Cornell Cooperative Extension
Cornell Garden-Based Learning

Gardening in Our Warming World: Youth Grow!
Unit Two: "What Do I Know?" about Climate Change
Facilitator Guide

Introduction

In **Unit One: What's My Story**, your group participated in activities that explored self-awareness, self-control, existing knowledge, and how they see themselves as part of a larger and more complex system. In looking at the big picture, stress and concerns that our younger generation may have regarding the fate of their future has placed a burden on their shoulders for which they may not be ready. As adult leaders, it is our responsibility to provide guidance, awareness, and evidence needed to for youth to effectively process this information and make more informed decisions and choices for positive change.

Unit Two: What Do I Know? provides an exploration of proactive sustainable practices that offer solutions to climate change issues. Before starting this unit, take a look at the curricula and resources listed here, should your group need a more in-depth inquiry and basic knowledge of climate, weather, and the science and effects of climate change and global warming. You can also use these resources to compliment the activities in Unit Two. Ongoing, open and honest discussion will help address the fears or misconceptions youth may have in regard to climate change and how as a society we are addressing these issues.

Photo by Oneida County Cornell University Cooperative Extension

How to Talk About Climate Change with Youth

Since climate change perspectives may differ, it is advisable for educators and youth leaders to be ready to respond to those feeling climate anxiety or those in need of science-based knowledge. To provide the public with awareness of climate change risks, we need to frame conversations around climate change impacts and the capacity of our communities to adapt and be engaged. We need not have all the answers to play a critical role in addressing climate change, since this is an ever-changing, complex topic that still has unknown factors. Facilitate conversations and dialogue that allow youth to fully engage and express personal viewpoints, and to process any emotional response such as worry, fear, interest, and curiosity which may emerge in their understanding about climate change vision of the future. We can promote a positive tone while using of scientific evidence, when participating in discussions around the critical nature of the issue and offer strategies for curbing and adapting to climate impacts.

Target Objectives

- ✓ Recognize the relationships between personal actions, evidence of global warming, climate change facts and sustainable methods.
- ✓ Explore different actions and methods that foster sustainability in the natural world.
- ✓ Understand the philosophy of Permaculture Design and how it promotes a caring and sustainable environment.
- ✓ Experiment with different ways to grow food in a both a controlled and natural environment.
- ✓ Observe patterns of pollinating insects and construct a dwelling and/or natural habitat to attract pollinators.
- ✓ Recognize gardening practices that promote sustainability.
- ✓ Evaluate a garden site and create a design that supports sustainability.
- ✓ Investigate solutions and identify how communities develop a plan for Climate Resiliency.

Photo by Donna Alese Cooke

Learning Activities

Thriving Model Attributes

Youth Engagement:

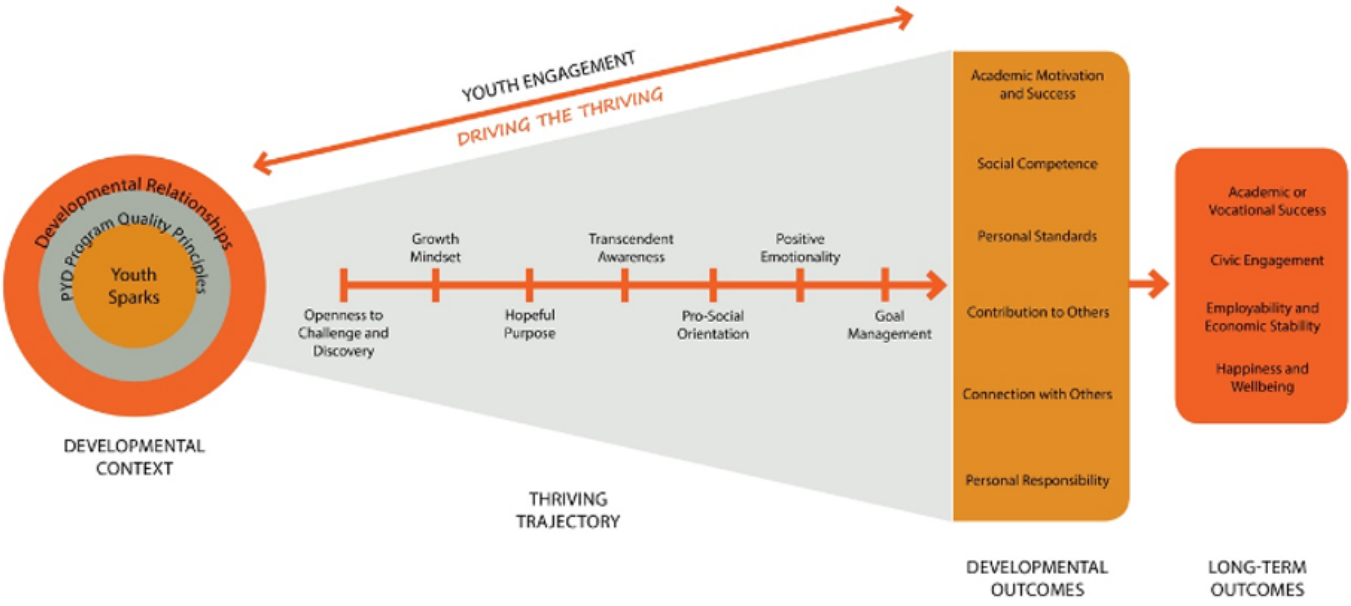
- Growth mindset
- Openness to Discovery
- Goal Management

Developmental Outcomes:

- Contribution to others
- Connection to others
- Personal responsibility

Long-Term Outcomes:

- Happiness and Wellbeing



4-H Thriving Model, Oregon State College of Public Health and Human Science

Introduce the Topic

For youth interested in or need a basic introduction to climate change and its effects on living things, the curricula and activities listed below are recommended as a way of introducing students to the concept of climate.

Beginning Skill Level: Terrariums

Terrarium making gives students the opportunity to begin working with plants in a tactile way and to begin to understand climate variables like moisture and temperature while creating their own miniature worlds.

Terrarium making:

- A demonstration using two identical terraria, one open and one covered, can be used to demonstrate the ***greenhouse effect***.
- Explain to students the similarity between a closed jar (glass dome) and greenhouse gases (gas dome).
- Discuss how the burning of ***fossil fuels*** creates the gas dome that traps heat. The use of miniature electronic temperature and humidity sensors can demonstrate the difference in climate between a closed terrarium, where infrared radiation is trapped, and an open terrarium where infrared radiation escapes.

Terrarium variations:

- Create individual terraria in quart-sized Mason jars or other small glass containers to represent different climates. Emphasize creativity and allow students to dream up their own miniature worlds. Play with the variations (closed/open, dry/wet, warm/cool). Grow lights can be used to create more light/heat.

- Learn about the largest terrarium on Earth, Biosphere II (figure 1). This "terrarium experiment" was designed to contain different climates under one roof. It was created as a home for plants, animals, and even people! Explore the Biosphere 2 website to learn about the history of this project and how it functions today.

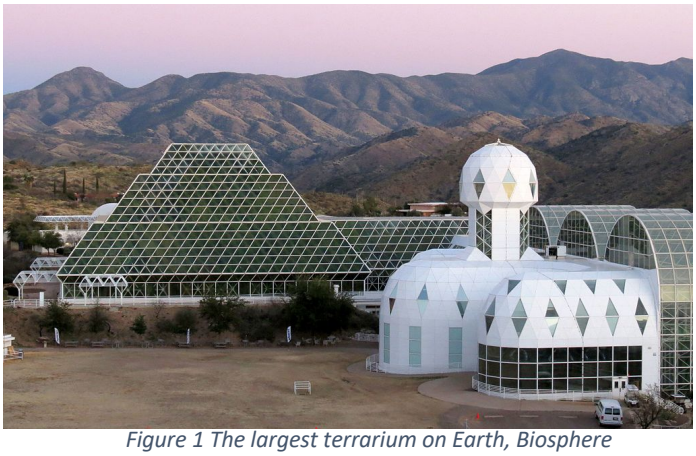


Figure 1 The largest terrarium on Earth, Biosphere

Explore climate fiction (cli-fi) and other climate change literature

- In the reference section below find links to lists of youth-appropriate climate-fiction and eco-fiction stories. Create a reading list appropriate for your students' age and reading level.
- Discuss the stories. What feelings do they evoke? What do they say about our future and our choices?
- Create your own story. After reading climate literature, have students imagine their own short stories or story boards exploring the challenges facing our planet's future, with a hopeful and positive outcome.

Intermediate Level: Defining Climate

Discussion: Have a discussion of ***climate*** and its effect on our daily lives. Opening questions include:

- What defines the climate where you live?
- How does it compare with other climates?
- How does your climate affect what you wear? What you eat? How you play? When you go outside?

Make climate flashcards:

- Using a web-based image search, find images that show examples of landscapes and their locations for each of the five major color-coded climates represented on the Koppen-Geiger climate map in figure 2. below (tropical, dry, temperate, continental, and polar).
- Write the climate name on the other side of the card. Guess the climates simply by looking at the photos.
- For advanced levels this exercise can be made more challenging by expanding the exercise to include the climate sub-categories.

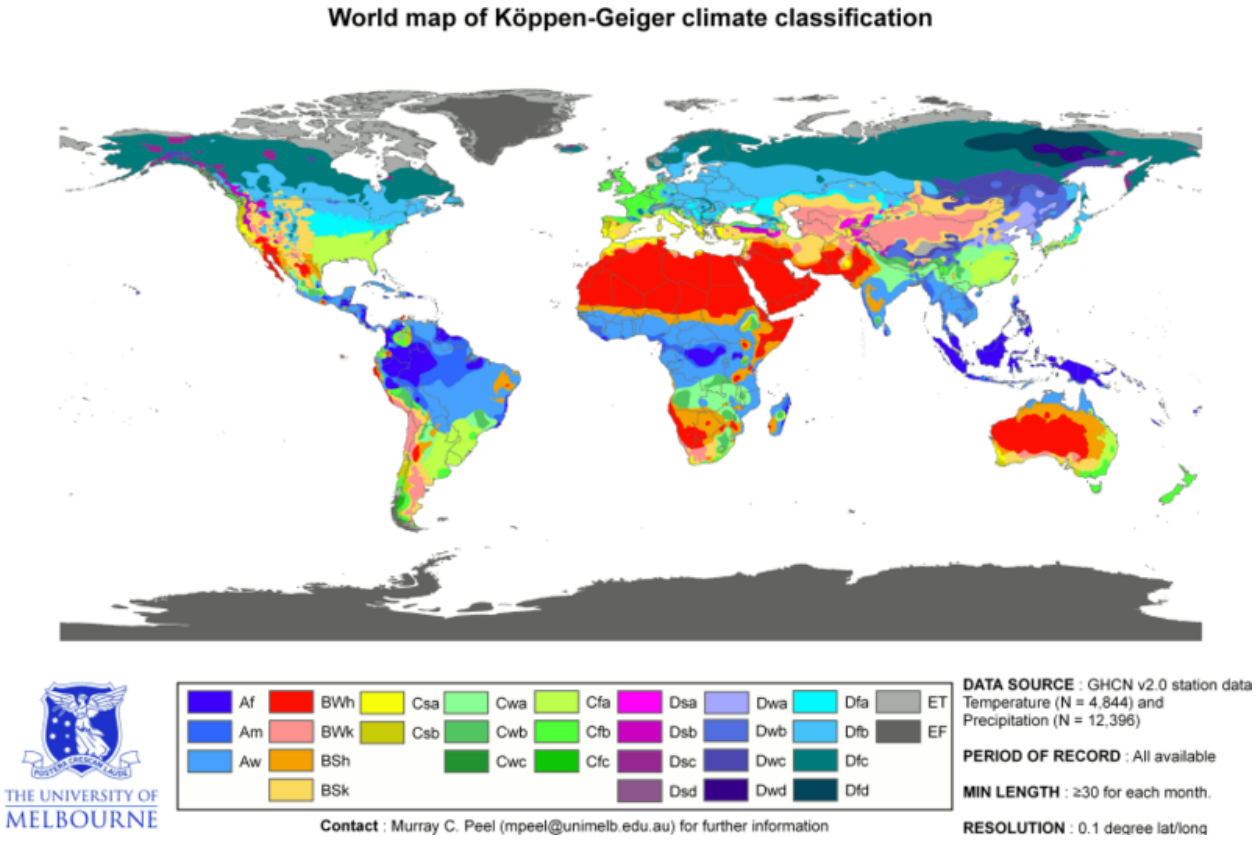


Figure 2: Koppen-Geiger climate map

The Köppen climate classification divides climates into five main climate groups, with each group being divided based on seasonal precipitation and temperature patterns. The five main groups are *A* (tropical), *B* (dry), *C* (temperate), *D* (continental), and *E* (polar).
https://en.wikipedia.org/wiki/K%C3%B6ppen_climate_classification

