STEMS^2 Unit Plan

BACKGROUND:

Background:

This unit guides students through the STEMS^2 framework, along with using Nā Hopena A'o. This unit is designed as a place and project based learning experience for students to understand that they can make an impact on their community and advocate for others using their given solution. Food security is a necessity that people should not be given the option to be denied for. The importance of educating students about sustainability in agricultural practices will help them to develop innovative ways of thinking to problem solve and understand how to make informed decisions in the future.

After reaching out to members of the community, the community partner that I had selected was Grow Some Good. They were able to support the scaffolding of this unit, while also providing me with resources tha aligned well with the topics selected. Havilah Mills volunteered into the classroom to demonstrate propagation with students, as well as provided a video on soil health to educate the students.

Students will understand information on upkeep of agriculture such as how to properly propagate, different types of gardens, what types of plants will support other plants' growth, types of soil best for vegetation, and the different uses of plants. Other information students will understand is how to best sustain the plant's growth for the best outcome once giving the plants away.

The teaching and learning environment of Kula Elementary incorporates concepts such as 'sense of place' as Kula was one of the areas that was affected by the Maui Fires. We also have students at the school who are currently in attendance due to being displaced from the Lahaina fires. Students that attend Kula Elementary were affected by these fires either through displacement caused by the loss of their homes, loss of loved ones, or listening to the local news, conversations in their homes, and the radio. The context and content of this unit is designed around the STEMS^2 framework and Nā Hopena A'o as it surrounds the needs of the community due to a natural disaster that had occurred causing devastation and ruin. Students will be able to determine the best ways to gain an understanding in bringing back the aloha spirit to the community, as well as give them a sense of belonging when they are making a positive impact.

Unit Overview:

The purpose of this unit is to address the need of the loss of vegetation and to promote agriculture as a sense of place and food security for those who had lost their homes due to the 2023 Maui wildfires. This interdisciplinary unit is designed to be used in a STEM classroom for fourth and fifth grade students. Throughout this unit, students will attend a weekly class where they will develop and execute a solution to propagate plants that will be given to the community in need. Students will have the opportunity to design, engineer, propose, and create a school garden. Students will develop ways that would be the most cost effective and sustainable manner. Students will also research and learn about the different uses of the plants that they intend to grow. Students will work in groups to create a proposal for which type of plants and gardening method that they discover to be the most efficient and sustainable. Students will share their final group proposal and discuss with the class to make an overall final decision for their final product. They will then produce their final project and at a community event they will give away and present their findings.

STEMS²

STAGE 1:

Unit Plan Title:

Revegetation and Restoration of Habitats Destroyed in the Maui Fires

Essential Question:

- How can we, as students, help to restore Maui after the wildfires and promote sustainability in our local community?

Enduring Understanding(s):

- Students will understand the meaning and importance of propagation and restoration.
- Students will understand the meaning and importance of sustainability.
    - Students may understand sustainable uses of plants (e.g. food, teas, land cover, dyeing, etc.)

Standard Benchmarks and Values

- Select standard benchmarks (HCPS III, CCSS, NGSS)
- Identify values to reinforce (culture-based, such as NHMO or other).
- Notate if students will be *introduced to,* will *practice,* or will *demonstrate mastery* of the standard during this unit.
- All assessed standards should be demonstrated mastery
- STEMS² Units are interdisciplinary and should address a minimum of standards across three content areas. Please list all standards addressed (i.e. *introduced to* and *will practice*) and assessed (*demonstrate mastery*) in the table below.

Science	Technology	Engineering	Mathematics	Social Science	Beyond

Standards Addressed

Students will practice/touch on these standards throughout the unit.

4th Grade

Next Generation Science Standards (NGSS)

- 4-ESS2-1: Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5th Grade

Next Generation Science Standards (NGSS)

- 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Standards Assessed
Students will be provided with an assessment grade in these standards.
Hawai'i Core Standards for Social Studies (HCSSS)

- Inquiry Standard SS.3-5.5.2: Explain different ways students could work individually or in collaboration with others (e.g., other students, teachers, community and/or global organizations) to address local, regional, or global problems or issues and predict possible results of their actions

4th Grade
Common Core English Language Arts

- CCSS.ELA-LITERACY.RI.4.1: Students read informational texts and gather information from multiple sources to answer questions and deepen understanding.
- CCSS.ELA-LITERACY.W.4.7: Students conduct research projects, gather relevant information, and present findings orally or in writing.
- CCSS.ELA-LITERACY.SL.4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

5th Grade
Common Core English Language Arts

- CCSS.ELA-LITERACY.SL.5.5: Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
- CCSS.ELA-LITERACY.W.5.7: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

Nā Hopena A'o

- Strengthened Sense of Belonging
- Strengthened Sense of Aloha
- Strengthened Sense of Responsibility

Critical Skills and Concepts:

- Understand the meaning and importance of sustainability
- Understand how to design a garden that will
- Understand sustainable uses of plant resources
- Identify needs in the community (food, resources, sustainability)
- Advocate for a solution for the needs of the community

STAGE 2:

Authentic Performance Tasks:

Students will demonstrate their understanding by designing and planting a garden as a way to address the need of the loss of vegetation and to promote agriculture as a sense of place and food security for those who had lost their homes due to the 2023 Maui fires. In groups, students will create a proposal of their final ideas and designs for the class to agree upon to determine which is the most sustainable and cost effective. Students will execute their plans upon approval of their ideas. Students will present their findings at a showcase during a community event where they will give away the plants they grew to families in the community who need them and educate them to promote sustainability and food security.

