

# The Roof is Growing!

A top-down approach to saving the environment

## Overview

“The Roof is Growing!” is a lesson developed by the American Society of Landscape Architecture (ASLA) to engage and educate middle school students about green roofs and their environmental benefits. A green roof is a roof substantially covered with vegetation.

Students investigate how green roofs can make a difference in four key environmental areas:

- Reducing stormwater runoff
- Alleviating the urban heat island effect
- Improving air quality
- Providing habitat for wildlife.

Using an online, interactive program and a workbook, students gather facts about green roofs. They then apply their knowledge by preparing a proposal for building a green roof on the Frederick Law Olmsted School auditorium.

## Grade Levels

6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup> grades

## Connections to the Curriculum

Mathematics, Geography, Science, Art

## Academic Standards

“The Roof is Growing!” lesson design is based on relevant academic standards for Grade Levels 6 to 8 created by the Mid-Continent Research for Education and Learning (McREL). Local academic standards can be matched to these national standards.

- **Mathematics Standard 4:** Understands and applies basic and advanced properties of the concepts of measurement
- **Geography Standard 14:** Understands how human actions modify the physical environment
- **Geography Standard 18:** Understands global development and environmental issues
- **Science Standard 6:** Understands the nature of scientific inquiry
- **Art Standard 1:** Understands connections among the various art forms and other disciplines

View the benchmarks associated with each academic standard on the Teacher Resources page of “The Roof is Growing!” website.

## TEACHER GUIDE



## THE ASLA GREEN ROOF

The American Society of Landscape Architecture (ASLA) is the national professional association for landscape architects representing more than 18,000 members across the U.S. and abroad.

In April 2006, ASLA completed construction of a green roof on its headquarters building. It was designed by the nationally recognized landscape architecture firm Michael Van Valkenburgh Associates, Inc., with landscape architects Conservation Design Forum as technical consultants.

The ASLA green roof was planned as a demonstration project, both to showcase the feasibility and benefits of green roofs to communities, and to showcase design excellence in this project type.

American Society of Landscape Architects  
636 Eye Street, NW  
Washington, DC 20001



## Student Outcomes

After completing “The Roof is Growing!” lesson students will:

- Define the term “green roof”
- Describe four key environmental benefits of a green roof
- Calculate the actual environmental benefits a green roof provides
- Describe a landscape architect’s role in creating a green roof

## Implementation

“The Roof Is Growing!” lesson is flexible and can be implemented in a variety of formats as described below.

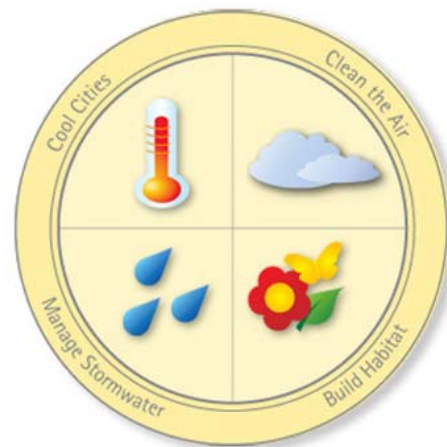
- Field trip + “The Roof Is Growing!” lesson  
A visit to the ASLA green roof or a green roof in your area is a great way to introduce the lesson.
- “The Roof Is Growing!” lesson  
Since the program’s web component provides a virtual tour of the ASLA green roof, it functions as a stand-alone lesson. Students can also visit other green roofs virtually.
- “The Roof Is Growing!” lesson + extensions  
The Teacher Resource page on “The Roof Is Growing!” website provides suggestions for extending the lesson.

Students can complete “The Roof Is Growing!” lesson individually or in small groups.

## Materials

- Computer with Internet access
- Teacher’s Guide “The Roof is Growing!”
- Student Workbook “The Roof is Growing!”
- Student handout “Going Green: The Frederick Law Olmsted School Green Roof Project”
- Student handout “Green Roof Facts”
- Maximum number of students: no limit

## GREEN ROOFS ARE GOOD FOR THE ENVIRONMENT



## SEE A GREEN ROOF UP CLOSE

[Sign up](#) for a tour of the ASLA green roof in Washington, DC.

