

ALTERNATIVE CLASS GARDENING:

FROM GARBAGE TO AQUAPONICS

JACKIE GARDNER, K-12 NGSS TOSA

SAN JACINTO UNIFIED SCHOOL DISTRICT

Presentation Link for Later: <http://bit.ly/garbagegardens>

jgardner@sanjacinto.k12.ca.us

Twitter: @the_fish_nerd

Website: <https://thefishnerd.weebly.com>

WHAT IS A GARBAGE GARDEN?



Waste not, want not!

A garbage garden is an environmentally-friendly and low-cost alternative to purchasing expensive class gardening kits using “garbage,” or found, recycled, & low cost materials.

1. Use leftover plant trimmings to grow new plants.
2. Recycle plastic containers to make planters.
3. Reduce the amount of water and chemical fertilizers needed to grow food.
4. Grow organic food in an urban environment.



WHY BUILD A GARBAGE GARDEN?

- Develop a sense of responsibility and commitment to caring for the living plants.
- View ecosystems at work in real time.
- Learn about reducing their use of virgin materials.
- Study external conditions (weathering and erosion, sunlight, etc) and their effects on the organisms in the garden.
- Cheaper to start and care for than traditional gardens.
- Learn how new agriculture techniques are reducing water and fertilizer needs to grow healthy food.



NGSS Standards: All Engineering Design standards apply if you are having the students design their own planters and garden layouts.

Kindergarten: K-LS1-1, K-ESS2-2, K-ESS3-1, K-ESS3-3

1st: 1-LS1-1, 1-LS3-1

2nd: 2-LS2-1, 2-LS2-2, 2-LS4-1, 2-ESS2-1

3rd: 3-LS1-1, 3-LS3-1, 3-LS3-2, 3-LS4-2, 3-LS4-3, 3-LS4-4

4th: 4-LS1-1, 4-ESS2-1

5th: 5-LS1-1, 5-LS2-1, 5-ESS2-1, 5-ESS3-1

6th Integrated: MS-LS1-1, MS-LS1-2, MS-LS1-3, MS-LS1-4, MS-LS1-5, MS-LS3-2, MS-ESS2-4, MS-ESS3-3, MS-ESS3-5

7th Integrated: MS-LS1-6, MS-LS1-7, MS-LS2-1, MS-LS2-2, MS-LS2-3, MS-LS2-4, MS-LS2-5

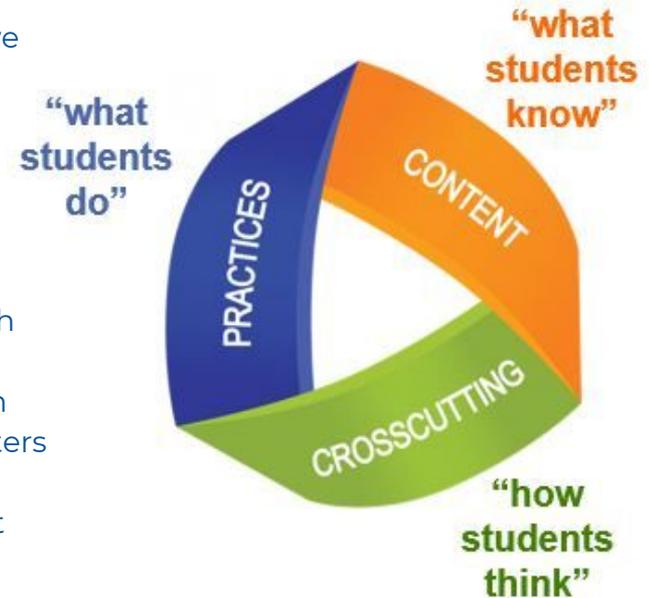
8th Integrated: MS-LS3-1, MS-LS4-4, MS-LS4-5, MS-LS4-6