Authentic Audience:

The students will share their garden and the plants that they propagated at a designated school event. School faculty, families of students, community members, and those affected by the Maui wildfires will be invited to attend. The take-aways of community members who attend will be to take home a plant of their choice to take with them. They will also be given information by the students on how to take care of their plant as well as educate them on its sustainable uses.

Other Evidence:

- Teacher's observation (participation in discussions and activities)
- Engineering Notebook (including drawings, reflections, notes, etc.)
- Proposal of Garden
- Research
- Lesson worksheets

STAGE 3:

Learning Plan:

Support given for students:

- Have vocabulary words (blue) with definitions displayed on the board for students to understand and refer to.

Lesson 1: Introduction to the addressing the problem

Materials:

- 2 large disposable aluminum pans per demonstration group
- 3-4 gallons of some good old fashioned soil (natural outside soil from a garden or yard, not potting soil)
- A watering can with water
- cups of water
- 4 or 6 books or wooden boards about 1/2-inch each thick each
- 4 sponges (cut each sponge into 6 equal pieces)
- Student Journal
- Pencils
- Teacher computer

- Projector and Screen

Before the lesson:

- Decide if you would like the students to conduct the demonstration themselves in groups or if you as the teacher just does the demonstration and students observe. This will determine the amount of materials needed. The materials below are for one demonstration.
- Before the lesson, pre-set up the two pans for the demonstration with the same amount of soil. In both of the pans place all of the soil on one side creating a small slope while leaving a two inch gap at the bottom of the slope. Raise the top of the slope of the aluminum pan to be elevated higher than the left side where there is the gap at the bottom with the books or wooden boards.

1. *Warm Up Activity* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in.
    b. Instruct students to answer statement in their journals in complete sentences and give them a few minutes to complete.
        i. List all of the endemic plants that you know.
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Ask students to share some of their answers aloud with the class
2. *Opening Activity: Demonstrate weathering, erosion, and deposition* (20 minutes)
    a. Pan 1: Pour water onto the top of the pan, and have the students watch what happens when the water breaks down the sand and water and collects at the bottom of the pan. Have the students note what they observe about the water that is collected at the bottom of the pan. Display how the water at the bottom of the pan is no longer clean fresh water as it was at the beginning of the process when being poured.
    b. Pan 2: Place and Spread out the sponge pieces on the top of the soil in the aluminum pan. Repeat the same process as the first pan by pouring water onto the top of the elevated pan. Have students note what they observe about the water that is collected at the bottom of the first pan. Display how the water at the bottom of the pan is clean and fresh with little to no dirt that has washed away.
    a. Ask the students to compare what happened to the first pan with the second pan.
    b. Explain weathering, erosion, and deposition, and have the students write down these words in their journal.
        i. Weathering is breaking down the rocks and sediment, erosion takes the sediment, and deposition drops the sediment in a new place.
        ii. Ask students to use their notes from their observations to identify weathering, erosion, and deposition of the demonstration.
    c. Relate this process to what happens when places lose land cover such as plants, and then it rains. What happens to the soil?
3. *Propose and Discuss the Essential Question of the Unit* (10 minutes)
    a. Ask students to read this question aloud together: How can we propagate plants to restore habitats that were destroyed in the Maui fires and promote sustainability to the local community?

i. Go over definitions of words in this question. Students should write down the definitions of these terms in their journal if they do not already know them.
    1. Def: **propagate** - the process of growing new plants from a variety of sources: seeds, cuttings, and other plant parts.
    2. Def: **restore** - to return (something) to an earlier or original condition by repairing it, cleaning it, etc.
    3. Def: **promote** - to support the growth of or help move forward; encourage/help to exist or flourish
    4. Def: **sustainability** - using natural resources in such a way that they will continue to be available in the future; small changes people can make to impact the Earth positively

b. Discuss as a class on how we can address the problem proposed in this essential question
    i. Instruct students to Think-Pair-Share
    ii. Then share aloud and discuss proposed solutions: buying the plants, growing the plants, etc.

c. Class and teacher will agree upon a proposed solution route: growing the plants, fundraising for supplies, etc.

4. *Exit Ticket* (5 minutes)
    a. Read the options:

    A: Garden design and layout group
    - Research about the garden design and layout to create an aesthetically pleasing and functional garden space
    - Different types of gardening styles
    - Estimating cost

    B: Plant Selection Group
    - Researching about the types of plants suitable for different types of garden spaces
    - Identify native and climate appropriate plants
    - Requirement of plants (sunlight, water, soil, etc.)

    C: Garden Features Group
    - Research about the requirements to enhance the garden such as fences, raised beds, watering, safety
    - How to harvest rainwater
    - How to clean garden depending on the type of garden
    - Estimating cost

    D: Garden Maintenance and Care Group
    - Research maintenance schedule for things such as watering, pruning, weeding, fertilizing
    - Pest management strategies
    - Organic gardening techniques
    - Importance of soil health such as composting, etc.

    b. Students select their choice of group by writing down their choices from most wanted to least wanted then turn in before leaving the classroom.

5. *Cleanup/Transition* (5 minutes)

Lesson 2: Creating Groups to Break Apart Research Tasks

Before the lesson:

- Using the exit ticket from the prior class that students had chosen, divide the class into equal groups.
- Add students to Google classroom based on their designated grade (grade 4 or grade 5) using their emails to invite them.
    - If you do not know students' emails: Once students have logged in to the computer, place the Google classroom code for their designated class on the whiteboard or invite students to the classroom using their emails prior to class.
- Organize the students into groups based on their selections from their exit ticket the lesson prior
- Add the documents (Group A, Group B, Group C, and Group D) containing 10 questions on a shared Google doc with only the students in each selected group.

