Sustenance Lab

DES 410 - PROJECT 3: DESIGN SOLUTIONS

David, Ricardo, Pietro, Aafreen

The Problem

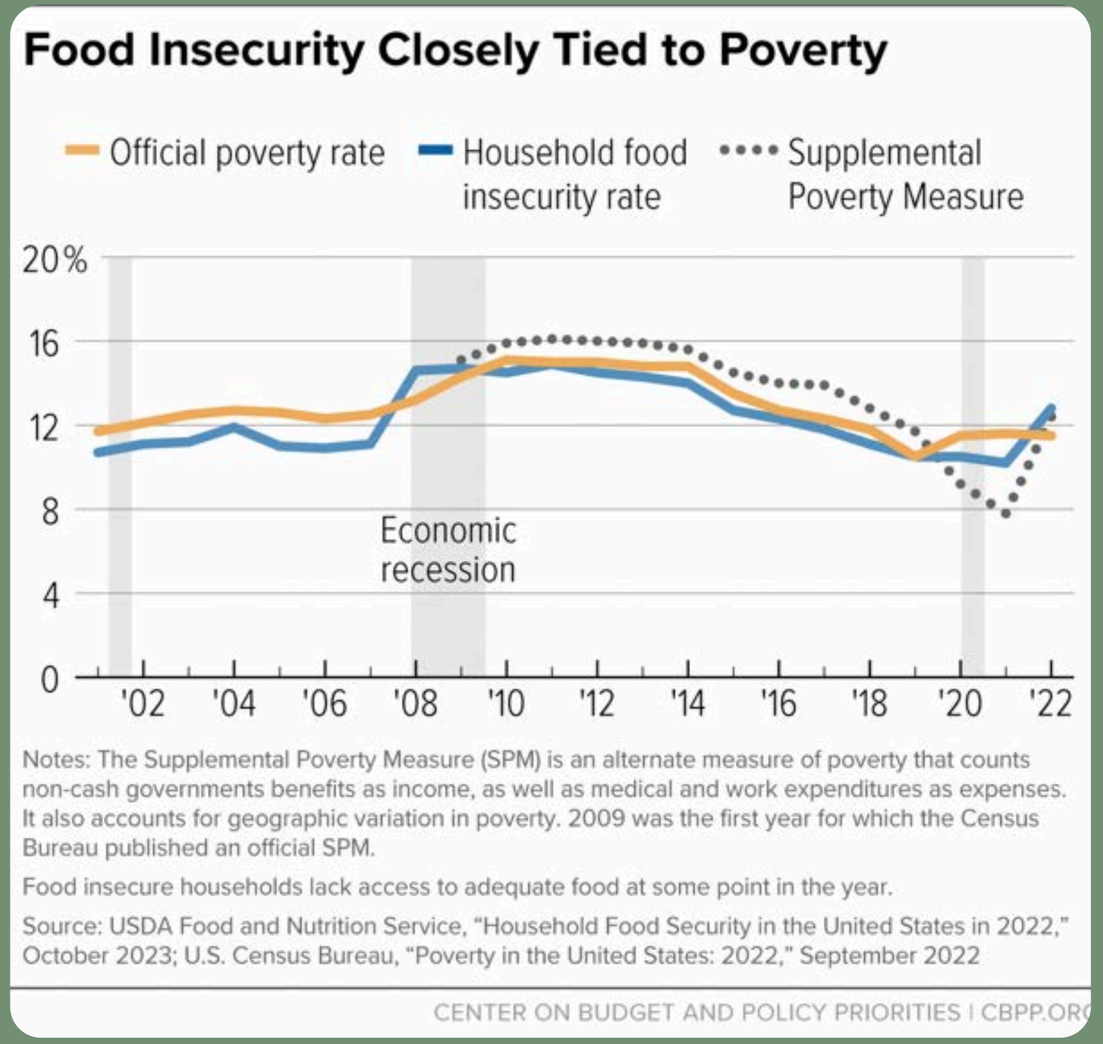
There is a growing need for healthy food to be easily accessible in people's daily lives. Everyone has the right to safe, nutritious meals. As government aid dries up, communities must work together to support one another and ensure those in need are not neglected.

