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## **4th Grade 'Ike Hawai'i Project: Engineering Your Own Raised Bed**

Aloha mai! I truly hope that you are all safe and following the suggested guidelines for personal and community sanitation and social distancing so we can beat the Coronavirus. The more that we can stop this disease from spreading, the sooner we can all get back to normal life again.

This project was created to encourage you to go outside and to grow something for your 'ohana to eat. In 'Ōlelo Hawai'i, our Hawaiian language, the general term **māla 'ai** is used to explain a **“dryland taro patch or any food garden.”**

If you don't have a food garden or a **māla 'ai** at home, then you will need to **engineer** one. **Engineering** means to design and build something. Many times engineering is done to create things that make life better for people or that help them to survive.

My hope for you today is that you will look at the resources or materials you have around at home, think creatively about how you will use them and finally to build your own māla 'ai. That's right... I want you to be an **engineer** and build your own māla 'ai or food garden, using our “use what get” thinking! The end goal is to learn how to grow 'ai (food) for you and your 'ohana! Ok? Let's get started...

### **Our Kūpuna Are 'Āina Engineers**

Across our Hawaiian island chain, our kūpuna (our Native Hawaiian ancestors) were and still are expert **engineers**. They created some of the most amazing ways to grow food to support our people both on land and at sea using the natural resources they had available to them.

They engineered:

- **'Auwai** or water ditches were designed and built to move freshwater very far distances to grow food in **Lo'i** or flooded taro patches on valley floors throughout Hawai'i. See below:



- Kuaiwi** or long rock walls were built to create terraces which grew huge amounts of food in dryland or “rainfed” agricultural fields. One of the largest agricultural field systems was built on the mountain hillsides above Kona. It was said that King Kamehameha the Great helped to construct the kuaiwi in a part of this system. The area he helped to create is called Kūāhewa. Kūāhewa means “Huge or vast” and the entire field system most certainly is ENORMOUS! The kuaiwi that were built formed agricultural fields that stretched from North to South Kona estimated to be about 29,562 acres. Some of these kuaiwi remain today in the ahupua‘a (land divisions) in Kona like those pictured below (left and bottom) in Kahalu‘u and Keālia. Some of the engineered rock walls are covered by forest which has taken over areas not used for farming anymore. See below:



- Māla ‘ai** or dry land food patches were designed and created all across Hawai‘i in areas without flowing streams. Māla ‘ai were created in many different ways throughout the Hawaiian Islands. One way was to collect soil in “pu‘e” or “pu‘epu‘e” (mounds) and to plant food crops in them. See below:



- **Loko i‘a** or fish ponds were designed and built to grow and easily catch large fish all across the Hawaiian islands. The picture below on the left is of a loko i‘a called Hale o Lono located in Honohononui, Keaukaha, Hilo, Hawai‘i it is on the Hilo side of “4 Mile” or James Kealoha Beach Park. Many people go to help the kia‘i loko (or guardians and caretakers of the fish pond) to help secure and maintain the rock walls which keep the fish trapped inside. These loko i‘a were the “refrigerators” for our kūpuna long ago and still to this day! See below:



### ‘Ike Kūpuna- Knowledge and Understandings of our Ancestors

Here in Puna, Hawai‘i we are blessed with many natural resources: fresh air, abundant rainfall, lush ‘Ōhi‘a Lehua rain forests and lots of **pōhaku**! If you don’t remember that word, **pōhaku** means “**rocks or stones**”. (Hopefully, you recall the difference between the 2 most common types of pōhaku, ‘a‘ā and pāhoehoe, from our last lesson.)

We could call Puna a place with plenty pōhaku, but very little **lepo** or soil. I know what you're thinking... “Kumu... how am I supposed to engineer a māla ‘ai to grow food for my ‘ohana if I no more **lepo**?!?!” That’s a great question. One way to answer it is to look to our kūpuna and learn about how they grew food in our rock-rich and lepo-less environment.

First, you need to know that our kūpuna were soooo AKAMA! (brilliantly smart), they knew how to grow or actually make more soil. Yes, that’s right! Soil is built or grown and it continues to grow over time. Let’s see how...

### “...‘eli ho‘opu‘u honua”- “...dig and heap up the earth”

When plants drop leaves and branches on the ground they slowly **decompose** or break down with the help of **decomposers** (or living things that take dead organic plant matter and break it down into smaller pieces called *humus*). Most decomposers are microscopic so our kūpuna could not have seen them in the old days because they did not have microscopes. These microscopic, teeny-tiny decomposers have names like microbes, bacteria, fungi and mushrooms. Yet, there are some decomposers that our kūpuna were able to kilo (closely observe) and that we can still kilo today when we examine lepo.

