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Home Improvement » Roof

Plant a green roof

Create an energy-efficient home or office (if you're able to modify your roof space) by planting a rooftop garden on your building's uppermost surface. You'll not only reduce cooling and heating costs, but you'll be providing valuable wildlife habitat and maybe even some green space for employees or family time. A bonus: you may qualify for LEED certification points.

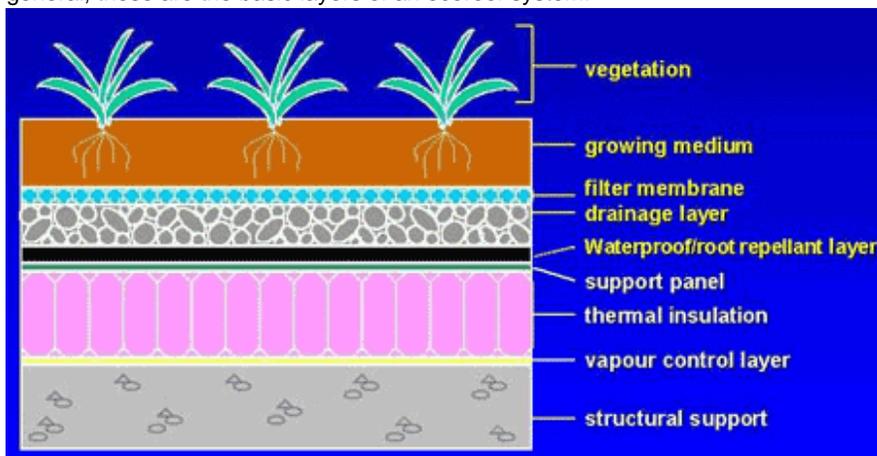
How to plant a green roof

The structure and style of green roofs varies tremendously depending on climate, building design, purpose, and aesthetic interests. Here are some ideas to get you started:

1. **Be inspired:** Discover the unique beauty and diversity of green roofs being grown around the world by checking out Green Roofs Australia's photo gallery as well as the Green Roof Maps. Then, for a good chuckle, take a gander at inhabitat's green roof spin-off idea—the grass wheel.
2. **Educate yourself:** Following are several organizations offering courses on green roof design:
 1. Green Roofs For Healthy Cities offers several courses on green roof design in cities across Canada and the US.
 2. Green Roofs Australia has periodical introductory courses and conferences.
 3. Also check out Greenroofs.com's greenroofs 101 online learning tools, their listing of upcoming events, and their greenroof.tv video segments for some basic educational information.
 4. Living roofs
 - a collaborative project between English Nature and Livingroofs.org, this leaflet gives information on greening small roofs such as those found on sheds.
3. **Determine whether existing roof is sufficiently strong:** Whether you're building new or re-roofing, you'll need to determine whether your roof is strong enough to handle a green roof addition. Green roofs weigh between 10 and 25 pounds per square foot (saturated weight) in addition to snow load requirements. Check with a structural engineer, roof consultant, or architect before you get started. Many cities require a signed document from a structural engineer stating a roof's stability before building permits are given out.
4. **Hire a green roof consultant:** Browse through the corporate directories on Greenroofs.com and Green Roofs For Healthy Cities for product suppliers and contractors specializing in green roofing technologies.

Components of green roofs

The components of a green roof depend somewhat on the building structure and capacity, as well as desired aesthetic results. However, in general, these are the basic layers of an ecoroof system:



- **Roof support:** Existing and new roof structures need to be sufficient to hold the weight of a green roof, so they are an important component.
- **Insulating layer:** Depending on the climate, a layer may be added to provide additional insulation.

