

Support Biodiversity by Starting a Seed Library

Overview: Looking for a way for your teen gardeners to dig deeper into the concept of biodiversity while also engaging in a project-based community service initiative? Invite them to start a seed library!

Grade Level/Range: 7 – 12th Grade

Objective:

Students will:

- Learn about the different kinds of biological diversity (biodiversity).
- Investigate the benefits of biological diversity.
- Understand how, in nature, seed production contributes to biodiversity.
- Delve into how commercial seed production inhibits biodiversity.
- Consider ways they can support efforts to protect and restore the biodiversity of plants.
- Learn about seed libraries.

Time: 1+ hours

Materials:

- Internet access
- Seed Library Planning Worksheet
- Variety of seeds (optional)
- Coin envelopes (optional)
- Storage bin (optional)
- Journal or notebook for record keeping (optional)

Background Information:

The term *biodiversity* (short for biological diversity) is used in several ways:

1. It can refer to the vast number of different species on Earth. Scientists estimate that there are about 10 million species on earth.
2. It can refer to the diversity of species within an ecosystem. For example, scientists estimate that 3 million different species of organisms live in the Amazon rainforest.
3. It can be used to describe the diversity of genetic material within a species.

Unfortunately, human activity is resulting in a decline in all three types of biodiversity. Scientists are racing against the clock to identify as many species as possible across the globe because so many are likely headed toward extinction. In the Amazon rainforest alone, [more than 10,000 species of plants and animals are at high risk of extinction](#) due to habitat destruction. Agricultural practices, such as selectively breeding for certain characteristics, have resulted in sharp declines in the genetic diversity of crop plants.

Students can support biodiversity by promoting genetic diversity via a seed library, which is a repository for seeds that allows people to swap, grow, and then reshare seeds from their harvest. More on that below, but first, let's look deeper into biodiversity and why it's important.

Diversity Within a Species

When genetic material is combined from two parent organisms, the resulting offspring are generally very similar to the parents, but they



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aren't carbon copies. In plants, seeds contain genetic material from both the pollen and the egg; therefore, each seed is genetically distinct from its parents.

These minor variations increase the genetic diversity of a species, and they are a driver of evolution. When faced with challenges, such as changing environmental conditions and pests, the subtle diversity of genes among individuals of the same species allows some to survive while others succumb to the stressors. Over time, as the survivors go on to reproduce and pass on their genes, the genetics of the species will slowly change. This process, called natural selection, results in adaptations that help organisms survive in the ever-changing reality of their ecosystems.

Human intervention has disrupted this natural process in many ways.

Agriculture

Large-scale agriculture production has focused on creating standardized crops through plant breeding. The intention behind the work has logical roots, such as:

- Increasing overall food production to feed growing human populations.
- Lowering the cost of production, such as by making a crop resistant to pests (lower pesticide costs) or easier to harvest (lower labor costs).
- Increasing marketability, such as improving the appearance or flavor of a crop.
- Reducing waste by producing crops that suffer fewer losses during transport or have longer shelf life.

However, in contrast to natural selection, which favors genetic diversity, human-directed selection usually results in a loss of diversity in the genetic material within the species. Whether through traditional plant breeding or genetic engineering, variation is intentionally reduced, and the plant loses some of the resiliency benefits that come from genetic diversity. Read more about [Plant Breeding Basics](#).

Seed Production

The commercialization of seed production has further decreased genetic diversity within individual species of plants. Historically, individual farmers saved seeds each year from their own crop plants that had the favorable characteristics they desired. Although the genetic diversity of their own crop plants may have been somewhat reduced, overall, the genetic diversity in crop plants remained high because of the large numbers of small-scale farms spread out over vast areas.

Things changed when seed production became concentrated in the hands of a few multinational companies. Today, just four companies control the majority of crop seed production!

In addition, plant breeders are now able to obtain patents on plant varieties that result from their work, and this has led to controversy over growers' ability to save seeds. Patent protection laws have made it illegal for farmers to save and replant seeds from patented crops. Incredibly, this extends to seeds harvested from non-patented plants that have been unintentionally fertilized by pollen from patented plants. Since seed production is responsible for the mixing of genes, limiting the collection and replanting of seeds dramatically changes the work of nature and process of natural selection.