Materials:

- Teacher computer
- Projector and Screen
- Student computers with Internet access
- Google Classroom or printed copy of the questions
    - Garden Research Questions - A
    - Garden Research Questions - B
    - Garden Research Questions - C
    - Garden Research Questions - D
- Student Journal
- Pencils

1. *Login to Google Classroom* - Have students log in to Google Classroom on their computers and add the Google Classroom. (5 minutes)
    a. Be prepared for students to write down their log in codes in their journals if they do not know their log in codes already.
    b. Have students join the STEM google classroom for their designated grade and go to the document based on the group that they were placed in:

        A: Garden design and layout group
        - Research about the garden design and layout to create an aesthetically pleasing and functional garden space
        - Different types of gardening styles
        - Estimating cost

        B: Plant Selection Group
        - Researching about the types of plants suitable for different types of garden spaces
        - Identify native and climate appropriate plants
        - Requirement of plants (sunlight, water, soil, etc.)

        C: Garden Features Group
        - Research about the requirements to enhance the garden such as fences, raised beds, watering, safety
        - How to harvest rainwater

- How to clean garden depending on the type of garden
- Estimating cost

D: Garden Maintenance and Care Group

- Research maintenance schedule for things such as watering, pruning, weeding, fertilizing
- Pest management strategies
- Organic gardening techniques
- Importance of soil health such as composting, etc.

c. Explain to students the importance of research and teamwork.
d. Introduce the activity and explain that each group will present their research findings to the class, and their collective knowledge will be used throughout the unit and to help sustain and regrow the school garden while propagating and maintaining new plants to give away to the community impacted by the fire.
e. Explain to students the criteria of their research and how they will organize their notes using a shared Google Doc located in their Google Classroom.
f. Instruct students to divide and designate questions per amount of group members (20 minutes)
    i. Students should write their name next to the question they are answering. Students should work on their designated questions during their class time.
    ii. It is recommended that you provide sources of information for students to read to find their answers for the information.
    iii. (If you do not provide sources for students)Emphasize the importance of using reliable sources and proper note taking. Instruct students to write their answers in complete sentences before submitting.
    iv. Encourage students to discuss their findings within their group when finding key information.

2. *Demonstrate* (5 minutes)-
    a. Display to students how it would look like to conduct research in this manner by answering a sample question using a credible source from online.
3. Circulate around the classroom to provide guidance and ensure students stay on task.
4. Encourage collaboration and discussions within the group when working.
5. *Closing/Cleanup* (5 minutes)
    a. Ask students to discuss what else needs to be done during the next class time to complete their research portion of the unit before sharing aloud.
    b. Ask students to clean up by placing their computers back into the designated slot in the computer cart, plug in the charging cord into the computer, and clean up their areas.

Lessons 3: Continuing to work on Research Task

Continuing research establishes the foundation that was established in the previous session. Instruct students to continue their research in preparation for sharing during the following lesson.

Materials:

- Computers with Internet access
- Google Classroom or printed copy of the questions
    - Garden Research Questions - A
    - Garden Research Questions - B
    - Garden Research Questions - C
    - Garden Research Questions - D
- Student Journal
- Pencils

1. *Recap the previous lesson* (5 minutes)
    a. Ask students to discuss as a group to recap the work they had completed during the previous lesson
    b. Ask students to discuss the work that needs to be completed during this class's lesson
    c. Emphasize the importance of building upon their previous findings and using their time effectively as this will be their last class conducting research
2. Discuss different research methods that can be used to deepen the students' understanding. (5 minutes)
    a. Example: Using multiple sources to answer a question
    b. Properly rewording answers from sources
    c. Evaluate the credibility of the sources the information is being found on
3. Encourage students to reflect on what they have already been working on and the knowledge they are obtaining with the questions they have answered.
4. *Independent research session* (10 minutes)
    a. Instruct students to continue their research independently or in their groups
    b. Instruct students to organize their notes and write their answers in complete sentences
    c. Remind students about citing their sources as they gather information
5. Circulate the classroom to provide guidance, answer questions, and ensure students are on task.
6. *Stop and Check for Progress/Classroom Discussion* (5 minutes)
    a. Gather students for a brief checkpoint
    b. Ask each group to share their progress
    c. Facilitate a discussion on any of the challenges that students are facing and offer guidance or suggestions as needed
    d. Ask students to discuss as a group what else work needs to be done before the next lesson
7. *Independent research session* (15 minutes)
    a. Instruct students to continue their research independently or in their groups
    b. Instruct students to organize their notes and write their answers in complete sentences
    c. Remind students about citing their sources as they gather information
8. Circulate the classroom to provide guidance, answer questions, and ensure students are on task.
9. *Closing/Cleanup* (5 minutes)- Summarize the key points of the lesson
    a. Remind students of the upcoming goal to share out next lesson for their research
    b. Assign students to continue their research outside of class, if necessary
    c. Encourage students to be prepared to share their findings in the next session

Lesson 4: Share out of knowledge they gathered during research

Materials needed:

- Print out document answered by group
- Projector and screen
- Timer if needed
- Student Journals
- Pencils

1. *Introduction* (5 minutes)
    a. Explain the purpose of sharing/presenting their research findings to the class
2. Remind students about the importance of clear communication and engaging the audience when presenting
3. Give presentation guidelines for effective presentations
    a. Examples
        i. Speak clearly and at right volume level for everyone in audience to hear
        ii. Engage the audience with eye contact and gestures
        iii. Stay within the allotted time
4. *Presentation Sessions* (9 minutes per group)
    a. Remind the audience to be courteous and respectful when presentations are occurring.
    b. If time allows, recap the main ideas shared after each presentation, and facilitate a brief questions and answers session.
    c. Instruct audience to take notes on important information in presentation
5. Encourage students to reflect on their presentation skills and areas for improvement
6. Assess students based on their participation in group discussions, the quality of their research findings, and their ability to present their findings clearly.
7. *Clean Up/Transition* (4 minutes)
    a. Thank all students for their participation and presentations
    b. Collect printed research papers
    c. Students put away their journals