Curricula and Resources to Introduce Climate Change

4-H Science Toolkit Series: Climate, https://static1.squarespace.com/static/58e51ba6db29d619dcb73826/t/5b6b573c55b02cf2e50c2383/1533761341529/climate.pdf

AgroClimate , Weather and Climate Variability Toolkit, http://agroclimate.org/wp-content/uploads/2017/04/weatherAndClimateVariabilityToolkit.pdf

Alliance for Climate Education, Our Climate Our Future, https://ourclimateourfuture.org

Biosphere 2, About Biosphere 2, https://biosphere2.org/

Climate Change Education Resources: Activities & Lessons, Cornell Institute for Climate Smart Solutions, https://ecommons.cornell.edu/bitstream/handle/1813/58810/Teacher%20Handout-Climate%20Resources-6-27-18.pdf?sequence=2&isAllowed=y

Climate.gov, Teaching Climate Literacy, https://www.climate.gov/teaching

Climate Literacy & Energy Awareness Network (CLEAN), https://cleanet.org/index.html

Cooperative Extension: 4-H - University of Maine Cooperative Extension, Climate Project, https://extension.umaine.edu/4h/stem-toolkits/climate-project/

Cornell Cooperative Extension , Setting up a Classroom Grow Station, https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/575/files/2016/08/Organizing-a-Classroom-Grow-Station-1recgbi.pdf

Instructables, Terrarium making basics, https://www.instructables.com/id/The-Basics-of-Closed-Jar-Terrariums/

Koppen-Geiger Climate Map: Wikimedia Commons: World Köppen Map.png: Peel, M. C., Finlayson, B. L., and McMahon, T. A. (University of Melbourne) https://commons.wikimedia.org/wiki/File:K%C3%B6ppen_World_Map_(retouched_version).png

National Agriculture in the Classroom, search for lessons relating to climate change: e-Learning Resources https://agclassroom.org/eLearning/ and Agricultural Literacy Curriculum Matrix:, https://www.agclassroom.org/matrix/

NYS 4-H STEM Projects: Energy and Climate Smart Solutions https://nys4-h.org/projects/#energy

National 4-H Curriculum, Exploring Your Environment Curriculum, https://4-h.org/parents/curriculum/exploring-your-environment/

NASA Climate Kids: Terrarium, https://climatekids.nasa.gov/mini-garden/

NOAA Climate Change Education Resources,
https://www.noaa.gov/education/resource-collections/climate-education-resources

Ohio State University 4-H, Project Idea Starter: Climate Change,
https://ohio4h.org/sites/ohio4h/files/d6/files/publications/documents/SelfDetermined/365_14_Climate_Change_2015.pdf

UNICEF Canada, Get Real on Climate, Climate Change Lesson Plans for Grades 9-12,
http://www.unicef.ca/sites/default/files/imce_uploads/UTILITY%20NAV/TEACHERS/DOCS/GC/get_reel_change_lesson.pdf

University of British Columbia, Teacher's Guide: Introduction to Climate Change, Local Lessons For A Cool Climate,
https://calp2016.sites.olt.ubc.ca/files/2019/05/Introduction-to-Climate-Change_CALP-UBC.pdf

Climate Literature

Reading list from ecofiction.com (dragonfly.eco).
https://ecofiction.com/category/books/ya-fiction/

Climate fiction (Cli-fi) for teens from The Hub.
http://www.yalsa.ala.org/thehub/2015/01/20/clifi-climate-fiction-ya/

Children's books about climate change from Yale Climate Connections.
https://www.yaleclimateconnections.org/2018/08/childrens-books-about-climate-change/

Photo by Cornell Garden-Based Learning

2.1 My Carbon Footprint

Skill Level
Beginner
See Variations for Intermediate and Advanced level activities

Learner Outcomes, Youth will:

- Demonstrate personal relationship with the earth and the input they have on the environment.
- Understand the benefits of a "low carbon" diet (i.e. a local food diet).
- Illustrate knowledge inputs through a food system map and collage to find out how far their food has traveled from field to table.
- Recognize that food plays a role in climate change
- Express daily actions that affect climate change.

Education Standard(s)
NS.K-4.3 Life Science: Life cycles of organisms, Organisms and environments
NS.5-8.3 Life Science: Populations and ecosystems
NS.9-12.3 Life Science: Interdependence of organisms, organization in living systems

Success Indicators
Greater awareness of the carbon cycle and impact from food systems

Life Skills
Problem-solving, critical thinking, healthy life-style choice

Time Needed
2 hours (more time needed for baking the cake)

Materials List

- Kitchen to bake cake
- Print outs of letter-sized maps of the world for each person
- Small stickers, rulers, pencils.
- Go to a local supermarket and find the cake ingredients. If there are different brands available for an ingredient, choose the one that is the most local.
- Magazines and newspapers with pictures of food, trucks, farms, people, stores, etc.
- Glue, scissors, markers, paper, etc.
- Food items: popcorn, cereal, bread

Space
Kitchen classroom or other space to with an oven and counterspace for large groups to observe cake ingredients and to work on collages.

Suggested Group Size: 12-15 or more

Acknowledgements
- Dina El-Mogazi: Cornell Garden-Based Learning Climate Change in the Garden: One Seed at a Time
- National Agriculture Literacy Curriculum, Climate Change Phenomena: Bananas in Our Breadbasket; Carbon Hoofprints: Cows and Climate Change

Introduction
We have a tremendous impact on the environment through the food we eat. The average American meal has traveled more than 2000 miles before it arrives on your plate. We can make a big impact to help stop climate change by committing to eating as locally as possible. A good way to eat local is to start growing as much food as possible in your garden. This activity will highlight awareness of our food system impacts the carbon cycle, and how growing vegetables and buying local foods reduces global carbon emissions. Variations of the activity explore the Carbon Cycle, and the relationships of weather, climate, climate change, and the production of our food.

Opening Questions:
- What do you know about our carbon footprint?
- Have you thought about how much energy (carbon) it takes for food to reach your plate?

Background Information
Before the Activity
Purchase materials and set put all the ingredients on the table for each activity. Save the packaging from the cake.

Let's Do It!
1. Map a chocolate cake!
    - Follow the recipe and make the cake.
    - While the cake is baking, take the time to map the chocolate cake to see how far it traveled to your meeting place!
    - Distribute paper-sized maps of the world and small stickers. Locate NY on the map and put a sticker there.
    - Talk about each cake ingredient, inspecting the package to find out where it came from. Put a sticker on that location.
    - Using the ruler, draw a straight line from NY to the place where the ingredient came from.
    - Do the same for all the ingredients. By the end, there should be a web of lines connecting to NY from around the world.
    - Ask the students how far they think the ingredients traveled. Ask them to make guesses… 100 miles, 1000 miles, 1 million miles?
    - Measure the lines and add them up: i.e. 8 inches + 4 inches + 3 inches = Total distance of 15 inches.
    - Based on the legend of the map, i.e. 1 inch = 100 miles, calculate that 15 inches = 1500 miles traveled. Discuss how the total carbon "food" print of the cake is 1500 miles of travel. That's a long way to go!
    - Additional questions to ask for each ingredient are:

- What steps did this go through between being picked in the field and sold in the store? List as many as you can think of.
- How do you think this item was transported (Truck, plane, train, etc?)
- How much time do you think it took to get from field to table?
- What resources might have been used in getting it here (topsoil, gasoline, fuel, oil, water, coal, etc.?
- Is the container recyclable? What happens to the waste products from making this?
- It's now time to eat the chocolate cake and be mindful of how far it traveled your plate!

2. Create a local food system collage
   - Begin by talking about the long adventure that food takes from seed to table (i.e. planting, harvesting, processing, packaging, transporting, etc).
   - Ask students to identify what's locally grown in NYS.
   - Give each student a food item as a starting point to create their own food system collage.
   - Invite them to use the magazines, newspapers, and art materials to illustrate a collage of their local food system.

Share
After they are finished making the collage, have youth share what the different photos mean to them.

Reflect / Apply
In what ways can we reduce our carbon footprint in the food system?
Knowing what you do about your carbon footprint, are you inspired to try one or all of the following:
- Commit for one week to eat as locally as possible.
- Try mapping the food you eat at home for a week.

Generalize
To wrap up the activity, talk about how growing food in your garden or buying from local farms means it doesn't have to be transported as far (by truck, plane, or boat) and how this is good for the climate!

Variations
Intermediate Level groups try out the National Agriculture Literacy curriculum's **Climate Change Phenomena: Bananas in Our Breadbasket?** https://agclassroom.org/matrix/lesson/703/ to further explore the Carbon Cycle, and the relationships of weather, climate, climate change, and the production of our food. **Learning Standards:** NS.5-8.3 Life Science: Function in living systems, Populations and ecosystems

Advanced Levels can explore the **Carbon Hoofprints: Cows and Climate Change** at https://agclassroom.org/matrix/lesson/707/ to explore the carbon cycle and evaluate the carbon footprint of beef cattle, using critical thinking skills and the *Claim, Evidence, and Reasoning* model to determine the effect of cows' methane production on the environment and investigate the extent cattle contribute to climate change. **Learning**

Standards: NS.9-12.6 Personal and Social Perspectives: Environmental quality, Science in local, national, and global challenges.

References

Adapted from Climate Change in the Garden: One Seed at a Time, Cornell Garden-Based Learning

National Agriculture Literacy, Climate Change Phenomena: Bananas in Our Breadbasket and Carbon Hoofprints: Cows and Climate Change

Learn More

Cornell Garden-Based Learning http://gardening.cals.cornell.edu

AgroClimate, Carbon Footprint Calculator
http://agroclimate.org/tools/carbon-footprint-calculator/

Cornell University's Commitment to Sustainability. https://sustainability.cornell.edu

Energy Star Carbon Footprint Survey
https://www.energystar.gov/ia/products/globalwarming/downloads/GoGreen_Activities%20508_compliant_small.pdf

National Agriculture in the Classroom, search for lessons relating to the topic:
e-Learning Resources https://agclassroom.org/eLearning/ and Agricultural Literacy Curriculum Matrix:, https://www.agclassroom.org/matrix/

Nature Conservancy, Calculate Your Carbon Footprint
https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/

NOAA, Carbon Calculator Activity
https://www.climate.gov/teaching/resources/carbon-calculator-activity

Oregon State University, Bioenergy Education Initiative Lesson Plans
https://agsci.oregonstate.edu/sites/agscid7/files/carbon_footprint_5.23.2017.pdf

Zero Footprint Youth. Requires registration. https://calc.zerofootprint.net/
Conservation International. Allows calculation for an individual, household, event or trip. https://www.conservation.org/act/carboncalculator/calculate-your-carbon-footprint.aspx#/

Published: June 2020
Authors: Dina El-Mogazi, Donna Alese Cooke
Reviewer: Marcia Eames-Sheavly

2.2 Exploring Sustainability: Overview

Skill Level
Varies per subtopic

Learner Outcomes, Youth will:

- Review the science and long-term impacts of climate change, and the impacts humans have on the earth and how our actions affect future generations.
- Explore and have a better understanding of sustainable practices.
- Reflect on personal responsibility.

Success Indicators
Openness to discovery, hopeful purpose, transcendent awareness, positive emotionality, goal management

Life Skills
Civic engagement, happiness and wellbeing

Time Needed, Materials and Space
Varies per subtopic

Introduction
Sustainability encompasses actions we can take, such as recycling, repurposing, composting, greening the world, and keeping our valuable resources intact. In Exploring Sustainability, youth will gain a greater understanding of what sustainability and resiliency is, and how methods that consumers, farmers, and others use can reduce their carbon footprint for future generations and provide climate resiliency.

Depending on the skill level and interest of your group, you may choose to explore as many or all of the five topics. Within each topic, there are relevant links and resources for hands-on and inquiry-based learning for your group. The first three topics are appropriate for all skill levels, and the last two are best to do with intermediate and advanced skill levels. Each topic builds on the next and will be most effective when implemented in sequence.

- 2.2A Climate Change in the Garden (all skill levels)
- 2.2B Save the Bees "Bee-coming a Bee Rancher" (all skill levels)
- 2.2C Exploring Ways to Grow Food (all skill levels)
- 2.2D Permaculture (Intermediate, Advanced)

Each topic will include a final activity and will lead into a culminating action project where youth will devise a plan in the following section 2.3: A Plan for Climate Resiliency.