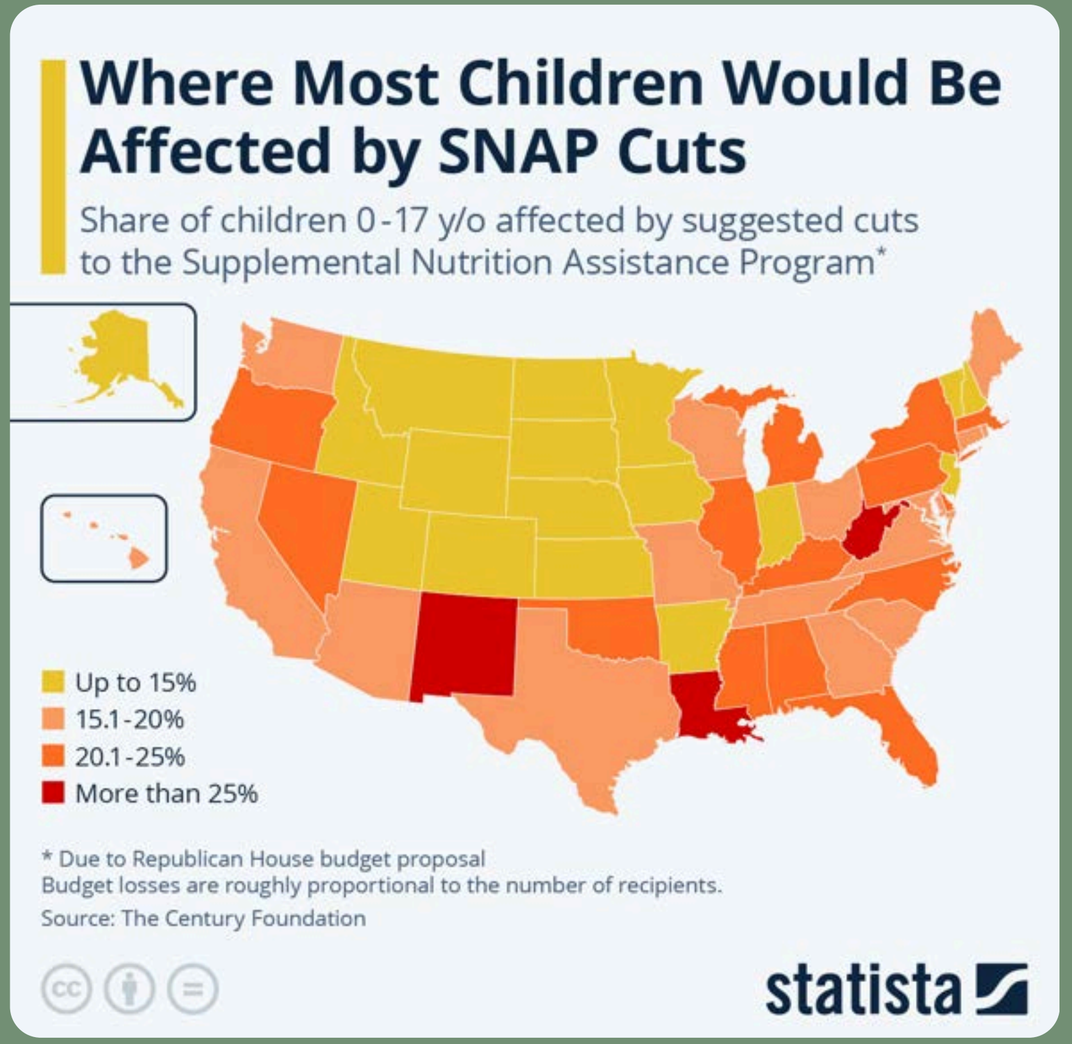
- A childs access to nutritious meals are their **fundamental right.**
- Let's address this with a **direct and sustainable solution.**
- The education system can step in to teach our future generation how to provide for themselves when **political systems fail** them.

We should do BETTER than this!