The **ko‘e** or “earthworm” are decomposers that were very important to our kūpuna. You see ko‘e live in the soil and feed on the dead plants that have fallen down onto the ground. Ko‘e, with the help of other decomposers, break down dead plants into “humus” or the soft greasy stuff in lepo (soil) that plants need to grow healthy and strong. The more dead plants that fall on top of the

ground the more the ko‘e have to eat and the result is even more lepo. It is a continuous cycle which is always adding more and more lepo to the surface of the earth.

Our kūpuna were so akamai and so observant that they believed that the ko‘e was one of the first creatures to have existed on land. They seemed to understand that the ko‘e had the function or job of helping to dig and heap or hill up the earth as they were continuously creating lepo. Using this knowledge our kūpuna here in Puna used the ko‘e (and it’s microscopic decomposer friends) to grow food in places that had very little lepo and even no lepo at all. We could say that our kūpuna understood how to create lepo so they could grow food just about anywhere.

### **Pu‘epu‘e**

In Puna, and all throughout our Hawaiian islands, our kūpuna used many creative styles or ways to grow food in the very different places they lived. All of our kūpuna around Hawai‘i grew food with the help of the mighty decomposing power of the ko‘e and it’s microscopic friends!

One very important and ancient planting style which was used in Puna and in many other areas around Hawai‘i was called “**pu‘epu‘e**.” **Pu‘epu‘e** means “to mound or hill up soil for planting.” This style of planting was used to grow ‘ai or food in both lo‘i (wet taro patches) and in māla or dryland or rain watered planting areas. There are many variations of this planting style and all are maika‘i or good because they are used to grow food for people wherever they live.

### **Pu‘epu‘e in Puna**

The following descriptions of the ways that pu‘epu‘e planting styles can be done below are from Puna, Hawai‘i.

Some planters in Puna would collect what little soil could be found in an area by digging and scraping it together. Then they would pile all the lepo up in one spot and form a hill or mound. These mounds or hills could be as large or small as needed. Next food plants were planted inside and **PULU** or “mulch” (dead plants that are used to cover soil like a blanket) was collected and used to cover the mound. As the pulu was broken down by the ko‘e over time, more pulu was added on top. The Pu‘epu‘e style uses the hungry decomposing actions of the ko‘e and it’s friends to create more and more lepo in one spot so that we can grow more food.

Other kūpuna I have spoken to in our area told me that they believed pu‘epu‘e plantings referred to the gathering and heaping up of any and all types of dead plants and planting materials in many creative ways. They said that any leaves, branches, tree trucks, etc. were gathered and put in low spots in the lava rock and made into a pile. After a long time the mound broke down and decomposed into lepo, then the Kalo (taro), ‘Uala (sweet potatoes), Maia (banana), ‘Ulu (breadfruit) and other food crops were planted inside. Then more and more pulu was added on top to keep the lepo wet. How cool is that? Our kūpuna built soil in low spots on the lava rocks!

Here are some of the other creative ways our kūpuna used the pu‘epu‘e planting styles to grow food. Some used:

- The center of large decomposed tree logs and tree stumps to plant food inside.
- Inside the roots of a dead Pūhala (Hala tree) where leaves were stuffed in between the root system and left to decompose, more and more leaves were stuffed inside and then kalo huli were planted inside the lepo that was created.

- Planting areas were made using rocks or tree trunks to make a pā (an enclosure or an area) so that the lepo would not “run away” when it rained where other logs, dead Hala, Coconut, Hau, Mango, Avocado and Ti leaves, branches, sticks, and fern fronds were all piled inside. This heaping pile was left. After some time, the dead plants that did not completely decompose were pulled to the side of the mound, food plants were then planted inside and more pulu was added to cover the pu‘e (mound).

Many kūpuna in Puna today create these small māla ‘ai using the pu‘epu‘e concept with whatever they have around the house. Below are some examples of the modern day “Use what get” thinking to grow ‘ai (food) at home:



Here is one made with old recycled pieces of metal roof and old fence posts. Mahalo Uncle Howard Konanui for sharing his māla ‘āi in Hawaiian Paradise Park with us!



Mahalo to Uncle Jerry Konanui for sharing this picture with me some years back. Materials used are recycled metal roofing and scrap 2x 4's (wood)



The photo to the left is from Uncle Stanley Ka‘awaloa and Aunty Cheryl Ka‘awaloa of Nānāwale. Here he used recycled wood and metal roofing



Waiwī wood from the forest was used for these examples from Kahalu‘u, Kona. Mahalo to Dr. Natalie Kurashima and Jesse Kaho‘onei.



These Palm tree trunks were cut down by a neighbor because they were too close to a power line. After asking permission, they now will have a new home in my yard. ‘Uala (sweet potatoes) is planted inside with the lepo we were able to scrape up from around our ‘āina.