Tours of the ASLA green roof are available for groups or individuals on Tuesdays, Wednesdays and Thursdays between 10:00am and 2:00pm.

Go to the Teacher Resources page of “The Roof is Growing!” website to sign up

Outside the Washington, DC area, try this link to locate a green roof near you.  
[www.greenroofs.com/projects/](http://www.greenroofs.com/projects/)

## Suggested Procedure

### PREPARATION

Prepare for teaching “The Roof is Growing!” lesson by:

- Printing and reviewing the Teacher Guide and Student Workbook.
- Reviewing “Explore the Benefits of a Green Roof” website.
- Familiarizing yourself with green roofs and their environmental benefits. Suggested resources are provided on the website’s Teacher Resource page.
- Copying sufficient numbers of the Student Workbook and handouts (“Going Green: The Frederick Law Olmsted School Green Roof Project” and “Green Roof Facts”).

### OPENING

Introduce the topic of environmentalism.

- What does “taking care of the environment” mean to you?
- Why is it important that we take care of the environment?
- What steps are we taking at school to be more environmentally conscious? What are you doing at home?

Introduce the topic of green roofs.

- Explain that one way to be environmentally conscious is right over our heads.
- Ask if anyone has heard about green roofs. What do you know about them? Are there any in our area?
- Show some examples of buildings with green roofs. Be sure to include any green roofs in your area.

Explain green roofs and briefly summarize how they benefit the environment.

- A green roof replaces traditional roofing with a lightweight, living system of soil, compost, and plants. It creates a thin, green skin atop a building that gives a little bit back to the world.
- The plants – and the soil and gravel that hold them – filter rainwater and some of its pollutants. The plants produce oxygen that helps clean the air.
- A green roof helps to reduce a building’s heating and cooling costs because it acts as a form of insulation. They also help to lessen what’s called the urban heat island effect, which occurs when buildings warm up so much that they heat their surroundings.

Explain that students will have the opportunity to learn more about green roofs and their environmental benefits as they complete the “The Roof is Growing!” lesson.

- Share your implementation strategy with the students – introduce the lesson along with any plans for a field trip or extension activities.

### BACKGROUND INFORMATION

A green roof is a roof substantially covered with vegetation. Since the 1970s, green roofs have increasingly become part of the European landscape, where there are over 100 million square feet of planted roofs today. Faced with soaring and unpredictable energy costs and the desire for higher performance buildings, more U.S. building owners are opting for green roof technology.

Studies show that green roofs provide incredible economic, environmental, and aesthetic benefits. Green roofs significantly reduce stormwater runoff and provide water filtration; improve air quality; reduce the urban heat island effect; restore biohabitat in urban areas; and provide many other benefits.

### MORE ABOUT GREEN ROOFS

For other resources that provide deeper background information about green roofs and their environmental benefits visit this link on the Teacher Resource page of “The Roof is Growing!” website.

## DEVELOPMENT

Introduce “The Roof is Growing!” lesson.

- Distribute and review “The Roof is Growing!” Student Workbook.
- If possible, log onto the website and review the site with the students. Consider showing the 360° Tour of the ASLA green roof.
- Explain that students will complete the workbook as they do the online activity.

Provide the assignment.

- Explain how students will complete the online activity – individually or in small groups.
- Provide the timeframe for completing the online activity and Student Workbook.

Explain how the students will use the facts and figures they learn about green roofs.

- Distribute and review the “Going Green: The Frederick Law Olmsted School Green Roof Project” handout. It introduces the Frederick Law Olmsted students and their goal of putting a green roof on their new auditorium.

## SUGGESTED STUDENT ASSESSMENT

Through class discussion, determine students’ understanding of and attitude toward green roofs and their environmental benefits.