High School: HS-LS1, HS-LS2, HS-LS3, HS-LS4, HS-ESS2-5, HS-ESS2-6, HS-ESS2-7, HS-ESS3

NGSS & GARDENING

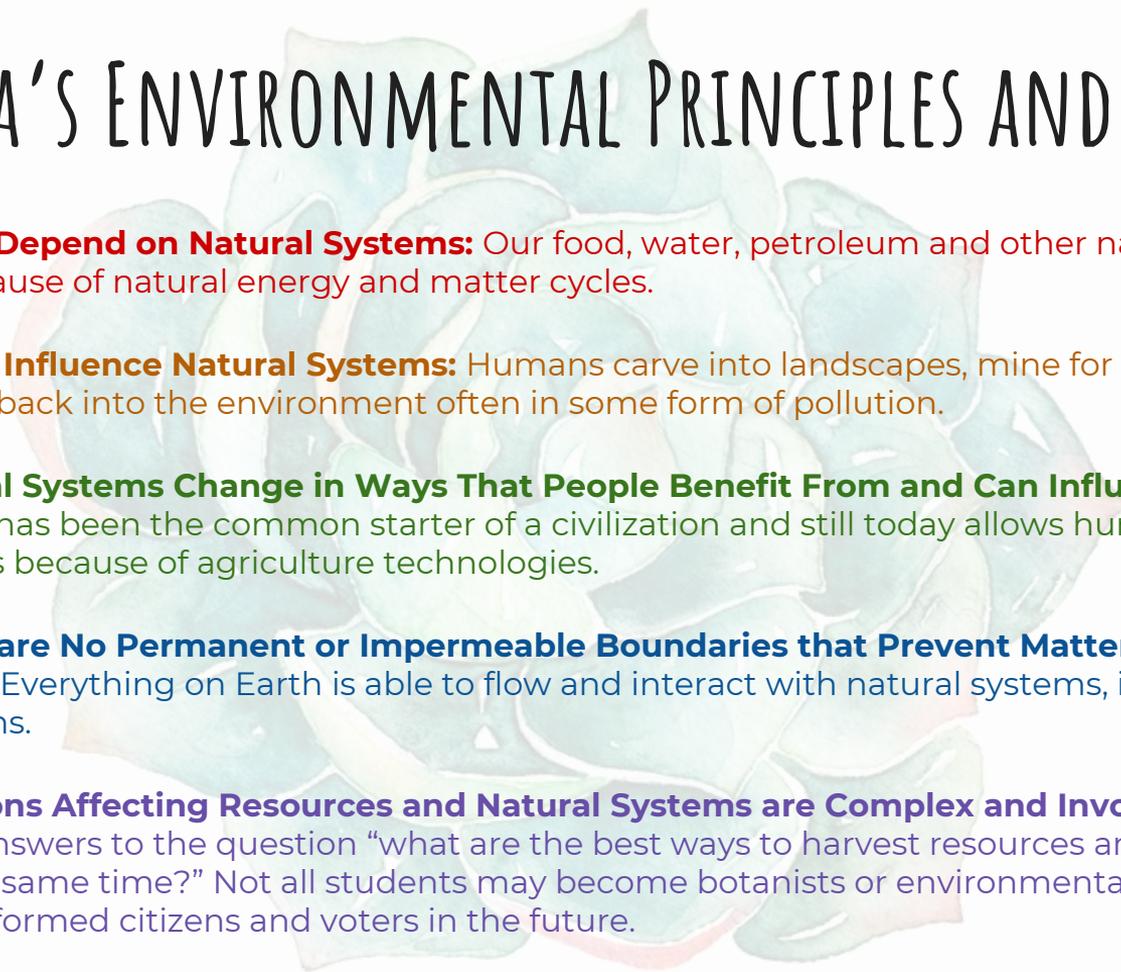
Science and Engineering Practices

1. **Asking Questions and Defining Problems** (ex: How many plants can we grow with 1 gallon of water a day?)
2. **Developing and Using Models** (ex: Draw schematics of your garden.)
3. **Planning and Carrying Out Investigations** (ex: Plan and test different growth experiments.)
4. **Analyzing and Interpreting Data** (ex: Measure plant health and environmental conditions.)
5. **Using Mathematics and Computational Thinking** (ex: Calculate growth rates, materials costs, use charts and graphs, etc.)
6. **Constructing Explanations and Designing Solutions** (ex: The carrots in deeper soil grow faster, therefore they should be put in the bigger planters with more room for roots to grow.)
7. **Engaging in Argument from Evidence** (ex: Have students debate what changes to make to the garden for growing healthier plants.)
8. **Obtaining, Evaluating, and Communicating Information** (ex: Have students share out their gardening practices based on their personal research and actual data from the garden.)