Learn More

Current Resources in Climate Change Science
U.S. Global Change Research Program (Mandated by Congress). Many good links and resources. https://www.globalchange.gov/climate-change

Inside Climate News. Review of the 2018 National Climate Assessment. https://insideclimatenews.org/news/24122018/climate-change-evidence-reports-2018-year-review-ipcc-arctic-emissions-gap-national-assessment

National Climate Assessment, 2018: https://nca2018.globalchange.gov/

- Ecosystems, including biodiversity invasive species, phenology, ecosystem productivity, etc. https://nca2018.globalchange.gov/chapter/7/
- Agriculture, including rural population and poverty, groundwater supply, soil degradation, extreme precipitation, etc. https://nca2018.globalchange.gov/chapter/10/
- Northeast Region of U.S. https://nca2018.globalchange.gov/chapter/18/

U.S. Climate Resilience Toolkit: https://toolkit.climate.gov/ This inter-agency initiative operates under the auspices of the United States Global Change Research Program. The site is managed by NOAA's Climate Program Office and is hosted by NOAA's National Centers for Environmental Information.
https://toolkit.climate.gov/regions/northeast
https://toolkit.climate.gov/regions/northeast/ecosystems-and-agriculture

Climate Change Glossaries
US Global Change Research Program https://www.globalchange.gov/climate-change/glossary
USDA https://www.fs.fed.us/climatechange/documents/glossary.pdf
EPA (Note disclaimer that this is a January 2017 "snapshot")
https://19january2017snapshot.epa.gov/climatechange/glossary-climate-change-terms_.html

Published: June 2020
Author: Donna Alese Cooke
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2.2a Climate Change in the Garden

Skill Level
Intermediate
See Variations for Beginner and Advanced Levels

Learner Outcomes, Youth will:

- Recognize the relationships between personal actions, evidence of global warming, climate change facts and sustainable methods.
- Explore different actions and methods that foster sustainability in the natural world and promote sustainability in the garden.
- Evaluate a garden site and create a garden design that supports sustainability and identify ways to address and limit climate change impacts.
- Contribute to the community by initiating daily actions and taking responsibility in addressing climate change issues.
- Connect with others to formulate solutions for sustainability.

Education Standard(s)
NS.5-8.3 Life Science: Structure and function in living systems, Populations and ecosystems
NS.5-8.6 Personal and Social Perspectives: Populations, resources, and environments

Success Indicators
Youth reflect on current gardening practices and brainstorm to improve sustainability.

Life Skills
Healthy lifestyle choices, goal setting, planning, wise use of resources, resiliency

Time Needed
30 minutes

Materials List
Garden, flip chart and markers, enough sketch paper and pencils, colored pencils or markers for small group work. For Intermediate and Advanced skill levels: measuring tape, rulers. Facilitator references: Composting and Vermicomposting Q&A's, Sustainable Gardening Practices Poster; Youth handouts: Site Assessment Surveys, one for each small group

Space
A garden that the group has been working in, or a school or community garden they can visit. A place for youth to make drawings and sketches.

Suggested Group Size: 12-15 or more

Acknowledgements
Adapted from **Climate Change in the Garden: One Seed at a Time**: *Sustainable gardening practices:* Learn about the importance of sustainable gardening practices, Cornell Garden-Based Learning by Dina El-Mogazi.
Cornell Garden-Based Learning Library, CCE County Educators: **Composting and Vermicomposting Q&A's**

Introduction
Youth will gain an understanding of the importance of a community or school garden project, in helping to mitigate climate change. They will reflect on different gardening practices they are doing and why these help the climate and the overall importance of sustainable gardening practices.

Opening Questions:
- In what ways do you see that gardening helps us improve the environment?
- Each gardening practice has its own story; how do you see them helping in their own way, to reduce human impact and lessen climate change?
- What are we doing here in this [or our own] garden, that is making a difference in slowing down climate change?

Background information:
Sustainability encompasses actions we can take, such as recycling, repurposing, composting, greening the world and keeping our valuable resources intact. In **Climate Change in the Garden,** which is a subtopic in the **Exploring Sustainability** activities, youth will gain a greater understanding of what sustainability and resiliency are though gardening. In this topic, you will find relevant links, lessons and resources for garden-based learning and inquiry.

Before the Activity
Prepare materials and handouts; Review handouts, composting and vermicomposting FAQ's for background information.

Let's Do It!

Take the group out into the garden, share the **Sustainable Gardening Poster** and ask the opening questions:
- What they have been learning about climate change and how it affects us and our environment.
- In what ways does gardening improve the environment? Allow them to first think generally, in broad terms.
- Ways that growing a garden makes a big difference in helping to mitigate climate change.
- How each gardening practice helps in its own way, to lessen climate change?

Using Chart paper and markers, brainstorm together and record a list of answers to the questions. Reflect more specifically on different things being accomplished in the

garden in which they are standing. For each gardening practice, talk about how it benefits the garden and how it helps to stop climate change:

Gardening Practice: Growing Organically

- **Benefit to garden:** Learning about and limiting pesticide use keeps beneficial insects and pollinators alive.
- **Helps lessen climate change:** Growing your own food increases the amount of plant foods we eat, makes our carbon footprint smaller because we do not have to rely on using resources to purchase food that has come from faraway places.

Gardening Practice: Right Plant, Right Place

- **Benefit to garden:** Planting the ideal plants and trees for the site, which includes soil, sun, shade and water available helps the plants thrive and be healthy.
- **Helps lessen climate change:** Climate resilient and some native plants that survive in all kinds of weather and climate have less pests and diseases. Healthy plants mean less man-made inputs.

Gardening practice: Mulching

- **Benefit to garden:** Mulching is a great way to reduce water usage in the garden. It is also a great way to reduce the number of weeds.
- **Helps lessen climate change:** Through mulching, the garden needs less water and pesticides.

Gardening practice: Composting

- **Benefit to garden:** Compost is often called "Black Gold" because it adds a rich source of beneficial nutrients to the soil. It's full of rich organic matter that helps to build up the soil and make it a place where plants can grow and thrive! It's recycling nature back into the garden.
- **Helps lessen climate change:** Composting is a great way to reduce the amount of garbage we throw out. The garbage we throw out has to get trucked hundreds of miles away (which adds greenhouse gases to the atmosphere) and then is buried. Composting also helps to sequester carbon from the air (which is one of the biggest contributors to climate change).

Place where youth can create drawings: Bring the chart from the brainstorming session in the garden, to a place where youth can work in groups to sketch a garden map. Divide the group into smaller groups of 3-4, and work on the following steps:

1. Explain that they will work together in their small group to sketch out a map of the existing garden, making sure to label garden beds, what is growing where, etc. Add any features of the garden that demonstrate environmentally sound practices (such as a compost pile or mulch in the beds).
2. Using the **Site Assessment Activity handout**, have them observe the conditions and environment around the garden: is it in full sun or are there places with a lot of shade? What are the soil conditions? Where is the water coming from and going to (run off)?
3. Once everyone agrees that all the existing parts and environmental observations of the garden are drawn on the garden map, then explain they will make a plan on how to improve the current gardening practices. What practices are missing and can be added? Will that be an easy or difficult improvement?

Talk It Over:

Share
Groups will share their garden maps and discuss observations they made.

Reflect
What did you observe in the garden, as far environment and existing sustainability practices? What practices are being done now to fight climate change? What practices are missing and can be added? Will that be an easy or difficult improvement? Review the handout Composting and Vermicomposting Q&A's.

Apply
What practices are missing and can be added? Will that be an easy improvement or more difficult?

Variations
Adapt the Garden Map activity to the skill level of your group:

Beginning skill level: A rough sketch, using markers or crayons to depict the colors of the existing garden. An adult leader can help guide the activity with restating the questions asked in the garden:

- Is there a lot of sun in the garden (at least six hours daily for good vegetable growth for example), or too much shade? How might the amount of sun affect the plants growing in the garden? (Right Plant, Right Place)
- Is there a compost bin? If not, where can we add one?
- What else can we do to make the garden more climate change friendly?

Intermediate/Advanced Level: In addition to the above suggestions:

- Detail the garden map a step further, with actual measurements of additional features.
- Complete the Site Assessment Survey found in this section.

References
Climate Change in the Garden: One Seed at a Time: *Sustainable gardening practices:* Learn about the importance of sustainable gardening practices, by Dina El-Mogazi, Cornell Garden-Based Learning

Composting and Vermicomposting Q&A's: adapted from Cornell Garden -Based Learning Library, Contributor(s): Multiple CCE county educators.

Site Assessment Activity, Cornell Garden-Based Learning Library, Chrys Gardener, CCE Tompkins Community Horticulture Educator

Sustainable Gardening Practices Poster, CCE Dutchess County

Learn More
Garden-Based Learning Resources

Cornell Garden-Based Learning http://gardening.cals.cornell.edu

Hirschi and Sobel, Ripe for Change: Garden-Based Learning in Schools. 2015. https://www.amazon.com/Ripe-Change-Garden-Based-Learning-Schools/dp/1612507719

Life Lab (Santa Cruz, CA). https://www.lifelab.org/for-educators/schoolgardens/whyschoolgardens/

Little Green Thumbs resource page https://www.littlegreenthumbs.org/2018/08/25/resources-for-garden-based-learning/

National Agriculture in the Classroom, search for lessons relating to the topic: e-Learning Resources https://agclassroom.org/eLearning/ and Agricultural Literacy Curriculum Matrix:, https://www.agclassroom.org/matrix/

Youth Handouts:
Sustainable Gardening Practices Poster (3 pages), Site Assessment Surveys (2 pages)

Leader Handouts:
Composting and Vermicomposting Q&A's

SUSTAINABLE GARDENING PRACTICES

Sustainable gardening is the ability to grow plants in harmony with nature with minimal impact on the environment.

Compost

Composting manages decomposition to more quickly produce stable organic matter.*

- Compost yard/garden waste and fruits/ vegetable food scraps.
- Use finished compost as a soil amendment.

Manage Soil Heath

Healthy soil produces healthy plants.

- Add organic matter to augment soil to
  - build water/air retention.
  - grow biomass.
  - aid in nutrient retention/exchange.
- Avoid heavy soil tillage and compression.
- Use mulch to suppress weeds and aid in water retention.
- Manage water use to avoid nutrient runoff/leaching and erosion.

Promote Biodiversity

Biodiversity ensures ecosystem sustainability.

- Attract pollinators/beneficial insects:
  - Plant native plants.
  - Leave areas for beneficial insects to live.
  - Put up bird and bat houses.
  - Plant extended-seasons plants.
- Plant gardens/landscapes with a variety of plant species.
- Leverage polyculture to exploit the natural ecosystems.

Minimize Negative Environmental Impact

A clean environment enables healthy life.

- Avoid synthetic fertilizers/herbicides.
- Collect rain water.
- Save seeds.
- Buy local.
- Recycle with gardening in mind.
- Properly dispose of diseased plant materials.

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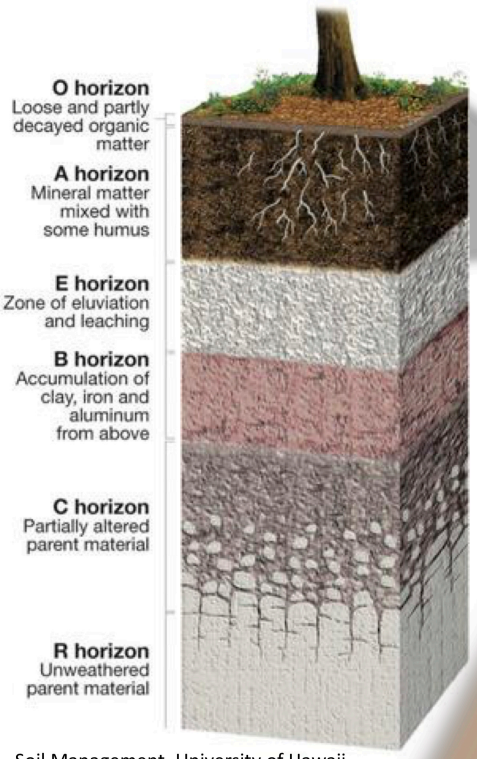
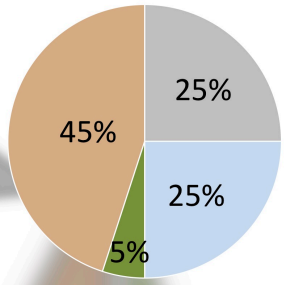
*Organic matter (or organic material) is the residues of dead plants and animals in various stages of decomposition. http://www.yourdictionary.com/organic-matter#mD1AgEoyyo96D0gz.99

Sustainable Gardening Practices Poster page 1

SOIL COMPOSITION



Soil Management, University of Hawaii



- Air
- Water
- Organic Matter
- Minerals

Soil Composition affects:

- Water-holding capacity.
- Nutrient-retention and exchange capacity.
- Susceptibility to erosion.
- Leaching potential.