Lesson 5: Learning about Propagation with ʻUala Propagation

Before the lesson:

- Gather ʻuala (sweet potato) vines from a sweet potato plant. Keep the vines nice and long for demonstration purposes for the students to view.
- Place the potting soil in the nursery pots

Materials:

- ʻUala vines
- ʻUala tuber
- Glass jar (to place ʻuala tuber in water)
- Water (enough to fill half of the glass jar)
- Clean student scissors

- Small nursery pots (as many as need per class size)
- Potting soil (I purchased Sunshine mix #4)
- Hand shovel
- Watering Can
- Student Journals
- Pencils
- Teacher computers
- Projector and Screen
- Lesson 5 Presentation

1. *Warm Up* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in.
    b. Instruct students to answer questions in their journals in complete sentences give them a few minutes to complete.
        i. What is a canoe plant?
        ii. What was ‘uala (sweet potato) used for in ancient Hawai’i?
        iii. What are the different ways to propagate plants?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Ask students to share some of their answers aloud with the class
2. *Introduction to Propagation* (5 minutes)
    a. Read the unit’s essential question and the lesson’s essential question.
    b. Remind students about the information that has already been discussed and topics that were covered
    c. Ask students to turn and talk with a partner to answer the question: How do plants make more plants?
    d. Discuss answers aloud with class
    e. Explain the definition of propagation, and have students write down the definition in their journals
    f. Explain the various ways to propagate plant: seeds, cuttings, or other plant parts such as (bulbs, tubers, or rhizomes)
3. Ask students to discuss with a partner: When you look at the plants around you, do you think you could figure out which type of propagation to use to grow new plants?
4. *Explain propagation by cuttings (*5 minutes*)*
    a. Explain to students that different types of plants are propagated in different ways depending on if they produce fruits or seeds.
    b. Explain that it is most common for plants to be propagated by cutting
    c. Explain how to propagate a plant by cutting
        i. Collect a plant by cutting a part of the main plant
        ii. Place the cutting water for 24 hours or until the plants grow roots, or place the cutting directly into soil
        iii. Transfer the potted cutting into the nursery for germination and sprouting
        iv. Water regularly and place plant outside for sunlight and continued growth

5. *Explain significance and importance of ʻuala* (5 minutes)
    a. Ask students what the purpose of the plant's roots are
    b. Discuss plant root system and the two different types of roots: taproots and fibrous roots
    c. Instruct students to think-pair-share if they think ʻuala plants have a tap root system or a fibrous root system.
        i. Explain the parts of a potato plant and how they have a taproot system
    d. Discuss key manaʻo (ideas/thoughts) about roots
6. *Background facts about ʻuala* (5 minutes)
    a. Instruct and discuss background information about ʻuala's Hawaiian history
    b. Read the Hawaiian proverb about ʻuala
    c. Instruct students read about the health benefits of ʻuala
    d. View Slides 14, 15, 16
7. *Conducting Uala Propagation* (10 minutes)
    a. Explain that ʻuala is primarily propagated through vine cuttings or slips
    b. Demonstrate how to place and propagate ʻuala by placing the tuber in the water for roots and shoots to grow
        i. View Slide 18
        ii. Leave the potato in the water to grow until next week's lesson before placing it into soil to grow
    c. Describe how to propagate ʻuala by vine cuttings
        i. View Slide 19
    d. Pull students to one area (carpet or center table) for a demonstration of the propagation process of cutting ʻuala vines.
        i. Explain to the students what nodes are and how when placed into soil they no longer want to be a leaf they begin to grow roots
        ii. Demonstrate counting three or four nodes, then trimming right under the bottom node where the root will grow.
        iii. Demonstrate cutting off the leaves to expose the nodes, then planting the cutting into a nursery pot with soil.
            1. If students would like to leave one or two leaves on the top they may do so. Explain that by leaving the leaves on a plant when propagating it takes the nutrients away from growing roots and leaves may often die then regrow once established in the soil
        iv. Explain the reason why we water the cutting after placing it in soil to firm the soil around the cutting while also giving the new cutting water to grow the roots
    e. Instruct students to pick an elbow partner to plant with and talk through the process with.
8. *Closing, Cleanup, and Transition* (5 minutes)
    a. Instruct students to answer the exit ticket question: Why is it important to understand how to propagate plants?
    b. Instruct students to put away their journals and help to clean up classroom

Lesson 6: Additional types of propagation

Before lesson:

- Gather taro plants. Gather as many as you can, but I recommend atleast one taro per three students. Leave one taro with the corm still attached for demonstration. About a week or two before this lesson, cut off the corm and save the kalo pieces. You can bring one of the kalo pieces for demonstration or use for a poi pounding lesson. Place the huli with leaves still attached in a 5 gallon bucket of water. Put just enough water to cover the bottoms of the huli for roots to grow. Change the water in the bucket after a few days as mosquitos will begin to lay their eggs into the water.