Quoted text from Peter A'Hearn

CALIFORNIA'S ENVIRONMENTAL PRINCIPLES AND CONCEPTS



Principle I: People Depend on Natural Systems: Our food, water, petroleum and other natural materials are made on Earth because of natural energy and matter cycles.

Principle II: People Influence Natural Systems: Humans carve into landscapes, mine for materials, and release byproducts back into the environment often in some form of pollution.

Principle III: Natural Systems Change in Ways That People Benefit From and Can Influence: Agriculture throughout history has been the common starter of a civilization and still today allows humans to live in harsh environments because of agriculture technologies.

Principle IV: There are No Permanent or Impermeable Boundaries that Prevent Matter from Flowing Between Systems: Everything on Earth is able to flow and interact with natural systems, including pollution in and out of gardens.

Principle V: Decisions Affecting Resources and Natural Systems are Complex and Involve Many Factors: There are no easy answers to the question “what are the best ways to harvest resources and care for our environment at the same time?” Not all students may become botanists or environmental lobbyists, but at least they can be informed citizens and voters in the future.

IT'S MORE THAN JUST SCIENCE AND FOOD...



Gardening is the greatest tonic and therapy a human being can have. Even if you have only a tiny piece of earth, you can create something beautiful, which we all have a great need for. If we begin by respecting plants, it's inevitable we'll respect people.

— Audrey Hepburn —

AZ QUOTES

PLANT PROPAGATION FROM TRIMMINGS

A surprising amount of plants can be propagated in water or soil from their kitchen trimmings, meaning you can grow new roots and eventually an entire plant from the leftover seeds or parts of some plants.

Common plants that can grow from scraps:

- Succulents
- Cabbage
- Celery
- Onions
- Lettuce
- Strawberries
- Pumpkins



More information about easy fruit and veggie propagation:

<https://foodrevolution.org/blog/reduce-food-waste-regrow-from-scraps/>

<https://dontwastethecrumbs.com/2015/05/regrow-food-water/>

<https://youtu.be/ZJuXpiEidcc>



COMPOST BIN

Chemical fertilizers have been known to harm many organisms in the environment including humans, so what can we use instead?

Got kitchen or lunch scraps that you cannot regrow? Don't let that carbon and nitrogen go to waste, toss the scraps in a compost bin!

Stir the contents of the bin every couple of days and keep outside where decomposers can help break down the scraps. You also might consider keeping your bin away from windows and air intake vents. *If it's not stinky, it's not working!*

Don't want to wait months for the compost to break down? Make compost tea to water your plants by pouring some of the "liquid extract" from your compost bin into your watering can.

DO'S

natural HOME PRODUCTS

- Fruits & vegetable scraps (including cores and melon rinds)
- Eggs shells
- Fresh and dry garden clippings & grass
- Old herbs
- Coffee grounds/tea bags
- Sawdust
- Nut shells
- Table scraps
- Stale bread products
- Paper towels
- Hair/fur/dryer lint

DON'TS

- Cooking oils: attracts animals and insects
- Diseased plants: don't want to transfer fungal or bacterial problems
- Heavily coated or printed paper (magazines, catalogs, printed cards): doesn't break down well, could have chemicals
- Human or animal feces: Too much health risk
- Milk products: degrades and attract pests
- Meat products: Including bones, blood, fish and animal fats-this will attract pests
- Weeds: most likely will grow instead of decompose
- Walnuts: contains a natural compound that's toxic to some plants

Visit Us At
www.NaturalHomeBrand.com
Get Your Own Compost Bin Now!

COMPOST DO'S AND DON'TS

***Coffee grounds can go directly on top of your soil to fertilize plants instead of waiting for it to break down in a compost bin.

VERMICULTURE

Anything you can do, worms can do better. At least when it comes to making fresh soil.