Feeding America and Akron-Canton Regional Food Bank host Hungry to Help Lesson Plan for students at an Ohio elementary school on May 24, 2017, in Fairlawn, Ohio. Photo by Duane Prokop/Getty Images for Feeding America.

Statistics


Food Insecurity Closely Tied to Poverty
Official poverty rate
Household food insecurity rate
Supplemental Poverty Measure
20%
16
12
8
4
0
Economic recession
'02
'04
'06
'08
'10
'12
'14
'16
'18
'20
'22
Notes: The Supplemental Poverty Measure (SPM) is an alternate measure of poverty that counts non-cash governments benefits as income, as well as medical and work expenditures as expenses. It also accounts for geographic variation in poverty. 2009 was the first year for which the Census Bureau published an official SPM.
Food insecure households lack access to adequate food at some point in the year.
Source: USDA Food and Nutrition Service, "Household Food Security in the United States in 2022," October 2023; U.S. Census Bureau, "Poverty in the United States: 2022," September 2022
CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG


Where Most Children Would Be Affected by SNAP Cuts
Share of children 0-17 y/o affected by suggested cuts to the Supplemental Nutrition Assistance Program*
Up to 15%
15.1-20%
20.1-25%
More than 25%
* Due to Republican House budget proposal
Budget losses are roughly proportional to the number of recipients.
Source: The Century Foundation
statista

Proposed Intervention

Solution must be :

- Community driven and controlled - We need to empower our community to find a system to support itself.
- Sustainable and long - term.
- Providing food security for our most vulnerable population.
- Most importantly educational so that they may find means for sustenance.

WHO

School children, communities that are in need of educatiion in food sovereignity.

WHAT

An educational farming lab within school grounds.

WHERE

School playground/ open areas.

WHEN

During the school year - throughout academics as a program.

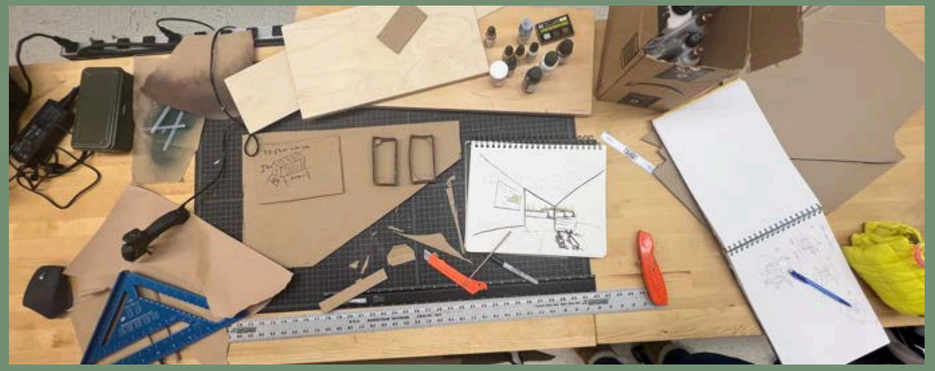
WHY

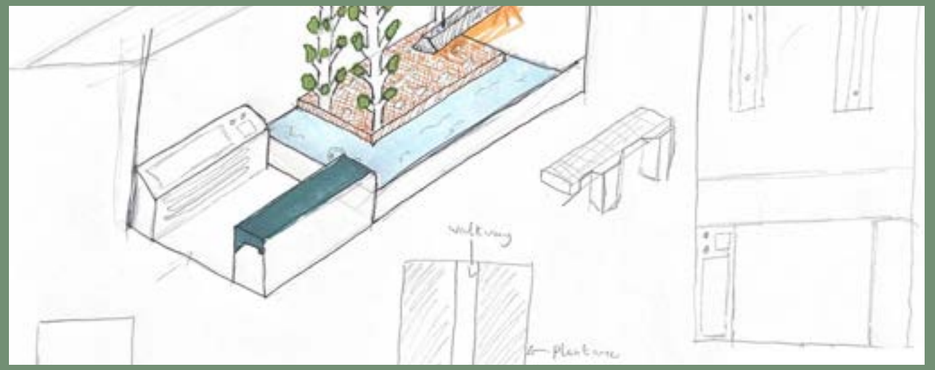
The education in these techniques will help build community resilience and independence.