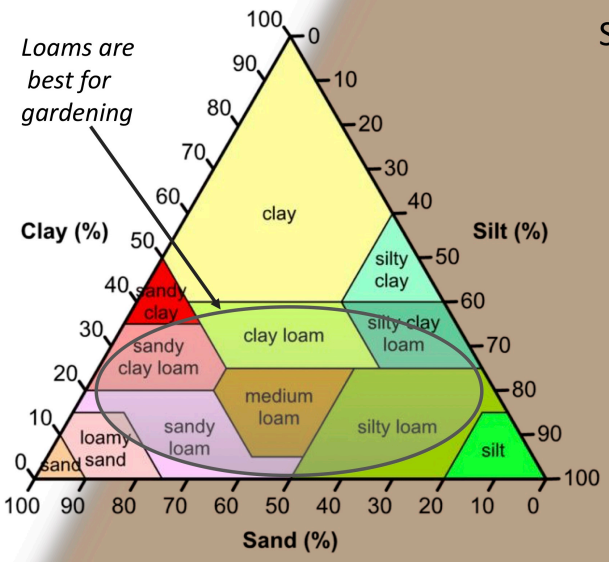
Minerals

(Soil Texture)

Clay

Silt

Sand



Organic Matter

(Compost)

BioMass (10%)

Residue (15%)

Humus (75%)

THE LIVING.

BioMass:
Roots, Fungi, Bacteria

THE ALMOST DEAD.

Residue:
Dead Roots and Organisms

THE VERY DEAD.

Humus:
Stabilized OM

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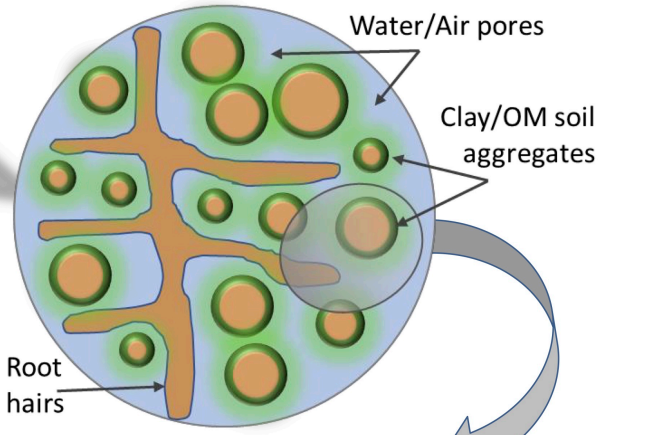
https://soilhealth.cals.cornell.edu/files/2016/12/04_CASH_SH_Series_Texture_Fact_Sheet_040517-10sn6o7.pdf

Sustainable Gardening Practices Poster page 2

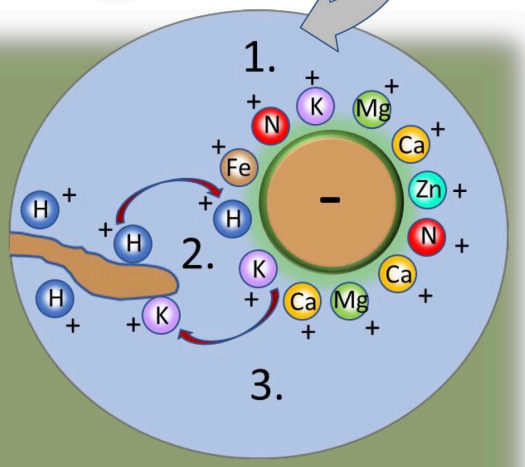
SOIL SCIENCE

Soil aggregates are arrangements of soil particles, minerals and organic matter.



Essential Plant Nutrients			
Type	Element		+/-
Non-Mineral Nutrient	C	Carbon	*
	O	Oxygen	*
	H	Hydrogen	+
Primary Mineral Nutrients	N	Nitrogen	+/-
	P	Phosphorous	-
	K	Potassium	+
Secondary Mineral Nutrients	Ca	Calcium	+
	Mg	Magnesium	+
	S	Sulfur	-
Micro-Nutrients	Fe	Iron	+
	Cl	Chlorine	-
	Mn	Manganese	+
	B	Boron	-
	Zn	Zinc	+
	Cu	Copper	+
	Mo	Molybdenum	-
	Ni	Nickel	+
	Co	Cobalt	+

*neutral



OM has the highest CEC rate (2-3 times higher), followed by clay, silt and sand.

OM is essential for healthy garden soil.

Cation Exchange Capacity (CEC)

1. Clay particles and humus (- anions) attract positively charged nutrients (cations).

2. Mineral nutrients are exchanged for hydrogen ions from the plant root.

3. Nutrients move from regions of higher concentration to lower, aided by osmosis and transpiration.

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Site Assessment Activity

60 minutes

Learning Objective(s): Participants will…

- Apply basic site assessment criteria to a familiar landscape.

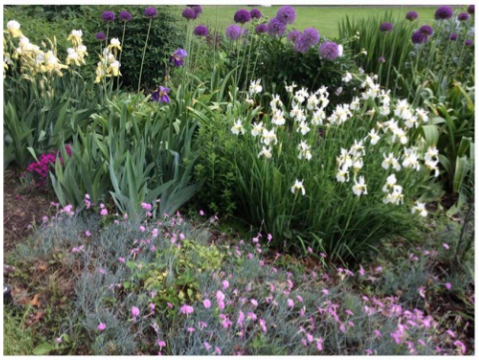
Supplies:

Handouts:

- Monocots and Dicots graphic

Materials:

- Paper, pencil and clipboard.
- Optional: Camera



Instructions:
First, locate a plot of land to work with. You might use your backyard, a schoolyard, or if you live in a city, a nearby park will work well for this. Ideally, it is a place familiar to you. Walk through the site assessment checklist to learn more about the site. Make notes, draw a basic sketch or take photos to represent each bullet.

Site Assessment Activity Handout (page 2)

Site Assessment Checklist
Name of Property:

☐ USDA Hardiness Zone:
- Last Spring Frost:
- Last Fall Frost:

☐ Aspect, Include North Arrow
- North
- South
- East
- West

☐ Sunlight
- Full sun (6 hours or more)
- Partial sun
- Shade

☐ Slopes
- Steep
- Moderate
- Gradual or flat

☐ Microclimate factors:
- Reflected heat
- Frost pocket

☐ Soil texture
- Clayey
- Loamy
- Sandy
- Silty

☐ Wind:
- Windy site
- Windy in isolated sections
- Calm site

☐ Soil compaction
- Compacted
- Partially compacted
- No compaction

☐ Obstructions
- Below ground (e.g. utilities or irrigation system)
- Above ground (e.g. overhead wires)

☐ Soil drainage characteristics
- Wet
- Well-drained
- Dry

☐ Wildlife interference
- Serious and obvious concerns
- Marginal concerns
- Not a problem

☐ Unusual conditions:

☐ Soil pH:

☐ Existing Plants:

Notes:

Date Published: April 2019
Author(s)/Contributor(s): Chrys Gardener, CCE Tompkins Community Horticulture Educator
Reviewer(s): Fiona Doherty

Q & A: Composting & Vermicomposting Handout

Composting

Q: Why should we compost?
A: To reduce needless contributions to the waste stream, which turn into potent greenhouse gases like methane and carbon dioxide. Instead, create a product which improves soil quality and promotes healthy plants. Learn more about Backyard Composting from the Cornell Waste Management Institute website http://cwmi.css.cornell.edu/smallscale.htm

Q: Who can compost?
A: There are approaches and systems available for homeowners, apartment dwellers and communities, large, small and in between. Anyone, anywhere can compost.

Q: What can I put in my home compost pile? Will it smell?
A: Use plant wastes such as leaves, grass clippings and spent plants, non-protein food scraps, as well as paper, cardboard and wood chips. Layer 1-part Greens with 3-parts Browns. No meat, no dairy, no diseased or seedy plant material, and be careful with manures. Your compost bin will not smell if you add enough Browns. Learn more about balancing Greens and Browns from Composting at Home: The Green and Brown Alternative found at https://ecommons.cornell.edu/handle/1813/29111

Q: Will it attract pests?
A: Not unless you add pest-attracting food. Lions and tigers and bears (oh my!) will not eat your compost if done correctly. Learn more about Preventing Animal Nuisances in Small Scale Composting from the Cornell Waste Management Institute website https://ecommons.cornell.edu/handle/1813/2177

Q: Is it expensive and does it take up a lot of room?
A: No, simple systems can be built inexpensively. Learn more about Choosing a Compost System from the CCE Suffolk Diagnostic lab at https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/5282/Choosing_a_Compost_System.pdf?1418849831

Q: What do I do with the finished product?
A: Compost is a valuable soil amendment and may also be used as mulch. Compost contains plant nutrients and improves both soil aeration and water-holding capacity.

Q: What happens if I don't turn the pile?
A: Compost happens, but at a slower rate. The more you turn the pile, the quicker you will produce compost.

Q: When is compost finished and ready to be used?
A: It is dark, crumbly, earthy smelling (not smelling like ammonia or rotten eggs), the original materials are not recognizable, and it will no longer heat up even after mixing.

Q: If I were to remember just the basics of home composting, what would it be?
A: That to compost effectively, you need the right combination of materials, space, air and water. For more information on Home Composting visit the Cornell Waste Management Institute website at http://cwmi.css.cornell.edu/composting.htm and read the brochure "Home Composting" found at https://ecommons.cornell.edu/bitstream/handle/1813/44638/compostbrochure.pdf?sequence=2&isAllowed=y

Vermicomposting

Q: What is vermicomposting?
A: Vermicomposting is composting with worms. It is typically done indoors in a closed bin populated with red wiggler worms that eat organic waste and expel it as worm castings or droppings. For more information on vermicomposting, visit the resources at the Cornell Waste Management Institute website at http://cwmi.css.cornell.edu/vermicompost.htm

Q: What equipment do I need to vermicompost?
A: Most people who keep a "worm bin" use a box or container (a plastic storage container works well) which has been perforated with air holes around the sides and top. Bedding for the worms can be made from moist, shredded newspaper (no glossy pages, please), computer paper, or coir. Add worms and food scraps and you are set.

Q: Can I use the worms I find in my garden?
A: No. The types of worms you find in your backyard are great for your garden and your backyard compost bin, but they're not suited for vermicomposting. Earthworms are known for burrowing and transporting organic material deep into the soil, as opposed to decomposing surface waste. In addition, earthworms will try to leave your bin if they are disturbed. Red wiggler worms are surface dwellers that are specially adapted to the environment of decomposing organic waste and don't mind being disturbed or kept in captivity.

Q: If I can't use my garden worms, what worms do I use?
A: The best worms for composting are "red wigglers" -*Eisenia fetida* and *Eisenia andrei*.

Q: Where do I get the worms?
A: Find a local supplier, but if that is not possible, order from a reputable supplier.

Q: Are there any concerns importing worms from out of state?
A: While there are species of invasive earthworms that are of concern to ecologists, the worms used to vermicompost are not earthworms. In fact, the "Red Wigglers used in vermicomposting are not found in the wild and are unable to survive the cold of northeast winters. Purchasing worms from reputable, recommended sources is advised".

http://www.srs.fs.usda.gov/compass/2012/12/18/invasive- earthworms-no-joke/
http://www.vtinvasives.org/other-invasives/earthworms

Q: Where should I put my worm bin?
A: Red wigglers feed most efficiently at temperatures between 59° - 77°F (15 - 25°C). While they tolerate a wide range of temperatures, those above 85° or below freezing may kill them. There are lots of good places for your worm bin inside of your house or apartment. They can be in basements, laundry rooms, under stairs, or under your kitchen sink. Basically, they need to be out of severe temperatures and somewhere where you won't forget about them!

Q: How many worms will I need?
A: Worms are sold by weight rather than number. Worm growers estimate there are about 1,000 worms per pound. A 2:1 ratio is recommended, worms to food scraps; meaning, for every pound of worms, you will need ½ pound of food scrap per day on average. Weigh your food scraps daily for at least a week to estimate how many worms you might need.

Q: Once I have my bin, what do I do?
A: Set up your bin a few days in advance of receiving your worms. While this isn't essential, it allows time for microbes to grow (which are what the worms are actually eating, not the food itself) on your two worm bin ingredients: bedding and food scraps. It's a friendlier environment for the hungry worms and makes for an easier transition. Also, throwing a handful or two of soil into the bin will help get the microbial action started. When you add food scraps to your bin, bury it under the bedding. Add new food scraps in different places around the bin.

Q: What do I feed my worms?
A: Red wigglers don't actually eat your food; they eat the microorganisms that eat decomposing organic matter. You can feed them the majority of your kitchen food scraps. Non-citrus fruits, vegetables, tea bags, coffee grounds and filters and crushed eggshells are great. The smaller you cut up the food scraps, the faster the microorganisms will break them down. There are some DO NOTs:

- No citrus. Citrus peels contain limonene, which is toxic.
- No meat or dairy. Just as in other home compost systems it attracts rodents and won't decompose at the same rate as the vegetables so may start to smell.
- No oil.
- No pet or human feces.
- No woody plant material or pits. They won't break down quickly enough.
- No non-organic matter. Plastic, metal, soap or other non-food items.