- **Waterproof membrane:** This impermeable liner protects the underlying roof structure and can be made from synthetic rubber (EPDM), hypolan (CPSE), reinforced PVC, or modified asphalt.
- **Root resistant layer:** These barriers inhibit root penetration and may or may not be required, depending on the vegetation chosen and the material used for waterproofing. Modified asphalts require a root barrier, but the other materials noted above do not. Plant species such as bamboo, lupines, and blackberries should be avoided as they are known to have aggressive root systems.
- **Drainage layer:** A porous layer made of perforated plastic components or gravel. This may optionally be connected to drain pipes that safely drain excess rainwater into a harvesting system (rainbarrels, cisterns, or stormwater facilities). In addition, gravel ballast may be placed along the perimeter of drain pipes, air vents, and other vertical elements to allow easy maintenance access.
- **Growing medium:** Your substrate or growing medium can contain a combination of some of the following materials: soil, compost, pumice, perlite, coir, or expanded clay or shale. The thickness of this layer will depend on what type of green roof (**see Types of green roofs below**) you choose.
- **Vegetation:** Many rooftop gardeners prefer to use plants that are very low maintenance (especially those used in sloped roof applications). They choose vegetation that's not only perennial or self-sowing, but also wind-, cold-, and drought-tolerant (since they will not be watered often, if at all). Also consider how much trimming, fertilizer, pesticide, or herbicide applications will be required, and look for growth patterns that will cover the substrate thoroughly to prevent soil erosion and moisture evaporation. Vegetation should also be fire resistant. Common low-maintenance plants used for green roofs include succulents, sedum, herbs, and grasses.

Types of green roofs

Ecoroofs fall into two general categories:

Extensive

- Vegetation: generally accommodates groundcover species, succulents, and grasses
- Substrate depth: one to 6 inches
- Weight: building structure must be able to handle a load 12-50 pounds per square foot heavier than conventional roof structures
- Access & maintenance: requires little maintenance (annual inspections) and therefore infrequent access
- Drainage & irrigation: uses simple irrigation and drainage systems

Intensive

- Vegetation: larger species, including trees, shrubs, high-maintenance gardens
- Substrate depth: one foot or greater
- Weight: building structure must be able to handle a load 80-150 pounds per square foot heavier than conventional roof structures
- Access & maintenance: frequent access required for higher levels of maintenance and should include railings, lighting, etc.
- Drainage & irrigation: requires more complex irrigation and drainage systems

Find it! Green roof products

Barrett Roofing Green Roofs



Extensive green roofing products and services.

Building Logics



Pre-vegetated and build-in-place green roof systems.

Eco-Roof Systems



Custom designed green roofs, both intensive and extensive.

ELT Easy Green



Pre-grown products for intensive, extensive, and hybrid green roof systems.

Green Roof Blocks



Green roof blocks for flat and sloped roofs, roof drain components and edging, etc.

GreenGrid System



Pre-planted green roof modules made of recycled plastic. The company also carries recycled-content furniture, walkways, ponds, and much more.

Hydrotech Green Roofs



Green roof systems, both intensive and extensive, for flat or sloped roof applications.

LiveRoof



Sells pre-vegetated modular green roof products. Claims to be seamless, instantly transforming your roof with beautiful greenery.

Rooflite



Rooflite can provide materials for intensive, semi-intensive, and extensive green roofs throughout North America.

Planting a green roof helps you go green because...

- They insulate buildings resulting in reduced heating and cooling energy requirements
- Green roofs stem the flow of stormwater runoff, which reduces strain on municipal water systems during heavy rainfalls and protects rivers and streams
- Foliage and soil on green roofs filter rainwater, making it safer to return to natural watersheds
- They extend the lifespan of an underlying roof membrane by protecting it from sun exposure, inclement weather, and temperature variations
- They increase vegetation and wildlife habitats for birds and other small animals in urban centers
- Smog is reduced and air temperatures are lowered where green roofs have been installed
- They can provide a local source of food, thus reducing food miles for those harvesting rooftop crops

Green roofs (alternately known as rooftop gardens, ecoroofs, or living roofs) have been in use in Europe for over 40 years providing many benefits to cities, businesses, and homeowners alike.[1]