If you have the space for a larger compost pile or bin, consider the addition of worms to speed up the composting process. While the organic matter will be broken down by natural bacteria and other passing microorganisms, worms have the ability to break down the matter much faster and even keep the smell down!

Worms like to stay in the topsoil, about 6-12 inches deep, so a wider composting bin would serve the worms better than a deeper container.

<http://www.wormpoop.com/Composting/Composting.htm>

<https://www.instructables.com/id/Multi-Layer-Vermiculture-Bin/>



CHAIN LINK FENCE DRIP GARDENING

Materials: Recycled plastic containers, zip ties/string/wire, gravel, potting soil, & seeds or plants.

Using old plastic coffee cans or other clean plastic containers, drill holes in the side (for connecting the containers to the fence) and in the bottom of the containers (for soil drainage).

Using string, wire, or zip ties, attach the containers to the fence so that they are lined up in columns. Fill containers with a little gravel, then soil and plants. The gravel will keep the potting soil from washing out of the drainage holes. Then water your plants and see how few drips go to waste as they drip down to water then next plant below.



PALLET PLANTERS

Materials: Pallet, industrial garbage bag from the school janitor, stapler, potting soil & plants. [Check out this blog for more!](#)



Line the pallet by attaching one or two plastic garbage bags (depending on sizes available) with a stapler. Fill with soil and plant your seeds and saplings! Old tires also work great as large recycled planters, you can prep them the same way.

CINDER BLOCK SUCCULENT WALLS

Cinder blocks are cheap and often left over from construction projects. Stack them to make a short wall for your garden, leaving the top row of blocks standing so that the openings are exposed. Fill with 2-3 inches of gravel and then potting soil for a well-drained succulent planter.

**Pro-Tip: Don't buy all of your succulents, break off the ends of adult plants and wait about a month for new roots to grow from the cuttings!*

1. *Break off succulent leaf or petal.*
2. *Set in a dry spot and wait for the broken end to callous over or dry up.*
3. *Set your trimmings on a moist paper towel, re-moisten as necessary without drowning the succulents.*



K-CUP GREENHOUSE

Hate seeing all those plastic single-use cups go in the trash? Toss the coffee grounds in your compost bin or right on the plants as fertilizer, then use the little cups to sprout your seeds!

Materials: K-Cups, box lid, potting soil, seeds & saran wrap.

Line the inside of a cardboard box lid with saran wrap to prevent water from breaking down the cardboard. Line your k-cups in the lid, fill with soil, and add your seeds. Gently drape another piece of saran wrap over the top of your box lid to finish your “green house” and place in a warm window.

