

Introduction

Right now there are approximately 7.8 billion people living on Earth. [This number is expected to rise 9.8 billion](#) by 2050. This begs the question: how do we feed this many people? Producing food, especially dairy and meat products, requires massive amounts of energy, land, water, labor, and other resources. Often, this has a negative effect on the environment. From fertilizer laden runoff producing ocean dead zones, to methane and carbon emissions contributing to global climate change, the business of growing and producing our food can cause irreversible environmental damage. Nonetheless, people still need food to survive, so we must produce more food as the world population grows.



This difficult dilemma is studied by agricultural and environmental scientists across the world to ensure that future generations will be able to produce enough food and do so in a way that is environmentally sustainable. These scientists and engineers try to solve problems such as how to produce enough food, how to produce crops that need less environmentally harmful fertilizer or pesticides, and how to grow food using less water.



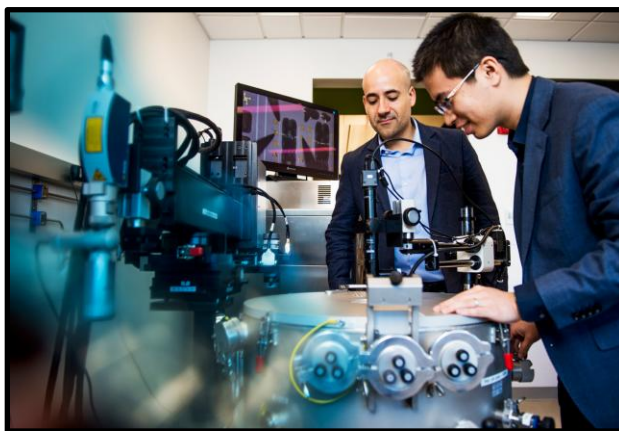
Additionally, many companies, entrepreneurs, and community leaders are attempting less traditional forms of agriculture such as urban gardening (growing food on green spaces (parks, lawns, curbs)) and [hydroponics](#) (growing food in nutrient-rich water solutions instead of soil). Some of these strategies also employ what's known as vertical gardening, which is the practice of growing plants in towers or on racks so that they use less space. This week's newsletter will discuss these topics and highlight scientists and engineers who are trying to solve them!

Watch this short documentary to learn more: <https://youtu.be/BCL1U1qRXM>

Northeastern Connections

Faculty Connection

Northeastern University Electrical Engineering Professor Matteo Rinaldi who leads [Northeastern SMART](#), worked on a project with funding from the Bill and Melinda Gate foundation to decode and detect the hidden language of plants. When plants are in trouble, either from pests, disease, lack of water, or other numerous causes, they release chemicals to warn other plants around them. Researchers in Prof. Rinaldi's lab are attempting to develop a low-cost, low-power sensor that can detect when these chemicals are released to warn farmers of any crop damage. News @ Northeastern (the University's internal news organization) wrote a story on the project and quoted Prof. Rinaldi as saying, "being able to monitor very large crop fields in real-time will help farmers make the best decisions to maximize their yields and has the potential to make a huge impact on society." To read the full story on this project, visit [this link](#).



Student Connection



Recent Northeastern University alum Madeline DuBois (Environmental Engineering '20) did her 3rd co-op at [The Land Institute](#) in Salina, Kansas during the fall of 2019. As part of their mission, The Land Institute "seeks to develop an agriculture that will save soil from being lost or poisoned, while promoting a community life at once prosperous and enduring." At The Land Institute, Madeline assisted with research and worked on an independent project that investigated water usage by deep-rotting crops.

Madeline says that she pursued a degree in environmental engineering "to be part of the movement to address and try to solve [environmental] issues." At the land Institute, she felt her work was important because "the current model of large-scale monoculture farming has huge environmental impacts, so developing and transitioning to a more sustainable system is imperative." Madeline was also awarded a prestigious Fulbright scholarship to continue her education after graduation.