- How would you explain to someone what a green roof is?
- In your opinion, what is the most important environmental benefit of green roofs? Why?
- What’s your opinion? Would people and the environment benefit if green roofs were put on new and existing buildings in our city?
- Do you think it’s a good idea for cities to provide tax incentives for people to build green roofs? Why or why not?

Distribute the “Green Roof Facts” worksheet.

- Have students complete the worksheet as homework or an in-class activity.
- Review the students’ answers and provide corrective feedback as needed.

## [Visit the ASLA Green Roof online.](#)



Access a [360° virtual tour](#) of the ASLA green roof from the Home page of “The Roof is Growing!” website.

## VOCABULARY

**greenhouse gases** – Gases in the Earth’s atmosphere that prevent heat energy the Earth has absorbed from the sun from escaping back into space.

**impervious surface** – An artificial surface that doesn’t allow water to flow through it.

**particulate matter** – Small particles of dust and soot that float in the air; they are an indication of air pollution.

**photosynthesis** – The way a plant makes food for itself. The process absorbs carbon dioxide and releases oxygen.

**stormwater runoff** – Water that flows over the ground surface into the sewer system.

**urban heat island effect** – Increased summertime temperatures in cities that occur when natural land is replaced with buildings, pavement, and roads that trap heat.

**watershed** – The land that catches rainwater and then drains it into streams, rivers, lakes, or groundwater.

## EXTENDING THE LESSON

Consider extending the lesson in these ways:

- Have students prepare a green roof proposal that the students at the fictional Frederick Law Olmsted school could present to their principal and School Board.
- Then have students give their presentations.

## CAREER DISCOVERY

Extend the lesson by discussing landscape architecture as a career choice.

- Tell students to review the Career Discovery page on the ASLA “The Roof is Growing!” website and select the type of projects they think would be most interesting. Ask them to think about what kind of skills a landscape architect needs in order to be successful.
- Lead a classroom discussion about the career of landscape architecture. Ask students to name the different types of jobs available in the field. Ask them to identify the skills a landscape architect needs to have.
- Consider inviting a landscape architect to speak to your class about green roofs and landscape architecture in general. Have students prepare questions for the speaker.
- Visit this link on the ASLA website to find out if there is an ASLA chapter in your area.  
[www.asla.org/states/ChPr.htm](http://www.asla.org/states/ChPr.htm)

## EXTENSION ACTIVITIES

For suggested extension activities to complement this lesson, visit the Teacher Resource page of “The Roof is Growing!” website.

## WHAT DOES A LANDSCAPE ARCHITECT DO?

The ASLA website “The Roof is Growing!” includes a Career Discovery page that provides opportunities for students to explore the career of landscape architecture.

The page provides links to videos, readings, and an activity that introduce the variety of jobs available in landscape architecture and the skills needed to enter the field.

# Going Green

## The Frederick Law Olmsted School Green Roof Project



Meet the students at the Frederick Law Olmsted Middle School. They care about the environment and are doing their part to take care of it.

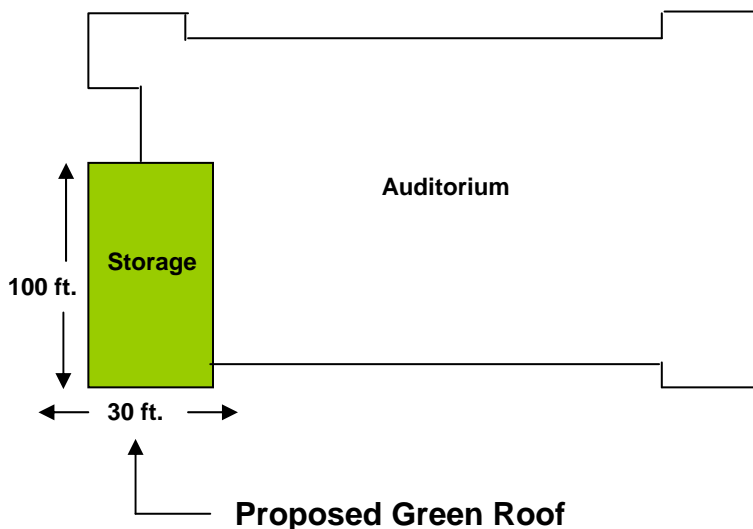
Working with their principal and teachers, the students have set up a recycling program at school. They also make sure that all unused electronic devices, like computers, are unplugged at the end of the day.