Q: Can I over-feed my worms?
A: Yes. If you overload the bin with food scraps, you may notice an odor of rotting food. This is due to the anaerobic conditions. Aerating the bin by turning the compost, adding fresh bedding and/or removing the undecomposed food should help return the worms to a healthier state.

Q: What are common problems with worm bins?
A: There are several common problems to watch for, but the solutions are usually a quick fix.

- Too much moisture – add dry bedding.
- Bedding too dry – spritz with water.
- The bin is smelly – check for overfeeding – remove excess food.
- Infestation - usually fruit flies - freeze scraps for 24 hours before you add them to the bin.
- My worms are gone! – look for centipedes in and around your bin – they are voracious carnivores. Cover air holes with a fine mesh screen to prevent entry.

Q: What are the other organisms in my bin?
A: Once your composting worm bin has been going for a while, you may notice other creatures like white worms, springtails, and millipedes living in your bin. This is normal. These creatures will not hurt your worms. In fact, they help the composting process. The only bugs that may be present that pose a threat to worms are centipedes.

Q: How do I harvest my compost?
A: After you get a good amount of castings you will want to remove them to use in your garden or houseplants without losing your worms. The goal is to keep the worms in the bin so they can keep doing what they do best. Find the areas that you fed longest ago and are the most broken down and remove them, placing them on a tarp or other surface in a pyramid small heap in the sun. Worms don't like light, so will dive below the surface to escape the sunlight. Wait 5 minutes and remove the top layer of castings. Continue this process until all your worms are together at the bottom of your pile. Return your worms to your bin.

Q: How often should I harvest?
A: Generally, it takes three to six months to harvest finished compost.

Q: What do I do with the compost?
A: Worm castings are a nutrient rich additive to soil. Use vermicompost when getting ready to plant new seeds or starts. Work a layer one to two inches deep in beds; in pots use a ratio of one part vermicompost to two parts soil. Top dress every two to four weeks for continued soil
health. Vermicompost can also be used to make a compost tea for foliar feeding.

Q: How do I make compost tea?
A: Compost tea is a liquid fertilizer made from compost. Worm compost tea can be sprayed on plants for foliar feeding or used on the soil as another form of soil nutrition. Here is an easy compost tea recipe from Cornell Waste Management Institute: Add 1-2" of compost to a water can or rain barrel. Allow mixture to "steep" for a day, mixing occasionally. Water plants with tea as you normally would. The resulting "tea" helps make nutrients already in the soil available to plants.

Q: Why should I compost with worms? Why would I want to?
A: Vermicomposting is an important part of long-term sustainability in your home and garden. The process reduces the amount of food waste being sent to landfills, and the

fossil fuel being used to transport and process waste. Worm compost also conserves the resources needed to produce and import soil amendments into your garden. By putting food scraps into a worm bin, you are using every part of the food you paid for. Worm composting is a fun and easy way to reduce your carbon footprint, and an excellent teaching tool for children.

References:

Except where cited, answers adapted from information in Appelhof, Mary. Worms Eat My Garbage. Flowerfield Enterprises, LLC, Kalamazoo, MI. 1997
http://www.urbanwormcomposting.org/faq-2/#8
http://www.sustainabletable.org/114/vermicomposting-101
http://compost.css.cornell.edu/worms/basics.html

Adapted from Cornell Garden -Based Learning Library, Contributor(s): Multiple CCE county educators
Reviewer(s): Donna Alese Cooke

Published: August 2020
Authors: Dina El-Mogazi, adapted by Donna Alese Cooke
Reviewers: Marcia Eames-Sheavly, Lisa Baastians, CCE Suffolk Master Gardener Volunteer

2.2B Save the Bees! "Bee"come a Bee Rancher

Skill Level
Beginning/Intermediate

Learner Outcomes, Youth will:
- Identify different bees and their pollinating habits.
- Understand conserving pollinators for sustainability.
- Create an example of a habitat for bees.

Education Standard(s)
- NS.K-4.3 Life Science: Life cycles of organisms, Organisms and environments
- NS.5-8.3 Life Science: Structure and function in living systems, Reproduction, Populations and ecosystems

Success Indicators
Building simple pollinator habitats yields positive results for the environment and food system.

Life Skills
Healthy lifestyle choices, goal setting, planning, wise use of resources, resiliency

Time Needed
One-hour, ongoing observation
Two hours per year to take care of mason bee nests

Materials List
Varies, depending on resource used to purchase Bee Nest Kits or supplies needed to build one nest per person; Journal notebooks, pen, pencils for each person

Space
Meeting space with tabletops set up for building bee nests. Outdoor area(s) where bee nests will reside.

Suggested Group Size: 12-15 or more

Acknowledgements
Veronica Kaliski, Master Gardener Volunteer, CCE Suffolk County: Action Project: "Mason Bees: Becoming a Bee Rancher"

Cornell Garden-Based Learning Library: Pollinator Protection Part 2: Habitat Establishment: Amara Dunn, NYS IPM; Mike Helms, Cornell PMEP; Beneficial Insects: Scott McArt, Assistant Professor in the Entomology Department at Cornell University, Dr. Elizabeth Lamb-NYS Integrated Pest Management Program, CALS Cornell University and CCE county educators: Pollinator Protection Part 2.

Introduction
Youth will learn about characteristics of native bees, and how they compare to non-native honeybees in pollination and sustainability. Youth will build a Bee Hotel or other nest, to encourage native bees to nest. Native bees, such as Mason bees pollinate a wide variety of plants. Unlike the Honeybee, Mason bees will fly in the cold, and are not susceptible to Colony Collapse Disorder (CCD). According to Bryan Danforth, Cornell University Entomologist, native bees are four times more effective at pollinating than "side working" honeybees. Danforth said research and fieldwork is proving wild bees can play a critical role in saving growers' money, easing pressure on vulnerable honeybee hives, and increasing sustainability.
http://www.cornell.edu/video/cornell-orchards-wild-bee-pollination

Opening Questions:
- What do you know about bees?
- How are bees important in sustaining our food system?

Background information:
Before the Activity
- Explore the **Resources and Kits for Bee Hotels and Nests** section to find where to purchase kits and/or cocoons or information on how-to build bee nests. Choose a resource that best fits your group's skills, budget and interest.
- Purchase and/or gather material to build a bee hotel or nest, one for each child.
- Optional: If your group wishes to join, review the Native Bee Network and 4-H, Native Bee Challenge at https://crownbees.com/4-h and prepare materials and activity steps.
- Invite a local Native Beekeeper or expert in the field.

Let's Do It!

1. Hand out one Journal notebooks, pen, pencils for each participant to personalize and record observations and notes.
2. Invite a local beekeeper or expert or be prepared to introduce the characteristics of mason and wild bees.
3. Watch the Mason Bee presentation as a group.
4. How can you tell the difference between mason bees, honeybees, bumble bees and flies?

Characteristics of Mason Bees
- solitary bees
- no queen, and no hive
- no "division of labor", all females are fertile
- docile and rarely sting
- live in pre-existing sites such as hollow reeds or nail or beetle holes
- rarely fly more than 300 feet from their nests
- do not make honey
- thrive on fruit trees, berries, trees, shrubs, dandelions and clover - they are early spring pollinators
- will fly in the cold

5. **Pick a spot** for each Bee Nest, such as the edge of a garden, close to flowers that mason bees pollinate and facing the sun. Avoid pesticides.
6. **Build a Nest:** Following guidelines steps on how-to build a bee nest, following the resource you found in the **Resources and Kits for Bee Hotels and Nests** section, and place the nest(s) in the desired location.
7. **Ongoing:** Observe and do seasonal "chores". Have participants record tasks and observations in their Bee-Rancher Journals.

A. What are the bees are doing in spring?

- The male bee cocoon, which is smaller, hatches first.
  The males wait for the females which can take up to two weeks. After mating the male dies.
- The female forages for pollen. She puts pollen and nectar in the nesting cavity, lays an egg, and seals off the cell with mud.
- She continues doing this until the chamber is full, then goes on to another tube. Females lay approximately 15-20 eggs.
- She makes 11-35 foraging trips to collect enough pollen and nectar for one baby bee.
- After approximately 6-8 weeks, the female dies.

Spring Chores

- Put mason bee house where it faces the morning sun. Put the house at eye level.
- Holes should be 8 mm in diameter.
- General rule is put the cocoons out when it is 50-55 degrees for three consecutive days; do not worry about nighttime temperatures.
- Put the cocoons on top of or behind nesting holes - you can put them in a small paper cup.
  Provide approximately one nesting hole for each cocoon.
- Generally, you want 6 males to 4 females.
- Make sure emerging bees have enough to eat - within 300 feet of flowers

Provide mud- females separate the cocoons and cap the tubes with mud, hence the name "mason". Put chicken wire in front of nesting holes, to keep out birds; do not but your bees near a bird feeder.

B. What are the bees are doing in summer?

- The larva hatch and eat the food.
- After 10 days they spin a cocoon then pupate.
- They are at this point fully formed bees which will emerge the following spring.

Summer Chores

- Leave the reeds in place outside but put them in a mesh bag which guards them against wasps and other pests which may invade the cocoons.

Keep doing chores!

C. Autumn Chores

- It is now time to harvest the cocoons - (October to December). Handle the cocoons gently but remember that they are waterproof. Open the nesting tubes - you will see the cocoons, the frass (larva excrement) and the mud partitions.
- Using something flat (a nail file, flat screwdriver) remove the cocoons to a shallow dish.
- Discard cocoons that have small holes in them (caused by mini wasps).
- Clean the cocoons in 0.05 bleach solution (1 T of bleach to 8 cups of cool water). After one to two minutes, rinse the cocoons in cool water.
- Roll them gently in a towel to dry.
- Your cocoons are ready for winter storage!

D. Winter Chores

- Put the cocoons in a ventilated container such as a Humidibee. Keep the container in the refrigerator, in a crisper (39-40 degrees F, with 50-75% humidity).
- Do not keep apples in the same crisper - the ethylene gas will kill the bees.
- Keeping the bees in the refrigerator protects the bees from predators and from fluctuations in temperature.
- Check the container every few weeks to make sure that the pad below the foam is damp. Add water as necessary - usually 1 T a month.
- If cocoons get moldy, put them in a paper bag and close the top (mold spores have a harder time penetrating the paper bag).

Talk It Over:
Share
Participants demonstrate their completed nests share with the whole group and describe where they will be placed and why they chose that location. Share any observations made in **the Journals while doing this activity.**

Reflect
Ask: Can you think of ways that would keep bees going as pollinators? Why is this important?
Review the Pollinators Q&A in the handouts.

Apply
Have your group plan to do seasonal tasks on the "To Do List" (chores).

References
CALS Notes, Leap of faith by Cornell proves pollination can be honeybee free, https://cornellcals.tumblr.com/post/120639789353/leap-of-faith-by-cornell-proves-pollination-can-be

CORNELL CHRONICLE, Cornell orchards rely on wild bees, JUNE 4, 2015, https://www.cornell.edu/video/cornell-orchards-wild-bee-pollination

Crown Bees, https://crownbees.com/4-h

Cornell Garden-Based Learning Library: Pollinator Protection Part 2: Habitat Establishment, contributors: Amara Dunn, NYS IPM; Mike Helms, Cornell PMEP; Beneficial Insects: Scott McArt, Assistant Professor in the Entomology Department at Cornell University, Dr. Elizabeth Lamb-NYS Integrated Pest Management Program, CALS Cornell University and CCE county educators. Reviewer(s): Fiona Doherty, Anne Christian-Reuter and Donna Alese Cooke

Learn More
Cornell Garden-Based Learning http://gardening.cals.cornell.edu

Resources and Kits for Bee Hotels and Nests
4-H Beekeeping
https://edustore.purdue.edu/subcategory.asp?subCatID=335&CatID=16

Build Your Own Bee Hotel https://www.nationalgeographic.org/media/build-your-own-bee-hotel/

Building and managing Bee Hotels for Wild Bees
https://pollinators.msu.edu/publications/building-and-managing-bee-hotels-for-wild-bees/

Creating a Solitary Bee Hotel
http://extensionpublications.unl.edu/assets/pdf/g2256.pdf

Danforth Lab, Cornell University http://www.danforthlab.entomology.cornell.edu

Join the Native Bee Network and 4H at https://crownbees.com/4-h Crown Bees, The Native Bee Experts.