Do Now

Watch the following video about urban gardener and community leader Ron Finely who revitalizes urban spaces by growing food:

<https://youtu.be/7t-NbF77ceM>

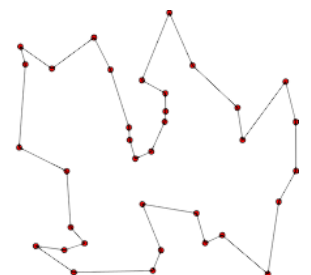
Garden Scavenger Hunt and Urban Garden Planning

Explore your community or neighborhood by taking a walk or asking an adult to drive you around. As you explore, try to find as many gardens as possible. This includes porches or stoops with potted plants, community gardens, or personal gardens in peoples' yards. If you cannot find any gardens near you, use a google image search to find different examples of gardens. As you discover more gardens, ask yourself the following questions:



1. Is this garden growing food or flowers?
2. What would the space look like without a garden? Would it look better or worse?
3. What kind of plants do you think are planted there?
4. How much food do you think could be produced from this garden? Enough to feed one person? One family?

Now that you've explored your neighborhood and examined other peoples' gardens, **it's time to plan your own!** Find a space near where you live (it could be your backyard, a local park, a grassy area next to a sidewalk etc.) and find a sheet of blank paper. Then start sketching and planning how you could turn that space into a garden! Make sure to include what types of plants you would plant, how many plants you would plant, how much space it would use, and how many people you think it could feed. Save your garden drawing and email a picture of it to stem@northeastern.edu to get it featured in the next newsletter!



Activity

Now that you've learned about Agriculture and Environmental Science and have planned your own garden, it is time for you to build one! For this activity, you will be building a vertical garden out of recycled bottles. To learn more about what vertical gardening means and how it's beneficial, check out this video:

https://youtu.be/ME_rprRlmMM



Before you start this activity, collect as many plastic bottles as possible either by saving them before you throw them out or checking your recycling bin. Make sure that you're able to find at least 2 bottles; however, the more bottles you find, the bigger your garden can be!

Once you collect enough bottles, clean them out and find a space for your vertical garden. It will need to be in a place where you can stack and tie your bottles. Ideal spaces could be a fence, a deck railing, or a wall. Also, make sure that your garden space gets plenty of sun!

Once you've found a space and collected your materials, follow this step-by-step WikiHow guide to build your garden!

<https://tinyurl.com/yda2rv67>

After your garden is constructed, you'll need to find soil and seeds to start planting it. This may require the help of an adult to either visit a local garden or hardware stores or order supplies online.

Materials Needed:

You can use any materials you want but here are some suggestions:

- Recycled plastic bottles
- String/Wire
- Scissors
- Soil
- Seeds

Steps:

- <https://tinyurl.com/yda2rv67>

Discussion Questions:

- What types of plants would you want to plant in your garden?
- How many people do you think your garden could feed?
- What are the benefits of vertical gardens? How could they be better than traditional gardens?
- What are the drawbacks of vertical gardens? Why might traditional gardens be better?
- Do you think the world population could survive off of urban gardens alone? Why or why not?
- Do you think any type of plant could be grown in a vertical garden? Why or why not?

Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share with us something you learned and/or send us pictures! Email us at stem@northeastern.edu.

Related links/Extensions

Videos:

- [Factory Farms and the Environment](#)
- [The "dead zone" of the Gulf of Mexico \(TED Talk\)](#)
- [The Diet that Helps Fight Climate Change](#)
- [Climate, Agriculture, and the Challenges Ahead](#)
- [Future of Food: Farming in the age of climate change](#)
- [Virtual tour of Syngenta crop lab](#)
- [What is precision agriculture?](#)
- [What is hydroponics?](#)
- [What is aeroponics?](#)
- [What is aquaponics?](#)
- [What is genetically modified food?](#)
- [Ron Finley TED Talk](#)
- [How the COVID-19 pandemic is sending American agriculture into chaos](#)

Other:

- [News @ Northeastern: This Indoor Farmers Market Targets Sustainability](#)
- [News @ Northeastern: From Fish Tank to Food Table](#)
- [News @ Northeastern: The Neighborhood Kids Were Hungry. He Planted a Garden.](#)