Materials:

- Taro plants
- Potting Soil (I used Sunshine Mix #4)
- 5 gallon bucket with water
- (Minimum size but can use larger) 2 gallon nursery pots
- Knife
- Scissors
- Ruler
- Hand shovel
- Watering Can
- Student Journals
- Pencils
- Teacher computer
- Projector and Screen
- Lesson 6.pptx
- Lesson 6 Presentation Kalo

1. *Warm Up* (5 minutes)
    a. Display the image and question on the board as students arrive to class and get settled in.
    b. Instruct students to create a hypothesis in their journals in complete sentences, give them a few minutes to complete
        i. What would happen if we cut this plant into two pieces like the image displayed?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Ask students to share some of their answers aloud with the class
2. *Introduction* (5 minutes)
    a. Ask students to read the unit essential question and the lesson's essential question
    b. Ask students to think-pair-share with their partner to answer the question:.
3. *Discuss Different Types of Propagation Methods* (10 minutes)
    a. Explain the process of creating new plants. Relate the seed to an avocado.
        i. Ask students if they know what a clone is. Explain the definition of a clone.
        ii. Tell students about a story if they went to a friend's house and ate the best avocado ever.
        iii. Explain that if you wanted to eat that same avocado during the avocado season,

how would you create the avocado plant in your backyard. Explain that if they plant the seed, that it is not guaranteed to taste the same. Discuss that if you plant a seed that the genetic makeup of the plant changes. Explain that if you were to take a piece of the tree branch and plant it in the ground that it would

b. Instruct students through slides 5-9
c. Explain the four methods of propagation
d. After describing each method of propagation, relate to a propagating native plant or vegetables.
    i. Examples:
        - Layering - ‘Uala,
        - Grafting - plumeria (white flowers and pink flowers growing on the same tree, also common with citrus fruits)
        - Dividing - olena/ginger
        - Cuttings - ti leaf

4. *Pop quiz/Check for understanding* (5 minutes)
    a. Ask students to answer the question in their journals: What are the 4 types of propagation?
    b. Circulate around the room to check for students’ understanding.
    c. Ask students to close their journals then go over the answers to the quiz
5. *Background information on Taro* (7 minutes)
    a. Ask students what they know about taro, then explain the background facts about taro on slide 3 of Kalo slideshow
    b. Ask students: Why is it important to know about the moon when gardening?
        i. Explain that when planting taro and other crops that produce crops, there are certain days that are better to plant than others
        ii. Explain how the ancient Hawaiians would plant during the waning moon times as it was believed to produce the best crops and growth for the plants
    c. Ask students why do you think taro is called a “Community crop”?
        i. Explain to students that there is no right or wrong answer to this question. You can go into as much detail as you deem necessary for this question. Here are some examples of reasons that can be discussed.
            - Taro in ancient Hawai’i would benefit the health of the community. Taro is known as the elder brother which means that it nourishes us, so we must respect and care for it in return.
            - Nowadays, mahi’ai (farmers) are well known for their lo’i kalo (kalo patch) both wet and dry where the community can volunteer their time to help with the care and cultivation of these plants. It is also a plant that is shared with others to grow as it provides sustenance
            - By learning some of the terms to describe the plant, it can be seen how taro has influenced Hawaiian family structures.
                - Makua is the Hawaiian word for parent

- From makua grows the ʻohā, or keiki
- With the makua and ʻohā together, it is called an ʻohana.

d. Select students to read through slide 6
    i. Discuss the importance of taro and its cultural significance

6. *Taro Propagation* (8 minutes)
    a. Discuss the picture on slide 7
    b. Explain that taro is propagated by the stock of the plant called the huli
    c. Demonstrate cutting the bottom of the taro called kōhina with a knife. Leave about 1/4 of an inch on the bottom
        i. Display what the corm (kalo) looks like. To make it look more distinctive, pull off the weeds and rinse off the dirt. Describe how corms are used to make poi
    d. Demonstrate cutting the stem of the leaves and measuring the 8 inches long to leave the length of the huli
    e. Explain that similarly to ʻuala that by leaving the leaves on the stem that it causes the plant to put all of its energy towards sustaining the leaf instead of growing roots and establishing itself. Oftentimes the leaves will die off and a new stem will grow with a new leaf faster when leaves are cut prior to planting.
    f. Place the huli into water and explain leaving the cutting into water until roots start to grow
    g. With the huli that has been growing roots from a week or two prior, demonstrate placing stem into a 2 gallon nursery pot. Cover the bottom, kōhina, then water well.
        i. In a few days you should begin to see a new stem with leaf growing off of the main stem
    h. Group students together in groups of 3 students
        i. Explain to students about the importance of planting with good intentions, and that during the process of planting you should not be arguing or fighting as this will affect the growth of your taro plant
        ii. Ask one of the students to use their ruler and scissors to measure and cut the leaves off of the taro plant with a scissors leaving about 8 in of the stem
        iii. Ask one of the students in the group to use the hand shovel to fill the 2 gallon nursery pot with soil
        iv. Ask one of the students to place the taro cuttings into the pot and cover the roots and bottom of stock with soil
        v. Ask one of the students to get water and water the newly planted taro cutting, press the soil firmly, then place outside
7. *Closing, Cleanup, and Transition* (5 minutes)
    a. Instruct students to answer the exit ticket question: Why is it important to learn different ways to propagate plants and how does it relate to restoration of our ʻāina?
    b. Instruct students to put away their journals and help to clean up classroom

Extension of lesson:

- If time permits, set up a poi pounding workshop for the students to learn how to pound the corm, kalo, into poi. Invite a local kalo farmer or members of the community who are experts in their field to the classroom to teach this lesson.

Lesson 7: Propagating by Seed

Before the lesson:

- If you have kukui trees on the school campus, take your class on a walk to gather kukui nuts. If not, then collect kukui nuts on your own. Gather enough Kukui nuts for each pair of students to have at least 3 nuts to test. I recommend gathering extras just in case many of the seeds are bad when testing, and there will be not enough seeds for students to learn the scarification process.
    - Tip: When collecting the kukui nuts, if you shake the nut and it rattles, it means that the nut inside is rotten. If taking students on a nature walk to collect seeds, explain the previous tip with them.