Honey Bee Challenge Kit https://shop4-h.org/products/honey-bee-challenge-kit

Pollinator Observations
Bumblebee Watch : www.bumblebeewatch.org

Create a Pollinator Paradise, CCE Putnam:
http://putnam.cce.cornell.edu/gardening/create-a-pollinator-paradise

The Great Sunflower Project: www.greatsunflower.org

Master Beekeeper Program

Million Pollinator Challenge: http://millionpollinatorgardens.org/

Monarch Net: http://www.monarchnet.org/

National Agriculture in the Classroom, search for lessons relating to the topic:
e-Learning Resources https://agclassroom.org/eLearning/ and Agricultural Literacy Curriculum Matrix:, https://www.agclassroom.org/matrix/

Native Beeology: Native Bee Field Guide

Northeast Pollinator Partnership: www.northeastpollinatorpartnership.org
And http://www.fruit.cornell.edu/tree_fruit/resources/wild_pollinators.pdf

NY Wild Bee Guide: http://www.sharpeatmanguides.com/picture-index

NYS IPM Pollinator Page: http://nysipm.cornell.edu/pollinators/default.asp
Pollinator Network @ Cornell

Plant Lists by region: http://www.pollinator.org/guides.htm

Plant Lists and Backyard Practices: Xerxes Society Backyard Pollinator Habitat

Plant Lists and Backyard Practices: Pollinator Partnership

Pollinator Partnership, Ecoregional Planting Guides at
https://www.pollinator.org/guides

Pollinator Watch: www.pollinatorwatch.org

PDF Booklet: How to protect and increase pollinators in your landscape

Smart Lawns for Pollinators: Michigan State U Extension

USDA Natural Resources Conservation Service, How Gardeners can help pollinators
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/gardeners/

US Forest Service: https://www.fs.fed.us/wildflowers/pollinators/pollinator-of-the-month/mason_bees.shtml

Yard Maps: http://content.yardmap.org/

Pollinators and Climate Change
Cornell Ornithology Lab, project feederwatch.
https://feederwatch.org/about/detailed-instructions/

World Wildlife Fund, Monarch Butterfly Report, 2015:
https://c402277.ssl.cf1.rackcdn.com/publications/845/files/original/Monarch_butterfly_-_WWF_wildlife_and_climate_change_series.pdf

Timing, Pollinators, and Impact of Climate Change: Blog post Union of Concerned Scientists, 2017 https://blog.ucsusa.org/science-blogger/timing-pollinators-and-the-impact-of-climate-change

Endangered Species Coalition: How Climate Change has Affected Pollinators, 2018.
http://www.endangered.org/how-climate-change-has-affected-pollinators/

Entomology Today: pollinator hotels, ecological and educational value. https://entomologytoday.org/2018/03/26/how-bee-hotels-support-urban-pollinators-and-educate-locals-on-one-college-campus/

Mother Nature Network: Build a hotel for wild bees. https://www.mnn.com/your-home/organic-farming-gardening/stories/how-build-hotel-wild-bees

Published: June 2020
Authors: Donna Alese Cooke, Veronica Kaliski
Reviewers: Marcia Eames-Sheavly, Veronica Kaliski, CCE Suffolk County Master Gardener Volunteer

2.2C Growing Food: Exploring Soilless Alternatives: Hydroponics, Aeroponics, Aquaponics

Skill Level
Beginner/Intermediate

Learner Outcomes. Youth will:

- Observe and reflect on how changing climate conditions affect how plants grow in the garden
- Explore alternative methods of growing plants and food in a controlled environment
- Practice growing plants hydroponically or by other soilless methods
- Become familiar with alternative methods farmers use to address climate change issues, and how to adopt such changes within the food system

Education Standard(s)

- NS.K-4.3 Life Science: Characteristics and Life Cycles of organisms, Organisms and environments
- NS.5-8.3 Life Science: Diversity and adaptations of organisms
- T4.3-5.b: Describe how technology helps farmers/ranchers increase their outputs (crop and livestock yields) with fewer inputs (less water, fertilizer, and land) while using the same amount of space
- T4.3-5.d: Provide examples of science being applied in farming for food, clothing, and shelter products

Success Indicators
Youth understand there are alternatives to traditional agricultural methods to grow food crops.

Life Skills
Healthy lifestyle choices, goal setting, planning, wise use of resources, resiliency

Time Needed: Varies depending upon activity choice

Materials List : Varies depending upon activity choice

Space : Varies depending upon activity choice

Suggested Group Size : 12-15 or more

Acknowledgments
Cornell Garden-Based Learning Library: Growing Vegetables, authored by CCE County Horticulture Educators.

Introduction
Climate change and a warming world has a direct consequence on our gardening and farming practices. Farmers, gardeners, schools, and large companies have looked to growing food indoors in controlled conditions for greater results. There are many methods of growing food without soil, using hydroponics, aeroponics and aquaponics and youth will explore how groups and organizations grow and harvest food using these methods to feed large and small groups of people. Your group will do hands-on practice of different methods of growing plants without soil, with a focus on food crops, then work in small groups to develop a plan for a simple, sustainable, soilless food garden to use in a school or community setting. Introduction to this activity will be though hands-on discovery of how these systems work. Choose one or more of the recommended 4-H, National AG in the Classroom, or other curricula in the activities listed in the Let's Do It, Variations or Learn More sections that are appropriate for your group's skill level.

Opening Questions:

- In what ways have you seen changing climate conditions affect how food grows in our garden?
- What ways have you seen farmers grow food without soil? What did they grow? For whom who was the food harvested?
- Have you grown plants without soil? Were they healthy and if not, what do you think you could do differently?

Background information:
Before the Activity
Leaders will research the different curriculum listed here and select one or more activities for your group to do before following the next steps of the activity. Purchase and prepare all the materials needed for the activities you choose.

Refer to the accompanying **"Growing Food in Changing Climate Conditions Q & A's"** to open the discussion on how we need to modify existing gardening practices and adopt and modify alternative methods and to address changing climate conditions. Adapted from Cornell Garden-Based Learning Library: Growing Vegetables, authored by CCE County Horticulture Educators.

- **4-H Stem Lab Bean in the Bottle**: Exploration of plant lifecycles, indoor gardens and what plants need to survive https://4-h.org/wp-content/uploads/2018/09/4H-STEM-Lab-Bean-in-a-Bottle.pdf
- **National Agriculture in the Classroom:**
    - **Test Tube Hydroponics** is an investigation of the importance of nutrients for plant growth and discover soilless growing by growing and observing plants in a test tube hydroponic system. https://agclassroom.org/matrix/lesson/654/
    - **Exploring Aquaponics**: Youth identify the basic needs of plants and fish and engineer, assemble, maintain, and observe a small-scale aquaponics system that meets plant and fish needs. Grades 3-5: https://agclassroom.org/matrix/lesson/632/

- **National Agriculture in the Classroom: "What? No Soil?** After learning the five basic requirements of plant growth, youth build and maintain hydroponic units from soda bottles. https://agclassroom.org/matrix/lesson/300/

Let's Do It!

1. Ask opening questions. Use the "**Growing Food in Changing Climate Conditions Q & A's**" to lead further discussion on how traditional growing methods may be difficult due to climate change.
2. Continue the conversation with: "Imagine growing food on a large or small scale, for the lunch program at your school or for a local food pantry".
3. Explain that you will be exploring different soilless methods of growing food, and how groups and organizations are feeding people
4. Follow the procedures of one or more of the suggested activities.

Talk It Over
Share
Varies depending upon activity choice

Reflect

- Varies depending upon activity choice
- Use a plant journal to keep track of progress and observations while growing plants in alternative ways.
- What examples of science are being applied in farming for food, clothing, and shelter products

Apply

- Varies depending upon activity choice
- How do you see farmers/ranchers using these technologies to increase their crop and livestock yields)with less water, fertilizer, and land while using the same amount of space?
- How does this address the issues we face due to climate change?

Variations
National Agriculture in the Classroom:
Simplified Floating Hydroponics: a long-term project demonstrating soilless growing methods https://cdn.agclassroom.org/ny/resources/activities/hydro.pdf

References
"Growing Food in Changing Climate Conditions Q & A's" adapted from Cornell Garden-Based Learning Library: Growing Vegetables, authored by CCE County Horticulture Educators.

National Agriculture in the Classroom https://agclassroom.org

Learn More
Cornell Garden-Based Learning http://gardening.cals.cornell.edu

4-H Leader's Guide: Grow with the Flow
https://ecommons.cornell.edu/bitstream/handle/1813/3283/Grow%20with%20the%20Flow.pdf

Climate Change Education, Stanford Earth School of Earth, Energy and Environmental Sciences, https://earth.stanford.edu/climate-change-ed/curriculum

Connected Science Learning: Seeding the Future: Blending Urban Gardening with Community Outreach and STEM Learning, National Science Teaching Association
http://csl.nsta.org/2017/05/seeding-the-future/

FarmFlavor: How Walt Disney World's Farm Grows the Most Magical Produce on Earth
https://www.farmflavor.com/florida/walt-disney-world-farm-grows-magical-produce-earth/

Foodspan, Teaching the Food System from Farm to Fork
http://www.foodspanlearning.org/lesson-plans/unit-2-farmers-factories-and-food-chains/index.html
http://www.foodspanlearning.org/_pdf/lesson-plan/unit2/lesson6-sustainability-lessonplan.pdf

National Agriculture in the Classroom, search for lessons relating to the topic:
e-Learning Resources https://agclassroom.org/eLearning/ and Agricultural Literacy Curriculum Matrix:, https://www.agclassroom.org/matrix/

Sustainable Agriculture Research and Education: Introduction to Climate Resilience in Agriculture
https://www.sare.org/Learning-Center/Bulletins/Cultivating-Climate-Resilience-on-Farms-and-Ranches/Climate-Risk-Management-and-Resilience-on-Farms-and-Ranches/Introduction

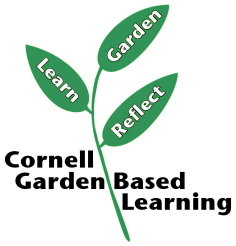
The Green Bronx Machine is a non-profit started by high school teacher Stephen Ritz. He teaches students and youth how to grow food and adopt healthy food choices in the classroom and in other spaces using aeroponics (Tower Gardens), and then share the harvest to feed students in schools and families in the community. Find curriculum and resources at https://greenbronxmachine.org

Seton Hall University Science Lessons and Exercises for Tower Gardens: Free CCSS and NGSS aligned lesson plans and learning materials in PDF format. Tower Gardens teach cross-curricula topics and healthy eating.
https://www.towergarden.com/grow/lesson-plans

U.S. Climate Resilience Toolkit: A powerful tool for exploring climate impacts and design solutions on a national scale. https://toolkit.climate.gov/

USDA National Agricultural Library resources on vertical farming, aquaponics, aeroponics and hydroponic farming: https://www.nal.usda.gov/afsic/hydroponics

Leader Handouts:
Growing Food in Changing Climate Conditions Q & A's



Published: June 2020
Author: Donna Alese Cooke
Reviewers: Marcia Eames-Sheavly, Lisa Baastians, CCE Suffolk County Master Gardener Volunteer

Leader Handout:
Growing Food in Changing Climate Conditions Q & A's

Q: When can I plant my vegetable garden?
A: Planting your vegetable garden will depend on what you want to grow, whether you'll be direct sowing or planting transplants, and what your average last freeze date is for your area. Understanding the difference between cold-season crops (e.g. spinach and peas) and warm-season crops (e.g. tomatoes and peppers) will help guide your decisions as well.
Check the Northeast Regional Climate Center's Average Last Frost Dates at http://www.nrcc.cornell.edu/services/blog/2011/05/10_last_frost/index.html or check with your local extension. Long Islanders can use this fact sheet as well: Vegetable Planting Times Guidelines for LI at https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/11705/Vegetable_Planting_Times_Guidelines_for_LI.pdf?1446826465 . Northern NY can use http://cceclinton.org/resources/vegetable-growing-guide-beginners-edition-northern-ny
Weather conditions will vary in any given year. The spring growing season may be "ahead" or "behind" schedule sometimes for a week or two or more. Another limiting factor in spring is wet soil conditions. Turning soil under or rototilling when soil is wet has the potential to damage the soil structure. This can cause a hard, crusty layer of soil at the surface as well as hard clods or balls of soil that interfere with seeding and good root development.

Q: Should I start seeds indoors or plant directly outside?
A: Eager gardeners who want to get their hands dirty can start warm-season vegetable crops indoors, given that they have the necessary materials and space. Those plants can then be planted in the garden when the time is right. Alternatively, plants can be purchased directly from nurseries and brought home to plant in the garden. Starting your own seeds indoors gives you the opportunity to grow an array of varieties that are not always available in nurseries.
See the factsheet "Indoor Vegetable Seed Starting, found here: http://moodle.cce.cornell.edu/enrol/index.php?id=168.
Either route you choose, make sure not to place warm-season crops out too early, and be sure to pay attention to the seed packet information. Plants that are started indoors too early tend to get leggy before the weather has warmed enough to plant outdoors. Some vegetables prefer to be sown directly into the garden: peas, spinach, lettuce, to name a few. These are generally cooler season vegetables that like to get an early start in spring. Read seed packets carefully to determine whether seeds prefer to be direct-seeded or started indoors.