HOW

A refurbished shipping container equipped with tech surrounded by traditional farming.

Process / Iterations





Sustenance Lab

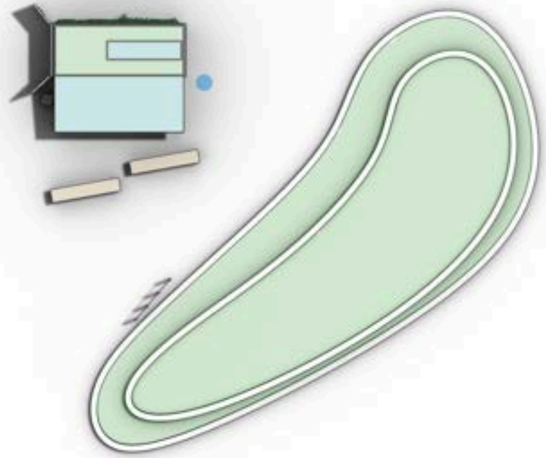
The Mission:

We at Sustenance lab built a educational tool to help our children learn sustainable cultivation methods. This system uses Aquaponics, Hydroponics as well as farming. Case studies show that practices such as these have proven high success rates on the long term scale. This knowledge has existed many generations and has been passed down through indegenious practices, yet has been lost to our urbanized population. It is important to re-invigorate basic sustenance intelligence to support our future generations to come.