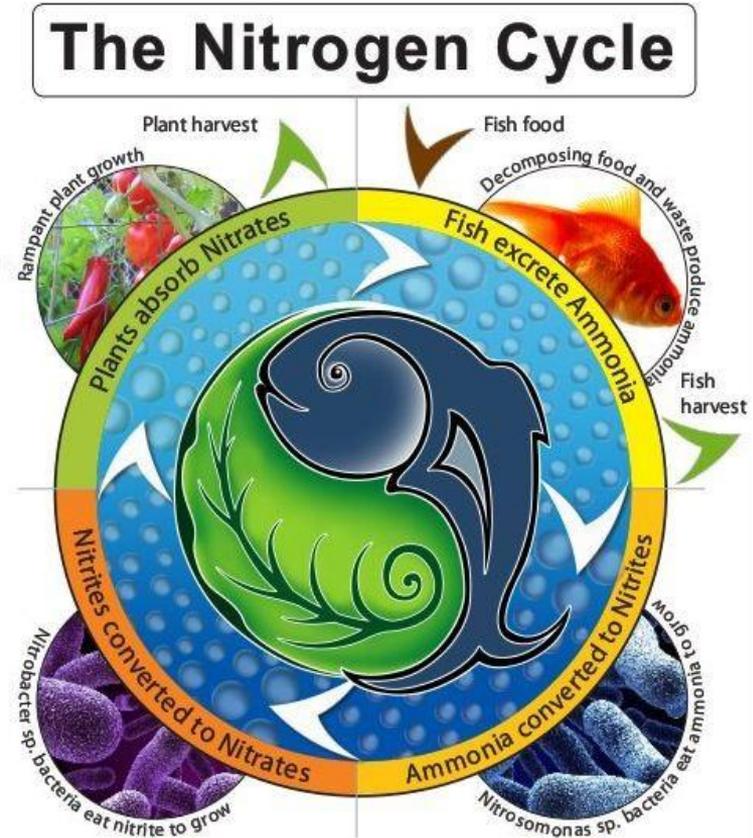


AQUAPONICS GARDENING

Aquaponics gardening, a hybrid of aquaculture and hydroponics, uses natural fish waste to fertilize plants while the plants clean the water for the fish. This nearly-self-contained ecosystem requires just fish food and low maintenance after it is set up. Surprisingly, many plants do not require soil and can thrive in this style of gardening that not only produces organic fruits and vegetables, but also depending on the fish you choose to raise (tilapia, catfish, carp, etc.) will produce organic animal protein as well.

“Aquaponics uses less than a tenth the amount of water a comparable soil-based garden uses.” - From [The Way of the Future: Aquaponics vs. Traditional Agriculture](#)

“The idea of combining fish and veggie production into an integrated system is far from new. Ancient precedents for integrated aquaculture include the chinampas of Mexico and the integrated rice paddy systems across parts of Asia. But how did we get from these sorts of ancient land-based systems all the way to backyard aquaponics?” - From [Aquaponics: a brief history](#)



DIFFERENT TYPES OF AQUAPONICS

Floating Planters in a Fish Tank vs Separated Tank and Planter



ALTERNATIVE GARDENING CLUB

Welcome video for our aquaponics pen pals in Hong Kong!



5 E AQUAPONICS LESSON

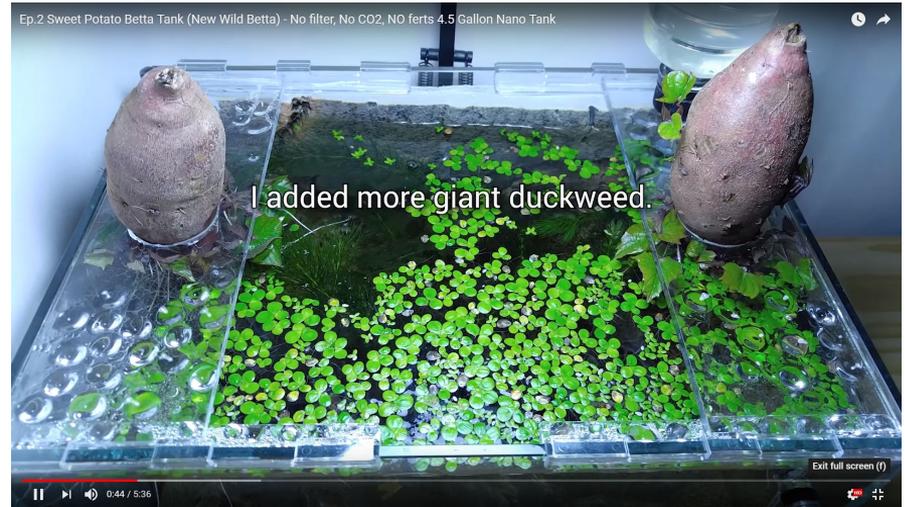
This lesson walks students through the discovery and exploration of the world of aquaponics. Utilizing the 5E model of instruction, this lesson starts out by introducing students to aquaponics through watching a set up video of a home system then leads them through discussion and analysis of this particular farming method. The lesson finishes with a performance task challenging students to design their own aquaponics garden on a budget.

Link to Student Handout:

<https://drive.google.com/file/d/1ld9-mIKIO61SAFeZZiliGMaaBODYJTcn/view?usp=sharing>

Link to Teacher Instructions:

https://drive.google.com/file/d/1VachJxiunHUUw_alDT1le_hwnqCfpV/view?usp=sharing





THANK YOU!

Jackie Gardner, K-12 NGSS TOSA

San Jacinto Unified School District

Office: (951) 929-7700 ext. 4252

Jgardner@sanjacinto.k12.ca.us

Twitter: @the_fish_nerd

<https://thefishnerd.weebly.com/>