Q: None of my seeds germinated. What went wrong?
A: Seeds may not germinate if the soil is too cold, if seeds were planted too deep, or if the soil is too wet or too dry. Some seeds require light to germinate, while others require darkness. Some prefer to be soaked overnight, or even slightly "scarified" with some sand paper. It is important to read the seed packet for germination information to ensure that you give it the right conditions for germination. It is also possible that the seed you used was too old: seed viability decreases over time, though this depends on the vegetable seed type. Try germinating seeds on a moist paper towel placed in a plastic bag. Depending on the percent of germination, you may decide to use them or scrap them for new seeds.

Q: I have vegetables seeds from a few years ago, can I still use them?
A: It is recommended that about a month or so before the seed is to be planted, you test the percent germination of the seed. This is the percentage of the total number of seeds that have the capability to germinate and grow. This will help you decide how many seeds to plant, especially if the percent germination is low. The easiest way to do this is to moisten two or three layers of paper towels. Place an even number of seeds on the towels and roll them up. Do not roll tightly. A loose roll will provide more oxygen and create a more accurate test. Place the rolls in a plastic bag. Keep in a warm place such as the kitchen counter or on top of the water heater. Some seed will germinate in a matter of several days; therefore, it is necessary to check the rolls every two or three days. Count the number of seeds which germinate and change this to a percentage of the total seed tested to determine an approximate percent germination rate of the seed you have saved. The percent of germination for seed that you purchase can be 90% or higher, so this can be used as a guide in determining how successful you have been in saving your seed. If the germination rate is less than 50%, it is likely worth composting your old seed and starting over with fresh seed.

Q: My plants died as soon as I planted them outside, what happened?
A: Vegetable plants that are started indoors need a period of hardening off before they go outside full-time. Reduce the amount of water they receive, and increase their exposure to sun, wind, and cool temperatures by placing them outside in a lightly shaded area for increasingly longer periods for a week or two. Once you're ready to transplant them, choose a still, cool, cloudy day to plant outside or plant late in the day if sunny. In a prepared area, loosen soil and dig holes large enough to accommodate the root system, and at the proper spacing as specified on the seed packet or in another resource. Carefully slide the well-watered plants out of their containers by putting two fingers like a V, straddling the stem at the base of the plant and gently turning them upside down; do not hold by the stems or you may damage the seedlings. Turn them

upright, cup your hand around the bottom of the seedlings and place them in their holes. Tap the soil gently around transplants to achieve good root-to-soil contact. Most vegetable seedlings want to be planted evenly with the ground soil, though tomatoes and some other crops want to be planted deeply. Keep soil moist for first week or two to allow seedlings to establish roots.

Q: How do I support my tomatoes?
A: The main reasons for staking and supporting tomato plants is to keep plants and fruit off the ground. This reduces losses from fruit rots when fruit touches the soil, and from sunburn when fruit are not shaded by foliage. Staking tomatoes also makes it much easier to harvest.
There are a variety of ways to support your tomato plants: staking, trellising or caging. You can use wooden or metal stakes and tie the plants to the stakes for support. Caging usually uses metal wire cages that do not require you to use ties to support the plants.

Q: What should I consider before using collected rainwater for food gardening?
A: Studies have shown that harmful compounds may leach into rainwater from roofing materials and treatments. Check to see if your gutter contains lead solder or lead-based paint, if the roof is composed of treated cedar shakes, new wood shingles, asphalt shingles or copper; or if your roof has been treated with chromate copper arsenate or chemicals to prevent moss, algae or lichen growth. If the answer is "yes" to any of these questions, do not use collected rainwater in your food gardens or orchards, as these compounds can end up in your fruits and vegetables. See this rain barrel resource for more information: http://cceonondaga.org/resources/how-to-build-a-rain-barrel.

References:

Northeast Regional Climate Center. Website. Accessed January 26, 2019 from http://www.nrcc.cornell.edu/.
CCE Clinton County. *Vegetable Growing Guide Northern New York: Beginner's Edition.* Accessed January 26, 2019 from http://cceclinton.org/resources/vegetable-growing-guide-beginners-edition-northern-ny
CCE Suffolk County, County Fact Sheet. *Vegetable Planting Times- Guidelines for Long Island*. Accessed January 26, 2019 from:
https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/11705/Vegetable_Planting_Times_Guidelines_for_LI.pdf?1446826465
Brewer, L. 2015. "Indoor Vegetable Seed Starting" fact sheet, Cornell Garden-Based Learning, online in CCE MGV Learning Library
http://moodle.cce.cornell.edu/enrol/index.php?id=168, accessed January, 2019

Cornell Cooperative Extension of Onondaga County Fact Sheet. *How to Build A Rain Barrel.* Accessed January 26, 2019 from http://cceonondaga.org/resources/how-to-build-a-rain-barrel.

Adapted from Cornell Garden-Based Learning Library: Growing Vegetables, authored by CCE county Horticulture Educators, Reviewer: Donna Alese Cooke

2.2D Introduction to Permaculture

Skill Level
Intermediate, Advanced

Learner Outcomes. Youth will:

- Understand the basics of Permaculture and impacts humans have on the earth and how our actions effect future generations.
- Recognize the philosophy of Permaculture Design and how it promotes a caring and sustainable environment.
- Experiment with different ways to grow food in a natural environment.
- Evaluate a site and create a design that supports Permaculture practices and sustainability.

Education Standard(s)

- NS.5-8.3 Life Science: Populations and ecosystems
- NS.5-8.6 Personal and Social Perspectives: Personal health, Populations, resources, and environments
- NS.9-12.6 Personal and Social Perspectives: Personal and community health, Natural resources, Environmental quality

Success Indicators
Work through the process of healing and restoring ecological health in the landscape.

Life Skills
Healthy lifestyle choices, goal setting, planning, wise use of resources, resiliency

Time Needed (multiple sessions)

- 40-minute introduction (whole group)
- 2 weeks, multiple visits to one location 2-3 per week for observation, a minimum of 5 minutes at the location each visit (individual activity)
- 40-minute activity to share/reflect/discuss

Materials List
YouTube videos https://youtu.be/TVS45dbNL-E by David Holmgren on **how you can change the world with permaculture** (5:43 minutes) and **The Permaculture Principles** https://youtu.be/0mwRAf3z9ag by Oregon State University Ecampus (9:42 minutes); **Permaculture Elements Handout** (provided), and other handouts you choose to help introduce the topic from **Learn More** section; sketch pads and pencils, colored pencils, pens, **Sit Spot Handouts**, cell phone or other camera to take photos of a site.

Space
Indoor space to watch videos if you choose to do so as a group; outdoor landscape to study, can be a participant or leader backyard or public space such as a park or school grounds; indoor/outdoor space with tables to work on sketches and drawings.

Suggested Group Size: 12-15 or more

Acknowledgements
Cornell Cooperative Extension Distance Learning Courses: Permaculture Design, Parts One and Two, https://moodle.cce.cornell.edu
Introduction to Permaculture, Bill Mollison, 2011
https://permacultureprinciples.com

Introduction
In this activity youth explore the basics of Permaculture philosophy, principles, and how it applies to the design of backyards, gardens, farms, and communities, and its process of healing and restoring ecological health and future climate change.

This topic builds upon **Systems Thinking** in Unit One and previous topics in Unit Two and will be most effective when implemented as a final activity for Units One and Two. For groups needing more background information, have participants look at the web resources and downloadable documents and illustrative posters mentioned in **Learn More.** Leaders will find a pre-determined landscape for the group to visit and do a **"Sit Spot"** site assessment, such as a public space such as a school yard or park. Someone's backyard will work too!

After completing the Sit Spot observations, your group will meet to do the sketch out Permaculture Designs that would enhance the landscape observed.

Opening Questions:
- What are the relationships you see between people and the landscape?
- In what ways can we redesign landscapes to use less energy, have less human impact, and maintain sustainability?

Background information:

- **Before the Activity**

Gather materials, review the videos and handouts for introduction the topic; review resources in **Learn More** to determine if more introductory resources are needed. Find an accessible location for your group to visit and do a Sit Spot, preferable a public space such as a school yard or park. Someone's backyard will work too!

- **Let's Do It!**
    1. Introduction and Pre-work: **What is Permaculture?**
        a. Introduce the **Principles of Permaculture Practices**, by having your group watch the two videos before your session at home, or together as a group.

1) Watch the video https://youtu.be/TVS45dbNL-E where David Holmgren explains how you can change the world with permaculture (5:43 minutes).
2) **The Permaculture Principles** https://youtu.be/0mwRAf3z9ag Oregon State University Ecampus (9:42 minutes).

b. Introduce **The seven domains of permaculture action** with the visual **Permaculture Flower** from https://permaculturepriniciples.com/flower/
c. Hand out the **Permaculture Design Elements Handout** and ask the opening questions, guiding answers based on what they know, what they have learned from the videos, and the Permaculture Flower. Explain you will be going out as a group to observe a landscape to do a Sit Spot activity.

2. **Introduce the Sit Spot Activity**: explain that at your next session, you will be meeting at a pre-determined location to observe the landscape, and that they will make a plan to revisit the same location for the next two weeks:
   a. On your first visit, 20 -30 minutes
   b. For a **minimum of 5 minutes** each visit, revisit the same location 2-3 times each week for two weeks.
3. **Permaculture Makeover:** After the Sit Spot Observations are completed, meet as a whole group with an outdoor/indoor space with tables to work on sketches and drawings. Have youth work on rough sketches of how they can adopt Permaculture Practice and make a new or enhanced design to the Sit Spot location they observed.

Talk It Over:
Share
Individuals will share their two week Sit Spot observations and rough sketches of their Permaculture Design makeover.

Reflect
- Why does this matter?
- How can we share with others this different way of looking at our landscapes and incorporating Permaculture?

Apply
Take the next step and create a plan to implement a Permaculture Design Makeover, using the ideas that come from each person's rough sketches,

Variations
Resources and curriculum on teaching younger children about Permaculture:
Children in Permaculture: resources for teaching permaculture to youth
http://childreninpermaculture.com/
- Big activities database with brief descriptions. Search by age, topic, mode of action. http://db.childreninpermaculture.com/
- Downloadable materials including teaching manual. http://childreninpermaculture.com/document-download-center/

Institute of Permaculture Education for Children (IPEC) list of resources.
http://www.permaculture.us.com/resources-3

References

Cornell Cooperative Extension Distance Learning Courses: Permaculture Design, Parts One and Two, https://moodle.cce.cornell.edu

Introduction to Permaculture, Bill Mollison, 2011
https://permacultureprinciples.com

Learn More

Children in Permaculture: resources for teaching permaculture to youth
http://childreninpermaculture.com/

Free downloads at:
https://permacultureprinciples.com

- https://permacultureprinciples.com/resources/free-downloads/
- The Seven Domains of Permaculture Action
  https://permacultureprinciples.com/flower/

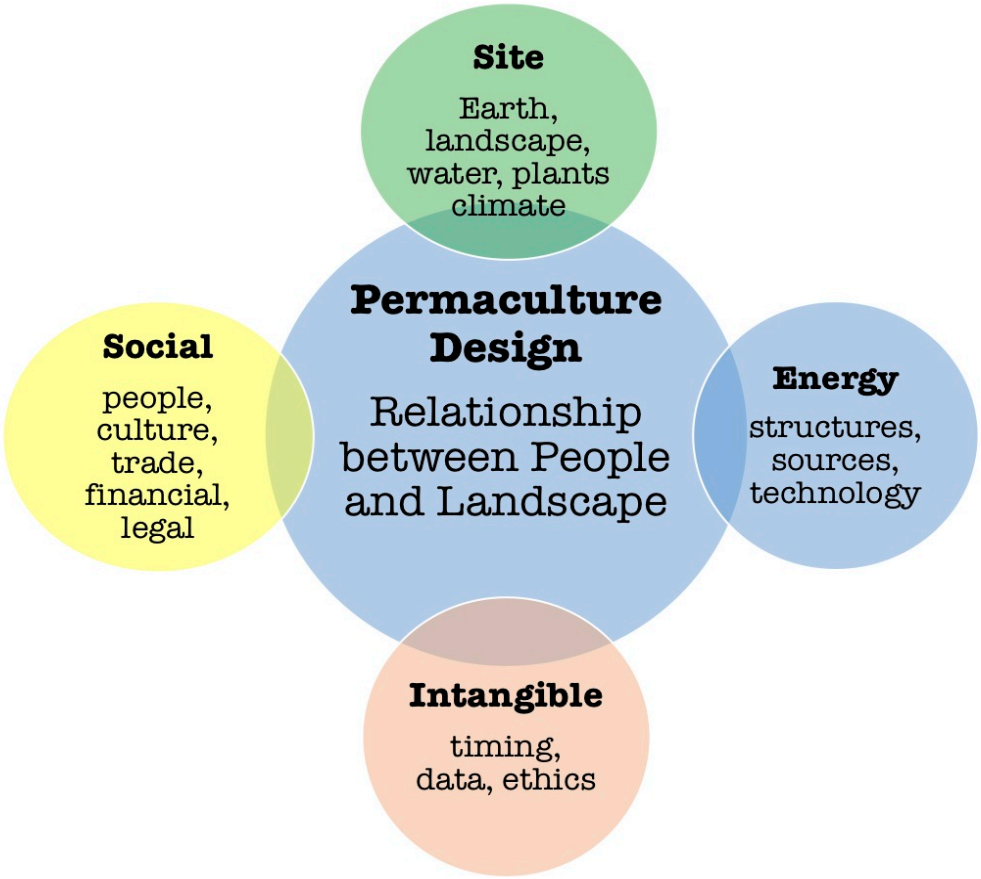
Permaculture Elements Handout
Sit Spot Handouts