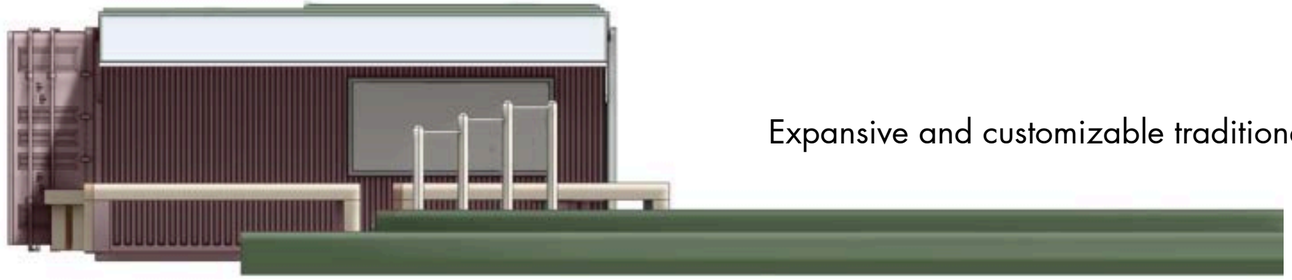
Natural Insulation

Tiered aquaponics/hydroponics

Rain - water collection system



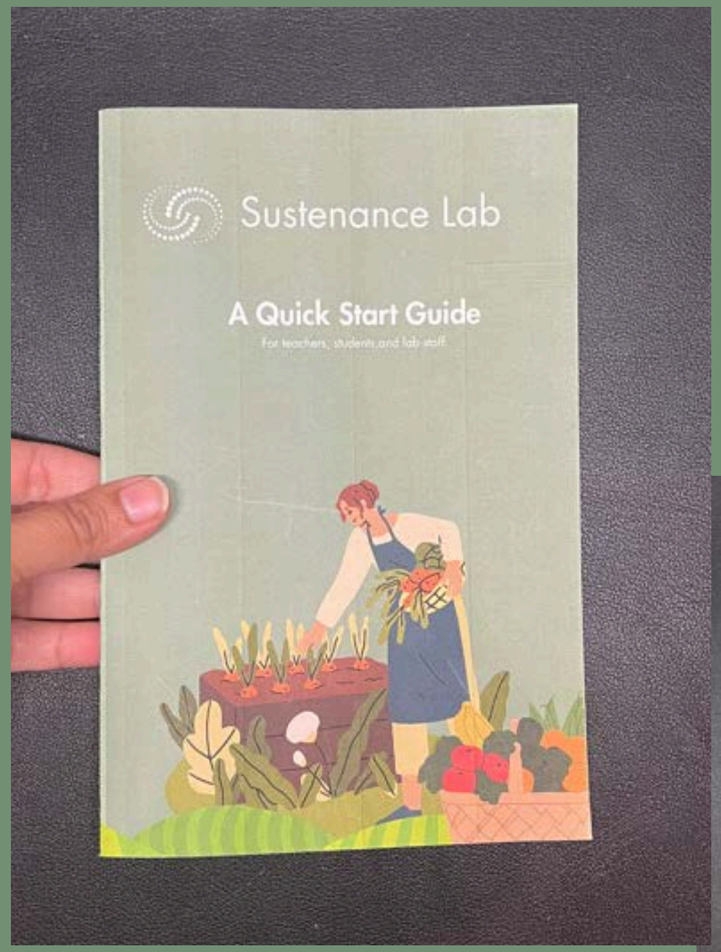
Solar Paneling



Expansive and customizable traditional farming ecosystem

Model

Instruction Samples



Safety

Safety is shared, but responsibilities are clearly divided. Post simple rules up on a bulletin board or poster in the space and review them regularly.

General rules

- No running, climbing, or horseplay in or around the container.
- Water and electricity must be treated with care: keep cords dry and report any damage.
- No chemicals, soaps, or sprays in the systems unless provided as part of the kit.

Who does what

- Teachers: Supervise student work, approve any system changes, and coordinate with site staff.
- Students: Follow instructions, use tools properly, report problems, and help with daily checks.
- Site/maintenance staff: Handle building power, structural issues, and any serious leaks or electrical concerns.

What to Grow

Choose crops that grow quickly, stay compact, and are familiar or culturally meaningful to your community. Leafy greens and herbs usually perform best in school systems.

Great starter crops

- Leafy greens: lettuce, spinach, kale, chard
- Herbs: basil, cilantro, parsley, mint
- Fast crops: bok choy, Asian greens, arugula

More advanced crops

- Fruit crops (like tomatoes, peppers) can work but need more space, support, and time.
- Root crops (like carrots, beets) are usually not ideal in small hydroponic setups

Encourage students to suggest crops that matter in their families and communities, and test small batches before scaling up.

What's Included in this Kit

Systems

- Hydroponic growing system (channels or beds, reservoir, pump)
- Aquaponic system (fish tank, grow bed/raft, biofilter, pump)
- Solar power system (roof panels, controller, batteries, outlets/switches)

Components & supplies

- Water pumps and tubing
- Nutrient solution for hydroponics
- Water treatment or conditioners (if required)
- Starter media and net cups or planting trays

