Western Engineering Outreach

Engineering a Vertical Farm
Grade 6-8

Meet Today's ENG HERO!

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Clare Robinson is an associate professor with the Civil and Environmental Engineering Department at Western University. She has a PhD in Environmental Engineering from Queensland University. She does work combining several aspects of civil and environmental engineering. She has done research on the Great Lakes, groundwaters and green roofs.

To learn more about Dr. Robinson visit:
https://www.eng.uwo.ca/civil/faculty/robinson_c/index.html

Learning Goal:

- Students will expand their math skills and fine motor skills by measuring and mixing ingredients.
- Students will discuss states of matter to learn about solids, liquids, and gases.
- Curriculum Connections: Grade 6 - Biodiversity; Grade 7 - Interactions in the Environment

Materials Needed:

- Tape
- Scissors
- Plastic Bottle(s)
- Planting soil
- Glue
- Plant/vegetable seeds
  https://www.amazon.com/Assorted-Heirloom-Vegetable-Varieties-Non-GMO/dp/B071RRBBXP/ref=sr_1_4?dchild=1&keywords=vegetable+seeds&qid=1593801795&sr=8-4

Engineering and Science Connections:

Today, we will learn about vertical farms. This combines concepts from civil and environmental engineering. This also relates very closely to a subfield of environmental engineering called agricultural engineering.

Agricultural Engineering (Environmental)

Agricultural engineering applies science and technology to the cultivation of animals and plants for food and other products used to sustain human life. Agricultural engineers combine their knowledge of animals and plants and mechanical, civil, and chemical engineering principles to solve agriculture-related problems. This broad engineering field encompasses many aspects of agriculture, including the management and conservation of soil and water, experimentation with crop production, and the design of new agricultural machinery.

Why We Need Vertical Farms

It is predicted that by the year 2050, the global population will increase to 9 billion people. Many experts warn that the Earth's current farmland and agricultural practices will not allow the production of enough food to support this growing population. Vertical farms offer a potential solution to the world's limited farmland. Vertical farms, also known as farmscrapers, are farms built within multi-floor buildings and skyscrapers. The vertical orientation of the farm provides more land for crop production on any given footprint. These types of farms would likely be located near urban centers where population density is the highest. Production of crops near cities would decrease the transportation required to deliver food. This could contribute to lower food prices and an increased availability of fresh food to urban populations. While vertical farms are primarily in the prototype stage of development, several small-scale vertical farms have already been built around the world in locations such as Chicago and Singapore. Skeptics of vertical farms question their feasibility and whether energy-efficient systems can be created to sustain the farms. Careful analysis of existing prototypes and advances in energy systems will contribute to the success or failure of vertical farms in the future.

Examples of Existing Vertical Farms

Mirai In Tokyo → https://miraigroup.jp/en/

Plantagon in Sweden → http://www.plantagon.com

Aerofarms in New Jersey → https://aerofarms.com

Video Recommendation: *Engineering Everywhere Special Report: Vertical Farms*

https://www.youtube.com/watch?time_continue=284&v=POAmtW9bh4E

Activity:

Before beginning, think about the following questions:

- What are vertical farms important for the future?
- What are different ways everyday people can implement vertical farms?
- Can this realistically work in cities?
- What different things can I grow like this?
- Are there any other solutions to growing more food?

Part 1: The Farm

Since we don't have the tools an actual civil or environmental engineering would have to create a vertical farm, let's create a vertical farm that we can make with everyday household materials. Since we are using pop bottles, you can either make your bottle farm on its side or standing vertically.

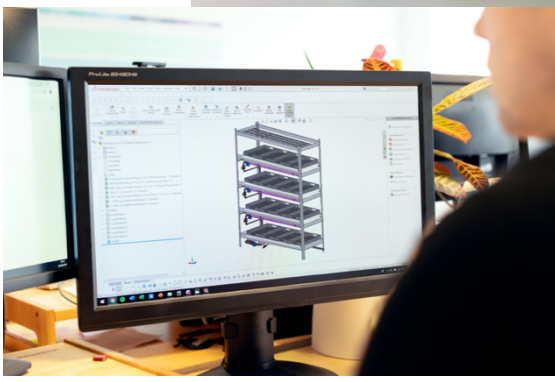
- Collect your materials
- Decide whether you want to have your miniature bottle farm to be vertical or horizontal

Horizontal

- Make a cut that revolves 180° around the bottle
- You can either build stands to allow your bottle from rolling over, attach it to a wall, or have it hung like a planter
- Add soil and your desired seed(s) into the bottle and watch your vertical farm grow!

Vertical

- Vertical: Make a cut that lies more so just on one plant of the bottle
- When building vertically, you can either allow it to just stand upright using its regular base, or stack multiple
- To stack multiple, you will cut the base of the bottle so that another bottle's spout can sit directly in it. This will allow you to stack multiple bottles
    - Add supports to this to allow your structure to become taller!
- Add soil and your desired seed(s) into the bottle and watch your vertical farm grow!



Growing Tips

- Make sure you farm has plenty of sunlight
- Plant the seed 2-to-3 times as deep as it is wide in the soil
- Make sure the soil is damp (don't make a mini-pond!)

What Did You Learn?

- What is agricultural engineering?
- Why vertical farms may be the future
- Places that are already using vertical farms

Future Learning

- Start your own vertical farm growing your own food! Find different ways to reuse everyday objects. Find different ways to hang up your farm. Search the internet for more motivation and ideas that you can implement! Try and get more people in your community to make their own vertical farm. Find out if your city is already doing this. If not, find out how you can ask your city to implement its own vertical farms and green roofs.

Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

Instagram: @westernueng
Twitter: @westernueng
Facebook: @westernueng

Thanks for discovering with us!