Scrap pieces of wood can be fastened together to make hold lepo inside and keep it from washing away with the rain.



In time the pu‘e or mound that was created using pulu (cut plants for mulch), will break down into lepo. Notice the use of **pōhaku** (rocks) to keep the planting materials from blowing or washing away.



Simple pā pōhaku (rock walls or rock wall enclosures) can be made to create māla ‘ai using the pu‘ep‘e style of all sizes. Here in Puna, we have plenty pōhaku so that’s one resource you could use. My son dug this hole and used the pōhaku that came out to make the pā pōhaku. We also used ‘Ōhi‘a lehua logs to help to keep the lepo around the huli (taro planting slips) from washing away in the rain. We will continue to add pulu as the kalo grows larger.



Pōhaku were used in the three examples above to make small sized māla ‘ai. The picture to the right is built against a hillside in a “U” shape.

### **The Importance of Pōhaku & U hau Humu Pōhaku**

Pōhaku played a crucial role in the lives of our kūpuna both past and present. Pōhaku, like all things on earth from a Hawaiian worldview, hold and carry mana (or power and energy) and need to be respected. Pōhaku were and are still used for the creation of tools, used in cooking, and were an essential natural resource used in the engineering and creation of structures used in all areas of life.

The term **uhau humu pōhaku** means “the sewing together of stones”. U hau humu pōhaku is a traditional Hawaiian practice of “dry stack masonry” that means the art and skill of designing, engineering and creating structures out of rocks without the use of cement. This practice is still taught and used today by many uhau humu pōhaku masters and their students.

Our kūpuna were able to use the forces of gravity and friction to create truly AMAZING structures all done with pōhaku and with no cement or concrete. U hau humu pōhaku techniques were and are still used today to create and restore heiau (Hawaiian spiritual places for practice and worship), loko i‘a (fish ponds as seen earlier in this document), kuaiwi and kīpapa (rock wall terraces and enclosures for growing food), hale (house foundation sites), pā pōhaku (rock walls used for property and animal enclosures) and in many many other ways throughout our Hawaiian island chain. Some of the ancient examples of the fantastic engineering work of our kūpuna can still be seen today. Here are some examples:



This is a picture of Pu‘ukoholā Heiau in Kawaihae, Hawai‘i Island. This heiau was built for King Kamehameha the Great using the practice of uhau humu pōhaku.



Left is a painting done by Uncle Herb Kane. It shows how many men, pōhaku and “hakahaka” small filler stones would have been needed to create this sacred site at Pu‘ukoholā Heiau. This heiau is now a National Park which you can visit. The National Park service says that it took as many as 10,000 to 20,000 men to pass pōhaku from Pololū valley to Kawaihae where the heiau was built.



Uhau humu pōhaku was used to create this heiau located in Hāna, Maui called Pi'ilani Hale Heiau. This sacred place was created for the great ali'i or chief of Maui called Pi'ilani. All those rocks are being held “dry stack” or without the use of cement or concrete!

The practice of uhau humu pōhaku is one which takes years to master, with many layers of spiritual and physical understanding. A non-profit group called Hui Ho‘oniho has created videos and continues to teach and share the practice of uhau humu pōhaku from the masters who still carry the knowledge from our kūpuna. If you would like to know more about this practice and are interested in learning some of the basic principles, beliefs and skills of Uhau humu pōhaku, check out some of the links at the bottom of this document in the **\*\*\*ADDITIONAL RESOURCES\*\*\*** section.

**Why learn about uhau humu pōhaku?** My hope is that if you have plenty pōhaku at home and you would like to use them to create your māla ‘ai, this information and some of the other resources below will help you to create a better dry stack pā pōhaku to keep your pu‘e from washing away in the rain!

# Student Work:

This project will take you more than a few days and has 4 different parts for you to work on...

- **Part 1: Re-read** the text above by yourself or with someone at home
  - **Think** about these questions as you read:
    - What natural resources did our kūpuna have in “the old days”?
    - How were our kūpuna scientists or scientific?
    - How were our kūpuna engineers? What did our kūpuna engineer?
    - Why is the ko‘e (earthworm) so important to us?
    - How can you use the decomposing power of the ko‘e to make lepo (soil) for your ‘ohana to grow food in?
    - What resources do you have at home that you can use to make a māla ‘ai with?
  - **Write** a reflection after you re-read answering at least 3 (or more) of the questions above.
  