Published: June 2020
Author: Donna Alese Cooke
Reviewer: Marcia Eames-Sheavly

Permaculture Elements Handout

Cornell Cooperative Extension
Cornell Garden-Based Learning

Permaculture Design Elements



Adapted from Elements of a Total Permaculture Design, Introduction to Permaculture, Bill Mollison, 2011

Building Strong and Vibrant New York Communities

Sit Spot Activity Instructions

20-30 minutes

Instructions:
Sit spot is a technique that is both simple and complex. It is a very effective way to begin to know your landscape because it encourages prolonged, thoughtful observation of one place in the natural world with you, the observer, continually asking questions, noticing patterns, and seeking information to apply to your garden design.

> ***From Wilderness Awareness teacher Jon Young:***
> *Find one place you can get to know really, really well. This is the most important routine you can develop. Know it by day; know it by night; know it in the rain and in the snow, in the depth of winter and in the heat of summer. Know the stars and where the four directions are there; know the birds that live there, know the trees they live in. Get to know these things as if they were your relatives, for, in time, you will come to know that they are. That is the most important thing you can do in order to excel at any skill in nature. Nature and your own heart are the best teachers, but your body, mind and spirit all have to attend the class, and do the homework. There is no replacement for this experience! From Kamana One: Exploring Natural Mystery by Jon Young*

The purpose of a sit spot is ultimately to improve and deepen your understanding of natural systems by devoting yourself to consistent time in them. Seeing the same spot at different times of day and during different seasons allows you to see the dynamics of nature unfold. This is a chance to spend time in your landscape, in your garden, learning directly from it.

Directions:

- Go outside and find a sit spot in a garden, lawn or forest. Sit quietly for 5-15 minutes. Set an alarm so you can be fully present.
    - Focus on one sense at a time, trying to "stretch" the sense as far as possible. For instance, cupping your hands around your ears helps amplify any sounds and you can learn to discern sounds that are close by versus those that are far in the distance. Or spend the entire time with your eyes closed.
    - Ask a multitude of questions beginning with "Why?"
    - Examine the layers of vegetation, evidence of animals, patterns of past human use.
    - Zoom your focus from the entire scene in front of you to the smallest leaf/insect/spec of earth. Then repeat; back and forth.
- Pair up with a partner and discuss what you experienced.
- This exercise can become part of your personal routine. See Sit Spot at Home activity.

Sit Spot Activity

Variable (as little or as much as you like)

Supplies:

Handouts:

-

Materials:

- a pad of paper or journal

Sit spot is a technique that is both simple and complex. It is a very effective way to begin to know your landscape because it encourages prolonged, thoughtful observation of one place in the natural world with you, the observer, continually asking questions, noticing patterns, and seeking information to apply to your garden design.

> ***From Wilderness Awareness teacher Jon Young:***
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> *Find one place you can get to know really, really well. This is the most important routine you can develop. Know it by day; know it by night; know it in the rain and in the snow, in the depth of winter and in the heat of summer. Know the stars and where the four directions are there; know the birds that live there, know the trees they live in. Get to know these things as if they were your relatives, for, in time, you will come to know that they are. That is the most important thing you can do in order to excel at any skill in nature.*
>
> *Nature and your own heart are the best teachers, but your body, mind and spirit all have to attend the class, and do the homework. There is no replacement for this experience!*
>
> *From Kamana One: Exploring Natural Mystery by Jon Young, page 98.*

The purpose of your sit spot is ultimately to improve and deepen your understanding of natural systems by devoting yourself to consistent time in them. Seeing the same spot at different times of day and during different seasons allows you to see the dynamics of nature unfold. This is a chance to spend time in your landscape, in your garden, learning directly from it.

Your task is to:

- Find a sit spot in your garden/home site that is easy to visit and where you can feel safe and somewhat secluded from a human-dominated landscape (this will vary on your urban/rural location). Water features, trees, and the likelihood of sighting wildlife are all desirable attributes, but it is most important that the spot be a place you will be easily able to visit. (*Even if you're in a very cold climate, TRY to push yourself a bit and make this sit spot outside. If you are physically limited, cannot handle the cold, or have no access to outside space, your sit spot can be from a window of your house, presuming you can see your garden site).*
- Visit your sit spot 2-3 times this week and 2-3 times next week for a **minimum of 5 minutes** each visit. On your first visit, 20 -30 minutes is ideal. If you are antsy, set an alarm and try to be present. Here are some ideas to maximize your experience:
    - Focus on one sense at a time, trying to "stretch" the sense as far as possible. For instance, cupping your hands around your ears helps amplify any sounds and you can learn to discern sounds that are close by versus those that are far in the distance. Or spend the entire time with your eyes closed.
    - Bring a pad of paper or journal and sketch a scene, leaf, or plant specimen *(try not to sketch the whole time though.)*
    - Ask a multitude of questions beginning with "Why?"
    - Examine the layers of vegetation, evidence of animals, patterns of past human use.
    - Zoom your focus from the entire scene in front of you to the smallest leaf/insect/spec of earth. Then repeat; back and forth.
    - Continue visiting your sit spot 2 to 3 times for at least one more week.

Hopefully your sit spot is something that becomes part of your routine. Visit it at different times of the year. You may, after some time, decide to change your sit spot if this practice continues for you for more than 6 months. At that point, a fresh spot might improve the practice for you.

Looking for more? Read *Exploring Natural Mystery: Kamana One* by Jon Young or *The Forest Unseen: A Year's Watch in Nature* by David George Haskell.

Cornell Garden Based Learning

References: Adapted from the Cornell Horticulture Online *Organic Gardening* Course
Published: April 2019
Reviewer: Fiona Doherty, Michelle Podolec, Donna Alese Cooke

2.3: Exploring Climate Resiliency

Skill Level
Intermediate/Advanced

Learner Outcomes, Youth will:

- Apply existing knowledge about how climate change and its effects on communities.
- Use web-based resources to research and identify methods of climate resiliency practices.
- Reflect on the stories of others in climate sensitive environments.
- Perform role play to understand roles and responsibilities of communities planning for climate resiliency.

Education Standard(s)

- NS.5-8.6 Personal and Social Perspectives: Personal health, resources, and environments, Natural hazards, Risks and benefits
- NS.9-12.6 Personal and Social Perspectives: Personal and community health, Natural resources, Environmental quality, Natural and human-induced hazards
- HS-ETS1-3. Evaluate a solution to a complex real-world problem and environmental impacts.
- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Success Indicators
Demonstrate how they and others embrace and adapt to climate change.

Life Skills
Civic engagement, resiliency, critical thinking, problem solving, responsibility

Tags
Climate change, mitigation, global warming, sustainable gardening,

Time Needed
45 Minutes

Materials List
Devices with Internet access to watch videos (listed in "Let's Do It!) for research; newsprint or sketch pads, colored markers, pens, pencils.

Space
Appropriate space and technology to view videos and space for youth to perform role-playing.

Suggested Group Size: 15-20 or more

Introduction
Actions to address climate change may be a result of destruction and displacement from unexpected extreme weather events. Communities are taking action to plan for such future catastrophic events. This activity will introduce Climate Resiliency and how local and global communities are preparing for the future. Climate Resiliency, defined as the power for communities to understand stresses that occur as a result of a climate change event, and how they cultivate a plan to be better prepared, to adapt, reorganize, for increased sustainability for the future. Later on, in Unit 4, your group will have the opportunity to dive deeper into finding and brainstorming solutions that help prepare for climate change impacts and will work together to develop a comprehensive plan for Climate Resiliency.

Opening Questions:
- In what ways are people and living things affected by extreme weather-related events (flooding, hurricanes, etc.)?
- What are important roles of people in communities that will need to be part of the emergency planning process?

Background Information

Before the Activity
Prepare materials, technical devices and handouts; provide or suggest devices (mobile phone, tablet, laptop) with Internet access and video capability. Participants may provide their own or use a computer lab at school or in the library; Review introductory videos.

Let's Do It!
1. **People Taking Action**
   - Unless you have a meeting space to view videos as a group, have participants view these short videos before you meet to do this activity.
   - Explain to youth that they will be watching a series of videos showing people taking action and developing plans for climate resiliency. Ask opening questions.
   - Watch the following short videos of individuals and communities who started action against climate change issues.
     - **Virginia environmental conservation organization** is teaching local school children from Grandby High School, climate resilience strategies to live with rising waters through https://youtu.be/VFI5p6SvnEE
     - Cornell University New York State Water Resources Institute, **Sea-level Rise: Planning Coastal Development:** https://wri.cals.cornell.edu/hudson-river
     - **Planning a Resilient New York City** https://www1.nyc.gov/site/planning/plans/climate-resiliency/climate-resiliency.page

    - **Eight Ways Cities are Building Climate Resiliency**, https://www.iisd.org/faq/building-a-climate-resilient-city/
- Explain that later on in the program, your group will be coming up with a Plan for Resiliency they can do in their own communities. Ask:
    - What in these videos inspired you? Who inspired you, and why?
    - Are you and others you know inspired to take action in a similar way? What might that look like?
    - How might you bring your strengths and skills to the table, when helping your community plan for resiliency.
- Have youth work in small groups to sketch comic strips that explores way to solve the problem and illustrates the path needed to create a plan for resiliency:
    - What is the environmental issue/problem?
    - Policy or practice to be changed?
    - What is the goal: (We want _____ to _____ , which will result in _____.)
    - How will we do this: strategy: (In order to achieve this, we will _____.)

Talk It Over:

Share:
Have groups share their comic strips and explain why they chose to explore this problem.

Reflect
Reflecting on what you've watched, and imagining your way into creating your own video to inspire others, what and who would you feature?

Generalize
Think about a video you will create- what would be the look and feel of your video?

Apply
Take Action:

- How do you see yourself taking action in the same way the leaders in your community are?
- What ways can you continue showing others in your community how to take action?
- What are some actions you will take today to mitigate climate change?

Continue the discussion and take action for Climate Resiliency by developing an Action Plan, which you will find in the Until Four activities.

References

Cornell University New York State Water Resources Institute, Sea-level Rise: Planning Coastal Development: https://wri.cals.cornell.edu/hudson-river-estuary/climate-change-hudson-river-estuary/helping-communities-become-climate-resilient/

International Institute for Sustainable Development, Eight Ways Cities are Building Climate Resiliency, https://www.iisd.org/faq/building-a-climate-resilient-city/

NewsHour Shares, https://youtu.be/VFI5p6SvnEE

Planning a Resilient New York City
https://www1.nyc.gov/site/planning/plans/climate-resiliency/climate-resiliency.page

Learn More

Cornell Garden-Based Learning http://gardening.cals.cornell.edu

Cornell Institute for Climate Smart Solutions: https://climatechange.cornell.edu includes links to resources and related curriculum in climate change science and solutions for youth and adults.

Food Span: Lessons of our Food System, includes a final project where students develop a Food Citizen Action Plan: https://www.foodspan.org/lesson-plans/final-project/

Our Climate Our Future: https://ourclimateourfuture.org find stories about how youth across the country have been affected by climate change and climate solutions made by and for young people.

The Alliance for Climate Education: acespace.org covers the science of climate change and how youth can take action.

W!ld Center Youth Climate Summit: https://www.wildcenter.org/our-work/youth-climate-program/ Offers an annual Youth Climate Summit for local high school and higher education students.

U.S. Climate Resiliency ToolKit, https://toolkit.climate.gov

Published: June 2020
Author: Donna Alese Cooke
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