allowing students time to work on their projects during school is an essential component of PBL. Project work time can sometimes feel a bit nebulous, as it requires trust in students' self-management skills! Work your way up to longer chunks of project work time, and begin by setting a timer for smaller chunks of time (i.e. 15 minutes with a specific deliverable). During work time, make it clear what the students' role should be, and what your role is. As you become more comfortable with Project Work Time, you'll find that it is a great time to check in with students1-1, set up meetings with student teams, and provide interventions for students that need extra attention.*

Work on Carbon Sinks

What do I need to do to ensure the success of this carbon sink?

What to collect from students:
-Progress Reflection(s)
-Project prototypes / first

The length of this building block will depend on the scope you take with the project. Project work time can be spread out over the course of days or in bigger chunks of time, depending on what students need to accomplish.

Ideas based on the scope of the project:

- **Community scope:** Students work alongside an existing project in the community.
  - Work with a community partner to involve students in existing work. Visit the site once or multiple times, with time for reflection in-between visits.
- **Individual, group, or whole class scope:**
  - Provide class time to work on project(s)
  - Students can gather materials, get permissions, create a prototype of their carbon sink, and work on building their carbon sink during project work time.
  - Review Professor Mora's grand plan to understand the scope and scale of planning a carbon sink
  - Give students opportunities to give and receive feedback as they work towards their final product.

drafts

Type of assessment:
-Formative

Skills and content:
-Self-management

Scaling Impact

How effective is the carbon sink we/I chose? Why was that type of sink chosen? How did our learnings support that choice? What will be the impact of our sink over time?

Explore these questions and set students up to understand the long-term impact of their climate actions. Students will learn to roughly calculate the amount of carbon that their carbon sink sequesters, and how that will change over time. They will use these numbers to reflect on the long-term impact of their carbon sink and predict what needs to happen in order for the carbon sink to be maintained and sustainable, beyond their legacy at the school.

Possible Activities: ***expanded on in the Scaling Impact document***

- Carbon Sink Sequestration Calculations
- Calculate impact over time using proportional relationships
- Create visual representations of data
- Calculate the scaled and collective effect of multiple/many carbon sinks
- Write a short argument explaining the type of sink chosen, why it was chosen, and what the impact will be. Students can include their data visualizations into their reflection to support their choice

Extension resources for educators to support this thinking:

- How non-native trees actually accelerate the release of carbon
- Understanding how backyard carbon sequestration works

What to collect from students:
-Students show their understanding of the math skills to scale impact of their carbon sink over time

Type of assessment:
-Formative

Skills and content:
-Recognize and represent proportional relationships (Math.Content.7.RP.A.2)

-Model with mathematics (CCSS.MATH.PRACTICE.MP4)

-Write arguments focused on discipline-specific content.(CCSS.ELA-LITERACY.WHST.6-8.1)

• Research reveals how climate change may affect Hawaiian fishpond aquaculture • DLNR Environmental Assessment of Loko I'a • Two brothers talk carbon sequestration **Please note that this is an area of ongoing research in science. Quantifying carbon sequestration was based on general numbers available with the purpose of giving students a chance to grapple with modeling in mathematics.*	-Draw evidence from informational texts to support analysis, reflection, and research. (CCSS.ELA-LITERACY.WHST.6-8.9) -Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (NGSS MS-ESS3-3.)
Put It Into Action How can I share my learning with others? How can I ensure that my carbon sink will be sustainable? **Through their final presentation, students will answer the essential question of the project and consider how their carbon sink will have a sustainable impact on their community.** Have students present to an authentic audience, at your school, or in a public or community space - to inform a greater audience of their learning. *Ideas may include:* • Community partners • Future students • Family night exhibition **After the public presentation,** reflection can take place in writing, verbally, through student-conferencing, or through whole-class discussion. Option to use the Project Reflection template as a tool.	**What to collect from students:** -The final product, in the form of the actual, implemented carbon sink and/or a written component **Type of assessment:** -Summative **Skills and content:** -Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (NGSS MS-ESS3-3.) -Reflection

Assessment Tip: *Determine before the final presentation day whether you will assess the final projects/presentations before or after the public presentation. If you decide to wait until after, students can be given a chance to reflect on how the public presentation went, make any final changes and then submit to you for assessment.*