

What's Up? Growing Plants on the Roof

Overview: Finding space for plants and gardens in urban areas can be a challenge. Green roof technology offers a way to expand cultivated square footage where open land is in short supply.

Grade Level/Range: 9–12th Grade

Objective: Students will investigate the benefits of green roof installations and begin to explore the technology behind their construction.

Time: 1 hour

Materials:

- Internet access



Background Information

A simple rooftop garden can be created by placing planting containers or potted plants on a roof that can support the added weight and is safe for people to visit. Rooftop gardens are especially beneficial for urban residents, offering a slice of nature and a place to produce fresh food in locations where green space is limited.

A green roof is a more elaborate growing experience where the "garden" actually becomes the roof. A green roof consists of several engineered layers: a water- and root-proof membrane on the bottom, followed by a drainage layer, a filter cloth, and growing medium (lighter than soil) on top. There are two types of green roof systems — "extensive" and "intensive." An extensive green roof weighs less than an intensive green roof. It generally has shallower growing material and heartier plants that require little maintenance. Intensive green roofs are the most like gardens on the ground — with deeper growing material, more intricate or delicate plantings, and more maintenance needs such as irrigation and pruning.

Just like rooftop gardens, a green roof can offer natural beauty and the potential to grow food crops, but they also offer broader environmental benefits. Green roof systems:

- decrease storm water runoff
- reduce air pollution
- reduce a city's heat island effect
- insulate the building to decrease energy costs

Since natural soils are heavy, particularly when wet, rooftop gardeners and green roof systems typically use lightweight growing media consisting of high-quality compost and recycled materials.



The purposes of these materials are to be water permeable; to retain water and air; to resist rot, heat, flying sparks, frost, and shrinkage; to provide nutrients appropriate to the chosen plants; and to provide a rooting medium. Generally, the growing media should be as deep and have as great a volume as possible within the constraints of the structural capacity, in order to provide plants with stability in wind and keep the system from becoming too dry. Rooftops can be hostile environments for plants due to the effects of wind, heat, rain, and shadows. Extra insulation may be needed inside and/or outside of planting containers to protect plants from freeze/thaw cycles in winter. A rule of thumb is that wind speed doubles for every ten stories of building height. Windy conditions increase the loss of moisture from growing media and leaves, so drought-tolerant plants often survive best.

Laying the Groundwork

Introduce the concept of a green roof to students. The video *How Green Roofs Can Help Cities* from NPR provides a concise overview and is available at: <https://www.youtube.com/watch?v=FIJoBhLnqko>

Next, divide students into teams and ask each team to research one of the noted benefits of green roofs, which may include one of the following:

- decrease storm water runoff
- reduce air pollution
- reduce a city's heat island effect
- insulate the building to decrease energy costs
- provide habitat for wildlife
- beautify urban landscapes

Give students a chance to share their findings with each other. After exploring benefits, ask students if they also discovered any challenges of green roofs during their research. Why do you think we do not see many green roofs in our urban areas?

Exploration

1. Ask students to brainstorm a creative design for a rooftop garden or a green roof for your school or another building and/or home in your community. Have them answer the following questions:
 - Why do you think plants would be beneficial for this building?
 - Would you want to install a garden or a green roof? Why?
 - Is this space currently accessible? How would people interact with your installation?
 - What kind of plants would you like to have in your design? Explain your selection.

Ask them to sketch their garden or create a 3-D model of their space to share their vision.

2. Once they have designed their dream garden, ask them to make a list of all the information they would need to gather to determine the feasibility of actually installing their design. Questions may include: How much weight can the roof hold? How much would it cost? How would we care for the plants? You can share the following resources with them to help them come up with their questions:

Using Green Roofs to Reduce Heat Islands from the EPA: <https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands#costs>

Reducing Urban Heat Islands: Compendium of Strategies – Green Roofs from the EPA: https://www.epa.gov/sites/default/files/2017-05/documents/reducing_urban_heat_islands_ch_3.pdf

The Roof is Growing! From The American Society of Landscape Architects:

<https://www.asla.org/greenroofeducation/index.html>

Green Roofs from The Soil Science Society of America:

<https://www.soils.org/about-soils/green-roofs/>

About Green Roofs from Green Roofs for Healthy Cities:

<https://greenroofs.org/about-green-roofs/>

3. Ask each student to share their list and, as a group, discuss the role green roofs and rooftop gardens could have in your community.

Making Connections

Ask each student to find an example of a green roof or rooftop garden project spotlighted in a recent article or in video. Ask them to create a summary of their project to share with the class.

Branching Out

Landscape Architects often serve as the lead for green roof initiatives. Encourage students to explore careers in landscape architecture. The following web resources can help:

- American Society of Landscape Architects website at: <https://www.asla.org/greenroofeducation/career-discovery.html>
- Seed Your Future at: <https://www.seedyourfuture.org/careers>