Materials:

- Jug of water
- Beakers or glass jars
- Bucket (to place the seeds in after scaring to germinate)
- Medium grit sand paper cut into 2.5 in squares
- Bag (to place old kukui nuts in to keep them separate)
- Kukui nuts
- Student Journals
- Pencils
- Teacher computer
- Projector and Screen
- Lesson 7 Slideshow

1. *Warm Up* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in.
    b. Instruct students to answer questions in their journals in complete sentences, give them a few minutes to complete
        i. What are the different types of propagation?
        ii. What are the different ways plants travel by seed?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Ask students to share some of their answers aloud with the class
2. *Introduction* (5 minutes)
    a. Ask students to read the unit essential question and the lesson's essential question
    b. Ask students to think-pair-share with their partner to answer the question: What is a seed?
    c. Select students to read what a seed is and instruct the class to write down the definition
    d. Relate the word "dormant" to the mountain on our island. As it is still alive, but is "sleeping" in wait. As a seed is waiting for the right conditions to grow
3. Discuss the difference between cone-bearing and fruit bearing seeds
    a. Relate these definitions to endemic Hawaiian plants such as Kukui nuts, 'A'ali'i, etc.

4. *Discuss seed dispersal* (10 minutes)
    a. Guide students through slides 8-13
    b. Ask students to relate these methods of seed dispersal to plants that they know are endemic to Hawai'i after each slide
5. *Kukui Nut testing* (10 minutes)
    a. Set up testing stations at each table so that each pair of students gets at least two to three kukui nuts each.
    b. Give students each one glass jar or beaker filled 3/4 with water
    c. Ask students to place/test the kukui in the jar one at a time. If the kukui nut is good, place it on the table. If the kukui nut is not good, place it in the bag.
    d. Read Slide 17: If the kukui nut floats, it means that the nut is not good to plant. If the kukui nut sinks, it means that the nut is good to plant.
    e. Ask students: Why is it important to check if the nut is good or not before planting?
        i. Instruct the students to Think-Pair-Share
6. *Scarification* (10 minutes)
    a. Ask the students to think-pair-share with a different table partner: Now that we know which nuts are good to plant, how do we plant them?
    b. Ask students to share some answers aloud.
    c. Ask the students to think-pair-share with the same table partner as the previous question: What is scarification and how does it help us plant kukui nuts?
    d. Explain the definition of scarification and ask the students to write down the definition in their journals
    e. Instruct students and demonstrate through the process of scarification.
        i. Take sandpaper and rub the outside of the seed.
        ii. Explain that it takes away the protective outer layer so that when soaking the seed in water it will take a shorter amount of time before it cracks open and begins to grow a sprout.
        iii. After sanding down the outside of the shell, place the kukui nut in the bucket of water.
        iv. Instruct students to do this with their
7. *Closing, Cleanup, and Transition* (5 minutes)
    a. Instruct students to answer the exit ticket question: Why is it important to understand the different ways seeds travel?
    b. Instruct students to put away their journals and help to clean up classroom

Lesson 8: Soil Health and pH

Before the lesson:

- Ask students to bring in 8 cups of soil from outside of their home. Write students' name and the general location of their home on the cup (ex: Sam, Waiohuli)

Materials:

- Vinegar

- Baking Soda
- Distilled water
- Cups (plastic) or glass jars (enough for one per student)
- 2 plastic cups (for demonstration)
- Soil (about 8 cups of Sunshine #4 and 8 cups of a different type of soil)
- 1-cup measuring cup
- ½-cup Measuring cups
- Student Journals
- Pencils
- Teacher computer
- Projector and Screen
- Lesson 8 Slideshow

1. *Warm Up* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in.
    b. Instruct students to answer questions in their journals in complete sentences, give them a few minutes to complete
        i. What do you know about soil and its importance for plants?
        ii. What is pH?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Ask students to share some of their answers aloud with the class
2. *Introduction/ What is Soil?* (10 minutes)
    a. Ask students to read the unit essential question and the lesson's essential question
    b. Ask students to think-pair-share with their partner to answer the question: What does alkaline or acidic mean? What do you think it means?
    c. Watch the video from Grow Some Good with Ms. Havi until minute marker 8:39
3. *Pop quiz/Check for understanding* (5 minutes)
    a. Go back to the slideshow and ask students to answer the question in their journals: What are the 4 ingredients of soil and their percentages?
    b. Circulate around the room to check for students' understanding.
    c. Ask students to close their journals then go over the answers to the quiz
4. *Background information on pH?* (5 minute)
    a. Ask students if they have ever been given a strip of paper and then stuck it in water and compared the change of the color on that paper on a color scale like the image on slide 8. Explain to students that they were testing the water for its pH level.
    b. Read the definition of pH and ask students to write down the definition in their books
    c. Review and describe the pH scale and some of the identifiers that cause acidity or alkalinity in soil.
    d. Explain to students that just like humans, plants have preferences.
        i. Refer to slide 9
    e. Explain to students that some plants such as blueberries or gardenias like acidic soil, whereas lavender or succulent plants like alkaline soil. View slide 10
    f. Explain to students that the pH of soil can be changed

i. Explain to students that by adding something alkaline to the soil that it can decrease the amount of acidity in the soil
   - For example, by adding something alkaline like baking soda to soil, this can make acidic soil more neutral causing the acidity in plants to change for example making tomato plants more sweet