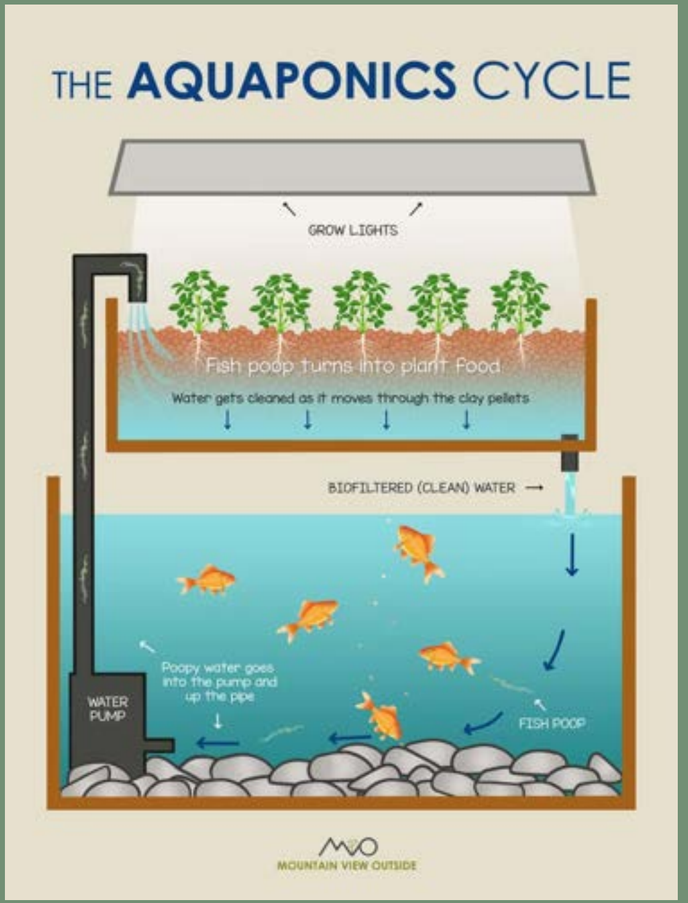
Educational materials

- This quick start guide
- Link/QR code to the full manual
- Links/QRs for lesson plans and activities
- Logbook or printable data sheets

What is Hydro/Aquaponics?

Hydroponics is a method of growing plants that utilizes a nutrient-rich water solution instead of soil. Some of the benefits of hydroponics are faster plant growth, higher yields, and less reliance on pesticides. Some downsides include more complexity and vulernability to disease.

Aquaponics combines hydroponics with fish farming in a closed-loop system. Fish produce waste, beneficial bacteria convert it into nutrients for the plants, and the plants filter and return clean water to the fish, using over 90% less water than traditional agriculture.



Traditional Farming VS. Aquaponics

Soil VS Aquaponics

	Soil Gardening		Aquaponics	
	Fertiliser needs to be constantly added throughout the growing season	Fertiliser	Natural ecosystem with liquid fish waste being used as fertiliser for the plants	
	Gardens need to be regularly water, especially in hot areas. Water runoff occurs, wasting water	Water Usage	Water is cycled through the ecosystem, only being topped up due to evapouration	
	Time consuming garden maintenance, especially weeding is needed regularly	Weeding	Good designs reduce the maintenance needed most aquaponics systems do not have weeds growing	

https://theaquaponicslady.com/post/what-is-aquaponics

Case Study: MALAMA Waimānalo

The MALAMA research study aims to test a culturally grounded, family-based backyard aquaponics intervention with Native Hawaiian families in Waimānalo. The study integrates modern aquaponics technology with traditional Native Hawaiian practices to create a ‘mini ahupua‘a’ system in participants’ backyards, providing consistent access to fresh fruits, vegetables, and fish.

https://www.malamaaquaponics.org

Community Success

In a community-focused model of an aquaponics system, the collective expertise and labor of a community would help to ensure success. While a home setup requires a large time and money commitment, a community-based setup can spread this across a large group of people. Additionally, it serves as a valuable resource for teaching children about science, marine life, agriculture, and healthy eating habits.

Intended Impact

The measurable impact that we will see from implementing this system in schools will be long-term. Children will learn invaluable lessons on traditional farming, growing and maintaining aquaponic as well as hydroponic farms. They will also have access to fresh and nutritious food on school grounds. The community also benefits from this initiative with the possibility of this becoming a resource for fresh produce drives.

Conclusion

We aim to design a cost-effective and intuitive aquaponic and hydroponic system that can be used to support low-income communities through childrens education in building food sovereignty and independence. In a world where families are experiencing limited access to funding for food resources, we need to build solutions that can empower them in times of need.

Will your school be the first to choose the path to sustainable sustenance?

References

- **Image and article on food insecurity and food drive in Minnesota and Ohio :** https://minnesotareformer.com/briefs/one-quarter-of-minnesota-households-with-children-are-food-insecure/
- **Food insecurity tied to poverty - how SNAP is putting food on tables :** https://www.cbpp.org/research/food-assistance/snap-helps-struggling-families-put-food-on-the-table-0
- **Statistics on Snap benefit effects on children in the USA:** https://www.statista.com/chart/34247/share-of-children-affected-by-proposed-snap-cuts/?srsltid=AfmBOoqKYIB6t2b5Wla3dDxS8Zy9bFZxxB8syA2GPVGDp3moW_1ZjgKN
- **Aquaponics vs traditional farming** - https://theaquaponicslady.com/post/what-is-aquaponics
- **Case study** - https://www.malamaaquaponics.org