- **Part 2: Plan and Design** a māla ‘ai for your home using the pu‘epu‘e style.
  - **Think & Plan-** Look closely at the resources (things you can use) outside in nature or that are around your home.
    - What could you use? Remember... “USE WHAT GET!” (Don’t go buy stuff)
      - EX. Pōhaku, branches, cut up tree trunks, old wood... use what get!
    - Ask a family member at home before you think of using or take anything from around the house!
    - Think about where you could put it so it gets the most sun and rain
    - What help will you need?
      - Can you find any soil or mud in your yard or forest area?
      - Or will you gather dead plants to pu‘epu‘e (pile up) and let decompose?
  - **Design**
    - Draw a picture or create a model of what your māla ‘ai will look like
      - Create an artistic representation of your plan
      - Label the parts and materials you will use
  - **Share** your design with a family member at home
    - Explain what you learned and why you are building this... remember you are trying to grow ‘ai (food) for your ‘ohana!

- **Part 3: Engineer it!** Build your māla ‘ai with your ‘ohana
  - Ask your ‘ohana for help before you use anything
    - **BE SAFE!!!!**
      - **Get help with moving anything**
      - **DO NOT USE ANYTHING SHARP TO CUT WITHOUT THE HELP OF AN ADULT!!!!**
  - Build it and fill it up
    - With help from your ‘ohana engineer (build) your māla ‘ai
    - Pu‘epu‘e- gather up what you can and make it into a mound inside your container
  
- **Part 4: Kanu- Plant**
  - Plant something to eat inside your māla ‘ai
  - Tomatoes, kabocha pumpkin, dried beans, sweet potatoes, potatoes and many other fruits and vegetables that you buy from the store all have seeds or can be used to plant and will grow into food to eat.

### \*\*\* ADDITIONAL RESOURCES \*\*\*

- **Māla ‘ai Resource Video**

- I have also created a video of how my ‘ohana has recently created māla ‘ai at home using the “Use what get!” mentality and the concepts of the pu‘epu‘e style in many different ways. If you are able to get internet access click on the following link:

<https://tinyurl.com/ycf4o2x4>

- Or if you have a smartphone take a picture of the QR code → to go straight to the folder:



- General Information on *Uhau humu pōhaku* for kids:

- Kumukahi.org- Uhau Humu Pōhaku Video:  
[http://www.kumukahi.org/units/na\\_kanaka/oihana/uhauhumu\\_pohaku](http://www.kumukahi.org/units/na_kanaka/oihana/uhauhumu_pohaku)
- Edith Kanaka‘ole Foundation’s -Hale o Lono Loko i‘a- Fish pond Kūkulu pā pōhaku (rock wall building & repair): <https://www.youtube.com/watch?v=E-MqOuGzpf8>

- Detailed Videos from Hui Ho‘oniho- related to Uhau humu pōhaku practice:

- Uhau humu pōhaku Part 1: <https://www.youtube.com/watch?v=GYagOPjQiTI>
- Uhau humu pōhaku Part 2: <https://www.youtube.com/watch?v=DNNJO5FnsAU>
- Uhau humu pōhaku Part 3: <https://www.youtube.com/watch?v=66ELVg0smag>
- Uhau humu pōhaku Part 4: <https://www.youtube.com/watch?v=fiy3lhEXUtA>
- Uhau humu pōhaku Part 5: <https://www.youtube.com/watch?v=OOGh9HjxeOU>

- Kumuola’s Loko I‘a (Hawaiian Fishpond) Website

- Explore this fact filled website created with links to mo‘olelo and resources about the various types of fishponds found all around Hawai‘i.
  - <https://tinyurl.com/ybrjzpg9>

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- Ancient Engineering- Wahi Kūpuna (Ancient Hawaiian Places & Sacred Sites) 3-D Mapping

- Check out this Interactive website created by Kamehameha Schools highlighting the engineering skills of our kūpuna
  - Wahi Kūpuna- Hawaiian Cultural Heritage Project: <https://beta.ks3d.org/>

### **Mahalo:**

I’d like to take time to mahalo the many people who have shared their mo‘olelo (stories), ‘ike (knowledge, understand and experiences), digital resources (websites, videos and pictures) and their own living practices with me related to the various topics shared in this lesson (both now and throughout the years). Mahalo for your help in making this lesson/project possible:

- Uncle Jerry & Aunty Gladys Konanui, Uncle Howard Konanui, Uncle Larry Kuamo‘o, Uncle Stanley & Aunty Cheryl Ka‘awaloa, Uncle Henry Leong, Pi‘ilani Ka‘awaloa, Keani Kaleimamahu, Ka‘iana Runnels, Keahi Thomas, Ka‘apuni Aiwohi, Lei Maile & Umi Wengler, Blake McNaughton, Maury Gutteling, Jason Jeremiah, Dr. Natalie Kurashima, Jesse Kaho‘onei, Kama Dancil, Jon Tulchin, Ku‘uleinani Harman and my son, Kalamakua.

**Questions:** If you have questions please don’t hesitate to email me and ask @ [nifranci@ksbe.edu](mailto:nifranci@ksbe.edu)