Private benefits of green roofs

Though green roofs are often pricier up-front than conventional roofs, they provide financial benefits to building owners in two ways. First, because they can reduce heat gain by up to 95 percent, they help reduce cooling costs.[2] Through the process of evapotranspiration, vegetated roofs reduce overheating of buildings so that the temperature indoors remains relatively cool during very hot months.[3] Studies conducted by the Centre for the Advancement of Green Roof Technology demonstrated that the outer membrane of a green-roofed building experienced 68 days of 20°C and zero days of 30°C temperatures, compared to a conventional building which had 257 days of 20°C and 206 days of 30°C temperatures.[4]

Although the greatest energy savings can be seen during summer months, green roofs have also been shown to provide insulation to buildings during cold winter months. Preventing heat from moving through the roof and out of a building, intensive green roofs with thicker layers of soil and more substantial vegetation keep heat within a building by protecting it from wind which draws heat away. Tests done by the National Research Council of Canada, the University of Toronto, and Environment Canada have shown that heat loss during cold weather can be reduced by 10 percent with green roofs.[5]

A second financial benefit of green roofs comes from their ability to protect roofing materials beneath. Green roofs cover and protect roof membranes, shielding them from heat and ultra-violet radiation, thermal stress (expansion and contraction), and physical stress (wind, hail, foot traffic).[2]

This results in roof lifespans that are two to three times longer than conventional roofs, thus requiring fewer roof replacements.[6] The typical green roof lifespan is estimated around 40 years.[7]

Many homeowners and businesses also use rooftop gardens as a source of locally produced food. By growing fruits, vegetables, and herbs on a rooftop garden, both home cooks and commercial chefs are able to harvest home-grown crops, thereby reducing food costs and food miles at the same time. In fact, the Fairmount Waterfront Hotel in Vancouver, British Columbia, was able to reduce food costs by an estimated \$30,000 per year by growing produce and flowers on their rooftop garden.[8]

In addition to these financial benefits, green roofs also reduce noise levels by providing a layer of sound insulation. Substrate materials block lower sound frequencies while plants block higher sound frequencies. Together, they can reduce noise by up to 50 decibels.[9]

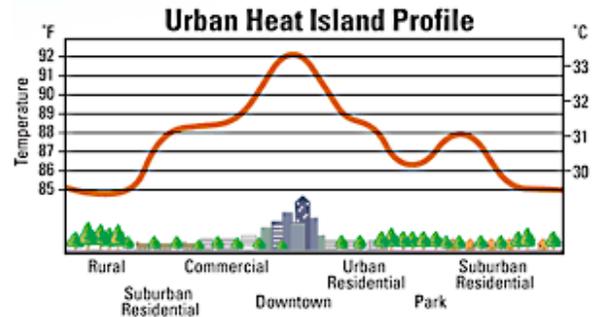
Public benefits of green roofs

Rooftop gardens have been shown to filter airborne particulates and remove carbon dioxide from the atmosphere.[10] They also filter and retain stormwater. The substrate used for green roofs filters any rainwater that happens to runoff, but retains a good portion of rainwater until it is taken up by the vegetation planted there, resulting in runoff decreases up to 28 percent. This reduces the strain on municipal water

systems and may help to prevent freshwater contamination by overflowing sewage in wastewater facilities.[11]

Green roofs also provide recreational space that can be used as healthy retreat spaces for employees, educational environments for daycares, and therapeutic areas for patients in hospitals.[10]

Additionally, green spaces can provide habitat to wildlife and insects, including some rare and endangered species.[12]



Of all of the public benefits associated with green roofs, probably the most dramatic is reduction of the urban heat island effect. Hard, reflective surfaces within a city (roofs, paved sidewalks, brick siding, etc) absorb solar radiation and release it back into the atmosphere as heat creating a bubble of higher temperatures in urban areas (compared to temperatures in the countryside nearby). By covering these surfaces with vegetation, more comfortable temperatures can be achieved within cities.[13]