If you would like to dive deeper into the history and current state of intellectual property rights involved in plant breeding, The Organic Seed Alliance has published [A Guide to Seed Intellectual Property Rights by Paulina Jenney](#).

Diversity Within Agricultural Ecosystems

In addition to the decrease in diversity on the genetic level, human actions have also led to the decrease of biodiversity on the ecosystem scale. From the [FAO's State of the World's Biodiversity for Food and Agriculture Report](#), more than 6,000 different types of plant species

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have been grown for food throughout human history. However, currently only 200 species make major contributions to our food system and 9 different plants currently account for 66% of total crop production (sugarcane, maize, rice, wheat, potatoes, oil-palm fruit, soybeans, cassava, and sugar beets). This means that a significant portion of cropland worldwide is dedicated to a very small number of types of plants.

Why does biodiversity in crop plants matter? A devastating example is the Great Hunger. The lack of genetic diversity in potatoes led to this 1845-1850 famine that occurred after potato blight decimated potato crops. More than one million people in Ireland alone died during the famine.

How Can We Support Increased Biodiversity?

Here are a few ways:

- Grow [heirloom and open-pollinated \(non-hybrid\) plants](#) that contain a diversity of genetic material and then save the seeds to replant and to share. (Learn more: [Growing and Saving Heirloom Seeds](#))
- Diversify our landscapes and our diets to encourage the planting of more variation of species. (Learn more: [The Role of Native Plants and Pollinators in Biodiversity](#))
- Start a **seed library**.

Seed Libraries

A seed library is a repository for seeds that allows for people to swap, grow, and then reshare seeds from their harvest. Seed libraries help support seed diversity in several ways:

- They support the genetic diversity of individual species level by encouraging people to plant and save seeds of open-pollinated (non-hybrid) varieties.
- They support biodiversity on an ecosystem level by inspiring people to try new plants and by making it more affordable to plant a diversity of plants.
- They offer resources to help increase people's knowledge about growing seeds and build awareness about the importance of seeds and biodiversity.

Seed libraries are popping up all over the world! Here's what's needed to start a seed library:

- A collection of open-source seed (seed that is not under restrictions of patents)
- A safe place to store seeds that is easily accessible to gardeners
- Directions for saving and submitting seeds back to the library

To prevent seeds in storage from germinating, a seed library must provide conditions that are the exact opposite of what seeds need to grow. Seeds should be completely dry before storing, and they should be stored in a place that is cool, dark, and dry. If stored properly, seeds will remain viable for at least two to three years, if not longer, depending on the plant type. Check out [Saving Seeds](#) and [Save Your Seeds](#) for more details.

Where can you set up a seed library? As sites with regular community foot traffic, traditional libraries, and community centers often provide ideal conditions for a seed library.

Laying the Groundwork:

Share the following quote from the opening of [The International Commission on the Future of Food and Agriculture's Manifesto on the Future of Seeds](#):

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"Seeds are a gift of nature, of past generations and diverse cultures. Thus, it is our inherent duty and responsibility to protect them and to pass them on to future generations. Seeds are the first link in the food chain, and the embodiment of biological and cultural diversity, and the repository of life's future evolution."

Ask students to discuss the quote. You can use the following questions to lead the discussion:

- What is a seed? How are they made?
- What are the reasons this author gives for seed being important? Can you think of other reasons?
- What does biological diversity mean? Why do seeds represent biological diversity?

Use the background information to teach students about biodiversity and discuss some of the reasons why seed biodiversity is decreasing. Ask them to find and read a published resource about the importance of seeds and biodiversity. Below are a few articles representing a range of reading levels that you could suggest:

- Young People's Trust for The Environment's [Seed Saving Factsheet](#)
- National Geographic's [Saving Seeds Article](#)
- Smithsonian Center for Folklife & Cultural Heritage Magazine's article ["Seeds Have Stories': Connecting Cultural Diversity and Biodiversity"](#) by Gabrielle Puglisi
- [Reducing biodiversity loss: Gardens could be an Eden for vulnerable plants](#) by Nature Publishing Group
- [The State of the World's Biodiversity Brief](#)
- The Food and Agriculture Organization of the United Nation's [The State of the World's Biodiversity for Food and Agriculture Report](#)
- The International Commission on the Future of Food and Agriculture's [Manifesto on the Future of Seeds](#)
- [Bloody Marvels: In Situ Seed Saving and Intergenerational Malleability](#) by Katharine Dow in the National Library of Medicine

As they read, ask students to look for answers to the following questions:

- Why is biodiversity of plants decreasing?
- Why are seeds important to biodiversity?
- What can we do to help increase biodiversity of plants?