5. *Demonstrate how to test pH? (*5 minutes*)*
   a. Explain to students that sometimes pH testing kits can be expensive
   b. As a more affordable way to test the pH of soil, we can use at home ingredients such as baking soda and vinegar.
   c. Ask two students to read the recipes aloud
   d. Gather students around one area for the demonstration:
      i. Take a cup of the sunshine mix and divide it into two cups. There should be about 2 cups of soil in each cup.
      ii. Take a cup of the other soil and divide it into two cups. There should be about 2 cups of soil in each cup
      iii. Demonstrate measuring ½ cup of water and add it to all the soil cups.
      iv. Demonstrate adding ½ cup of vinegar to one of each cup of soil (one cup of sunshine mix and one cup of the other soil).
         - Ask the students what they notice when the vinegar is added to the soil.
         - Ask the students if they notice if the cup is bubbling consistently aka fizzing, or not.
         - Ask the students to write their observations down in the journals.
      v. Demonstrate adding ½ cup of baking soda to the other two cups of soil
         - Ask students what they notice when the baking soda is added to the soil.
         - Ask the students if they notice if the cup is bubbling consistently aka fizzing or not
            - If using Sunshine Mix #4 or another potting soil with perlite, explain to students that the white rocks in the soil called perlite is a fertilizer which makes the soil acidic
         - Ask students to write their observations down in their journals
6. *Testing soil's pH* (10 minutes)
   a. Ask students to measure 4 cups of soil that they brought from home in each cups or jars
   b. Ask students to measure ½ cup of water and place over their soil in each cup
   c. Ask students to measure ½ cup
7. *Closing/Cleanup/Transition* (5 minutes)
   a. Instruct students to answer the exit ticket question: How does understanding soil health help me grow healthier plants?
   b. Instruct students to put away their journals and help to clean up classroom

Extension of Lesson:

- Ask students to fill a glass jar with soil and bring it to school. Conduct the shake jar test. Watch 8:40 - 11:55 of the video. This will take a day or two for soil to settle into clear defined layers.

Lesson 9: Specific Plant Research/Gathering information

Before the lesson:

- Create a list of all the different plants that are being propagated and/or growing in pots that students planted.
- Create a sample of exemplar of what you are looking for

Materials:

- Student Journals
- Pencils
- Teacher computer
- Projector and Screen
- Poster boards or paper
- Markers
- Colored pencils
- Other art supplies (if students ask)
- Scissors
- Pens
- iPads with access to iMovie
- Relevant books (depending on the plants originally chosen by students to propagate)
- Printed Articles
- Student computers with internet access
- Computer paper
- Construction paper
- Whiteboard/Expo Markers
- Rubric for Poster

1. *Warm Up* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in getting their computer and their journals.
    b. Instruct students to answer questions in their journals in complete sentences, give them a few minutes to complete
        i. Why is it important to educate our community about plants, their care and uses, and how to propagate them?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Call on students to share some answers aloud
2. *Introduction* (8 minutes)
    a. Remind students about the importance of endemic Hawaiian plants and sustainable plants.
    b. Explain the objective of creating information posters and why it is important. Explain about the importance of educating the community about propagation, restoration, and sustainability.
    c. Pull students together on the carpet
    d. Ask students what are the aspects of a poster
    e. Discuss and create a rubric as a whole class with the students on what should be included

in their poster, video, slideshow, brochure, or other form of presentation of their choice on the board.

f. Ask students to discuss what information would be useful on an informational poster on endemic plants.
    i. Examples: care, uses, location, etc.
g. Upload the final rubric onto Google classroom for students to write on as well as refer to as needed

3. *Independent Work Time* (27 minutes)
    a. Read and instruct students to answer the questions as these questions cannot be researched:
        i. Why is it important to help restore Maui after the impact of the wildfires? How does propagating plants help to do so?
        ii. How can we test soil to determine the pH?
            1. These questions can be used to determine students' understanding of the content of the unit (*summative assessment*)
    b. Provide access to research materials such as relevant books, computers, and printed articles that are related to the endemic plants that students propagated
    c. Instruct students to research and gather information about endemic plants focusing on the plants that students propagated.
    d. Provide guidance and support as needed while circulating around the room
4. *Closing* (5 minutes)
    a. Instruct students to save their work, put away the items they were using
    b. Explain to students that they are not just learning more about the endemic plant that they have chosen, but they are the ones who is going to be the experts in that plant, and are developing research and communication skills
    c. Instruct students to put their supplies away, clean up after themselves, and transition to next class

Lesson 10: Continuing Research/Creating Presentation

Materials:

- Student Journals
- Pencils
- Teacher computer
- Projector and Screen
- Poster boards or paper
- Markers
- Colored pencils
- Other art supplies (if students ask)
- Scissors
- Pens
- iPads with access to iMovie
- Relevant books (depending on the plants originally chosen by students to propagate)
- Printed Articles
- Student computers with internet access
- Computer paper

- Construction paper
- Whiteboard/Expo Markers
- Rubric for Poster

1. *Warm Up* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in getting their computer and their journals.
    b. Instruct students to answer questions in their journals in complete sentences, give them a few minutes to complete
        i. How does propagating plants promote sustainability to help restore the impacts caused by the Maui wildfires?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Call on students to share some answers aloud
    e. Explain to students to refer to this answer to respond to their first two questions for their poster.
2. *Introduction* (5 minutes)
    a. Recap the previous lesson briefly and remind students of the importance of endemic plants and their purpose to the community and the environment
    b. Explain that today's lesson will focus on continuing their research to gather more information for their choice of presentation (poster, slideshow, video, etc.)
        i. If students are finished with their research, review their answers (to double check that their answers are correct or understandable) then they may begin to work on their presentation
        ii. (The importance of checking answers is to correctly educate the community about the information on the poster when it is attached to the plant.)
    c. Guide students to identify the gaps of where additional information is needed on their posters. Discuss about the importance of arranging information in a manner that the audience can understand the information trying to be conveyed.
3. *Independent Work Time* (30 minutes)
    a. Allow students to continue research information independently, focusing on what more work is needed to be completed.
    b. Provide access to research materials such as relevant books, computers, and printed articles that are related to the endemic plants that students propagated
    c. Instruct students to research and gather information about endemic plants focusing on the plants that students propagated.
    d. Provide guidance and support as needed while circulating around the room
4. *Reflection and Next Steps* (5 minutes)
    a. Lead an reflective discussion on the research process, asking students about what they learned and the challenges that they faced
    b. Encourage students who are not finished with their research to work on completing their tasks outside of class and/or coming in during lunch.
    c. Instruct students to put their supplies away, clean up after themselves, and transition to next class