Drawbacks

Generally speaking, green roofs cost more upfront than conventional roof installations. Green roofs installed on new buildings cost on average \$10-15 per square foot, and when re-roofing a building about \$15-25 per square foot. By comparison, conventional roofs on new buildings run anywhere from \$3-9 per square foot, and re-roofing can cost between \$5-20 per square foot.[14] However, the benefits noted above (reduced heat gain and longer roof lifespans) mitigate the up-front costs of green roofs within a few short years.[2]

Related health issues

Green roofs can improve the health of urbanites through air and water purification and heat absorption. Studies prepared by Ryerson University for the City of Toronto have shown that atmospheric contaminants, including carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particular matter 10 microns or smaller (PM10), and sulfur dioxide (SO₂), were reduced in the presence of green roofs. With 100 percent green roof implementation, that city could potentially reap \$1,970,000 in annual air quality benefits.[15] That same study indicates pollution reduction in stormwater systems, resulting in a pollutant reduction benefits of \$14 million annually.[16]

As noted above, the urban heat island effect results in urban air temperatures that are higher than surrounding rural areas, which can increase heat-related illnesses and deaths.[17]

Vegetation on buildings with green roofs absorb a great deal of heat and can help to reduce a city's urban heat island temperature by up to 2°C.[13]

In addition to these very concrete health benefits, green roofs can also provide many social benefits. Urban centers often have limited green spaces—a gap which can be filled by rooftop gardens which can be used for a variety of recreational activities. Studies have shown that stress-related illnesses are reduced the more humans spend time doing leisure activities in natural settings.[18]

Tax credits and subsidies

Some cities and states now include green roofs in their green building incentive programs. Check out these programs:

- Chesapeake Bay Green Roof Incentive Program (limited)
- Chicago Green Roofs Grant Program
- Maryland Green Building Tax Credit Program
- New York City Green Roof Incentives
- Portland, OR City Incentives include Ecoroofs
- Philadelphia Green Roofs Tax Credit
- Seattle Green Roof Incentives

Glossary

- **coir**: Fiber made from the husks of coconuts. Can be used in gardening applications, for flooring, or for rope construction.
- **evapotranspiration**: The process by which moisture is transferred from the earth to the atmosphere through evaporation, sublimation, and transpiration.[19]
- **urban heat island effect**: A phenomenon where urban temperatures are 2°C to 10°C (1°C to 6°C) hotter than temperatures in nearby rural regions. This often causes increased energy demands (for air conditioning), air pollution, and heat-related illnesses.[17]

External links

- Chicago's Green Rooftops – a short guide to rooftop gardening
- Greenroofs.com
- Green Roofs for Healthy Cities - Awards of Excellence 2008
- Green Roofs Australia
- Green Roofs For Healthy Cities
- Green Roof Maps

Footnotes

1. City of Portland Ecoroof Program - page 3
2. Centre for the Advancement of Green Roof Technology - How do green roofs protect the membrane? - page 21
3. International Green Roof Association - Private Benefits: Heat Shield
4. Centre for the Advancement of Green Roof Technology - Statistics on Daily Maximum Temperature - page 24
5. Environment Canada - Green Roof Technology Adapted to Cold Climates: The Project
6. American Society of Landscape Architects - ASLA Green Roof Demonstration Project Fact Sheet: The Benefits of Green Roofs
7. City of Portland Ecoroof Program - page 10
8. Green roof For Healthy Cities - Private Benefits: Food Production
9. Green Roof For Healthy Cities - Private Benefits: Sounds Insulation
10. Green Roofs For Healthy Cities - About Green Roofs: Public Benefits
11. Centre for the Advancement of Green Roof Technology - Runoff Retention
12. International Green Roof Association - Public Benefits: Natural Habitat for Animals and Plants
13. Green Roofs For Healthy Cities - About Green Roofs: Moderation of the Urban Heat Island Effect
14. City of Portland Ecoroof Program - page 4
15. Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto - Air quality
16. Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto - Stormwater
17. US Environmental Protection Agency - Heat Island Effect
18. Green Roofs For Healthy Cities - About Green Roofs: Recreation
19. Dictionary.reference.com - Evapotranspiration



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