Exploration:

1. Based on the Laying the Groundwork discussion and research, ask students to share what they learned about biodiversity and brainstorm a list of ways people can help support increasing biodiversity of plants.
2. Present the idea of a seed library: a collection of open-pollinated (non-hybrid) seeds for people to "borrow," grow, and then return harvested seeds to share with others. You may want to share information from the [Seed Libraries Group](#) or show introductory videos such as this one by [PBS on a seed library started in Alaska](#).
3. Ask students to consider creating a seed library in your community. What do they think of the idea? Would it be useful? Are there people who could help get one started? What kind of details would they need to consider? They can use the Seed Library Planning Worksheet as a guide for gathering their thoughts.
4. Ask students to create a seed library proposal either as an individual or group project. Charge them with creating both a

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paper and presentation to share with the class. The proposal should include:

- Background information about the issue of biodiversity and why seed libraries can help
- Goals for their seed library
- Summary of community needs and possible supporters
- Detailed logistics on steps for starting a seed library, including a list of supplies and funds needed

Making Connections:

After the presentations, ask students to evaluate the practicality of starting a seed library based on their collective findings. Estimate the costs and time needed to set it up and keep it running. Consider challenges that may arise and constraints they may face. Predict the impact the seed library could have on your school, community, and the local environment.

If the class decides to move forward with creating a seed library, combine individual and/or group presentations into one presentation and present to peers, administrators, and community members. Seek out partnerships with local garden clubs, Master Gardeners, and garden centers to support your efforts.

Once the seed library is ready to go, kick it off with a seed swap event and ask folks to bring seeds to share.

Branching Out:

- From plant breeders to landscape designers, there are many different careers for people interesting in further the cause of preserving plant biodiversity. Ask students to explore Seed Your Future for available job opportunities.
- Dive deeper into the controversies around [Intellectual Property Rights in Plant Breeding](#). Ask students to debate both sides of the argument representing both the plant breeders who have invested heavily in creating new varieties and the farmers/gardeners who have been negatively impacted by their work.
- Watch the TEDxTC Talk by Winona LaDuke on [Seeds of Our Ancestors, Seeds of Life](#)

Related Articles:

Teen Sends 3 Sisters Seed Boxes Nationwide:

<https://kidsgardening.org/garden-stories-3-sisters-seed-boxes/>

Save Your Seeds:

<https://kidsgardening.org/resources/garden-activities-save-your-seeds/>

Saving Seeds:

<https://kidsgardening.org/resources/gardening-basics-saving-seeds/>

Growing and Saving Heirloom Seeds:

<https://kidsgardening.org/resources/digging-deeper-heirloom-seed-saving/>

Seed Banks:

<https://kidsgardening.org/resources/lesson-plan-seed-banks/>

Links to Next Generation Science Standards

HS-LS2-7.

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

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HS-ETS1-3.

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

HS-ESS3-4.

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-LS4-6.

Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. LS4.D: Biodiversity and Humans: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6) (Note: This Disciplinary Core Idea is also addressed by HS-LS2-7.)

MS-LS2-5.

Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-LS4-5.

Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

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Seed Library Planning Worksheet

Answer the following questions to begin the planning process for a seed library:

1. List community members who would benefit from having a seed library:
2. Do we have access to a space that could offer the right conditions for a seed library? Is this space accessible for community members to visit?
3. Where would we get seeds to start a seed library? Are there any local gardening clubs or organizations that could help? Are there any businesses or government organizations that might be able to help? How many seeds would we need to started?
4. In addition to seeds, what materials would we need to start a library? Would we be able to find donations or funding to obtain needed supplies?
5. What information would we need to share with folks checking out the seeds so they can be successful growing the plants?
6. How can we track the seeds that are shared/check out?

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7. Who will help run the seed library and keep it organized?

8. What will we do if people are not able to harvest and return seeds to the library to share?

9. How could we promote the seed library? How can we use the seed library to spread awareness about the importance of seeds and biodiversity?

10. What additional considerations need to be made before starting a seed library?

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