Lesson 11: Finish Creating Presentation

Materials:

- Student Journals
- Pencils
- Teacher computer
- Projector and Screen
- Poster boards or paper
- Markers
- Colored pencils
- Other art supplies (if students ask)
- Scissors
- Pens
- iPads with access to iMovie
- Relevant books (depending on the plants originally chosen by students to propagate)
- Printed Articles
- Student computers with internet access
- Computer paper
- Construction paper
- Whiteboard/Expo Markers
- Rubric for Poster

1. *Warm Up* (5 minutes)
    a. Display background questions on the board as students arrive to class and get settled in getting their computer and their journals.
    b. Instruct students to answer questions in their journals in complete sentences, give them a few minutes to complete
        i. How does propagating plants promote sustainability to help restore the impacts caused by the Maui wildfires?
    c. Instruct students to Think-Pair-Share with their elbow partner
    d. Call on students to share some answers aloud
    e. Explain to students to refer to this answer to respond to their first two questions for their poster.
5. *Introduction* (5 minutes)
    a. Recap the previous lesson briefly and remind students of the importance of endemic plants and their purpose to the community and the environment
    b. Explain that today's lesson will focus on continuing their research to gather more information for their choice of presentation (poster, slideshow, video, etc.)
        i. If students are finished with their research, review their answers (to double check that their answers are correct or understandable) then they may begin to work on their presentation
        ii. (The importance of checking answers is to correctly educate the community about the information on the poster when it is attached to the plant.)
    c. Guide students to identify the gaps of where additional information is needed on their posters. Discuss about the importance of arranging information in a manner that the audience can understand the information trying to be conveyed.

6. *Poster Design Elements Overview* (5 minutes)
    a. Review the rubric that students created and the criteria that was included to receive an "MP" or "ME"
        i. Encourage students to ask questions or clarification on any of the aspects asked of them on the rubric (especially in the case that some students were absent)
    b. Discuss the key elements of an effective poster/slideshow: clear and concise text, well organized layout (using color or bubbles to separate text), images and visuals that are relevant to the content, and creativity and visually appealing
    c. Display a well-designed poster or slideshow for inspiration
7. *Presentation Creation* (22 minutes)
    a. Allow students to begin working on their presentations, referencing the rubric as needed to organize their design
    b. Circulate around the room to provide guidance and support to students as needed
8. *Closing* (8 minutes)
    a. Encourage students to exchange posters with a peer to discuss what they had completed throughout the class time.
    b. Ask students to discuss what still needs to be completed before the next class
    c. Instruct students that they may need additional help or time to work on it to complete, that they may work on this during other available times throughout the week and/or come in during recess or lunch to eat lunch and work.
    d. Ask students to put their supplies away, clean up after themselves, and transition to next class

Lesson 12: Peer Review and Group Share Aloud

Materials:
- Student Journals
- Pencils
- Post it Notes
- Teacher computer
- Projector
- Rubric for Poster

1. *Introduction* (5 minutes)
    a. Remind students of the importance of constructive feedback
    b. Distribute the rubric created for evaluating the posters.
    c. Provide guidance and guidelines for constructive feedback emphasizing fairness and kindness with grading and comments
2. *Group Sharing of Presentation* (15 minutes)
    a. Divide the class into small groups of 3 or 4, ensuring that each group has a mixture of presentations from different endemic plants or sustainable crops.
    b. Instruct each student to briefly share their presentation with their small group
    c. Encourage students to ask clarifying questions about the content and design of the presentation
    d. Circulate around the room and facilitate discussions within the groups to ensure that all students have an opportunity to speak and be heard.

3. *Peer Review of Presentation* (15 minutes)
    a. Instruct students to rotate through each presentation in their group, spending a few minutes reviewing and assessing the poster based on the rubric
    b. Instruct students to write down feedback in their journals and to be specific and write down the name of the person they are assessing on the paper.
        i. Encourage the students to write down their feedback on post-it notes to place on their group members posters
4. Reflection and Discussion (5 minutes)
    a. Instruct the students to review the feedback on their presentations
    b. Discuss again the importance of giving and receiving feedback respectful and listen constructively on how to improve your presentation
    c. Lead the class in a discussion about the peer feedback
        i. Ask students to write a brief reflection in their journal answering the following question: How can I improve my presentation to reach a better grade?
5. Closing (5 minutes)
    a. Thank students for their participation in this unit as well as for this project.
    b. Collect physical presentations (ex: posters, brochures, fliers, etc) to be printed and/or laminated

After the lesson: Scan completed student posters on the computer, then create QR codes. Create a private link to attach videos to QR codes. On the back of the QR codes, write the name of the student and the plant. Print out QR codes on cardstock paper.

Authentic Assessment: As a class, create an event on the school campus inviting the community affected by the Maui wildfires. Ask students and their families to also attend the event. Laminate students' posters as well as printing out student slideshows, or setting up iPad to play videos. At the event, display students' work next to a small group of the designated plants. Students should be the experts in their knowledge about this topic, which they will be the ones to explain their plants when the community chooses one to take home. The purpose of this activity is for students to educate others, and promote sustainability as well as restoration about this project and their propagated plant.