On a recent field trip, students at Frederick Law Olmsted Middle School learned about the environmental benefits of a green roof. The new natural history museum in their town has a green roof and the landscape architect who designed it took them on a tour.

The students think it would be a great idea to have a green roof on their new school auditorium. Construction on the building will begin next year. The students are going to create a green roof proposal to present to the principal.

### Project Specifications

In their proposal, the students want to provide facts and figures about how a green roof will benefit the environment in their city. To make these calculations they needed to know some information about the roof that will be going on the auditorium. Below is an drawing of the auditorium that the architect provided.



### WHO WAS FREDERICK OLMSTED?

*Frederick Law Olmsted Middle School is named after Frederick Law Olmsted (April 25, 1822 – August 28, 1903), an American landscape designer and father of American landscape architecture.*

*He is famous for designing many well-known urban parks including Central Park in New York City. He also designed the landscape surrounding the United States Capitol building in Washington, DC.*

# Green Roof Facts

Help the Frederick Law Olmsted Middle School students write their green roof proposal by calculating how the roof will benefit the environment.



The roof the students want to build measures 30 feet by 100 feet. If the students' proposal is accepted, how many square feet of green roof will be built?

YOUR ANSWER

## Cool Cities

The average summertime temperature in the city where the school is located is 79° Fahrenheit. What would the temperature be if measured in Celsius?

YOUR ANSWER

The students know that the green roof can easily reduce the temperature of the surrounding air by 9° Fahrenheit. How much will that reduce the cooling demands in the building?

YOUR ANSWER

## Clean Air

How many pounds of particulate matter will the green roof absorb if it is built on the portion of the auditorium that the students are proposing (30 feet by 100 feet).

YOUR ANSWER

## Build Habitat

How much will it cost to build an extensive green roof on the selected portion of the school's auditorium?

YOUR ANSWER

By building a green roof instead of a conventional roof, how much more will it cost to construct the roof?

YOUR ANSWER

## Manage Stormwater

Students researched the monthly rainfall in their city. They found this information for the previous summer: June 3.38 inches, July 3.80 inches, August 3.91 inches.

Based on that information, how much rainwater can they predict a green roof will absorb during the summer?

YOUR ANSWER

# Green Roof Facts

## ANSWER KEY

Help the Frederick Law Olmsted Middle School students write their green roof proposal by calculating how the roof will benefit the environment.

The roof the students want to build measures 30 feet by 100 feet. If the students' proposal is accepted, how many square feet of green roof will be built?

ANSWER

3,000 square feet

### Cool Cities

The average summertime temperature in the city where the school is located is 79° Fahrenheit. What would the temperature be if measured in Celsius?

ANSWER

26° Celsius

The students know that the green roof can easily reduce the temperature of the surrounding air by 9° Fahrenheit. How much will that reduce the cooling demands in the building?

ANSWER

25%

### Clean Air

How many pounds of particulate matter will the green roof absorb if it is built on the portion of the auditorium that the students are proposing (30 feet by 100 feet).

ANSWER

750 pounds

### Build Habitat

How much will it cost to build an extensive green roof on the selected portion of the school's auditorium?

ANSWER

\$30,000 - \$75,000

By building a green roof instead of a conventional roof, how much more will it cost to construct the roof?

ANSWER

\$15,000 - \$45,000

### Manage Stormwater

Students researched the monthly rainfall in their city. They found this information for the previous summer: June 3.38 inches, July 3.80 inches, August 3.91 inches.

Based on that information, how much rainwater can they predict a green roof will absorb during the summer?

ANSWER

9.92 - 11.09 inches