



What is a green roof?

A *Green Roof* utilizes a waterproof membrane, soil, and vegetation to reduce the impact of rainwater runoff on the landscape, and enhance insulation properties within the building.



In 2002, Geauga Park District opened The West Woods Nature Center, which included a service building featuring a *green roof*. It was the Park District's intent to utilize this feature as a pilot project to study the benefits of *green roof* construction.

How long has green roof technology been around?

Evidence shows that *green roofs* have been used as early as 500 B.C. They have been popular in Europe, particularly Scandinavia, and even used by early American prairie settlers on the Great Plains. Contemporary *green roofs* were developed in the 1930s and have continued to gain in popularity. Today, over 800 buildings with *green roofs* can be found in Germany alone. Tokyo is the first city to mandate that building vegetation constitute 20% of all new construction.

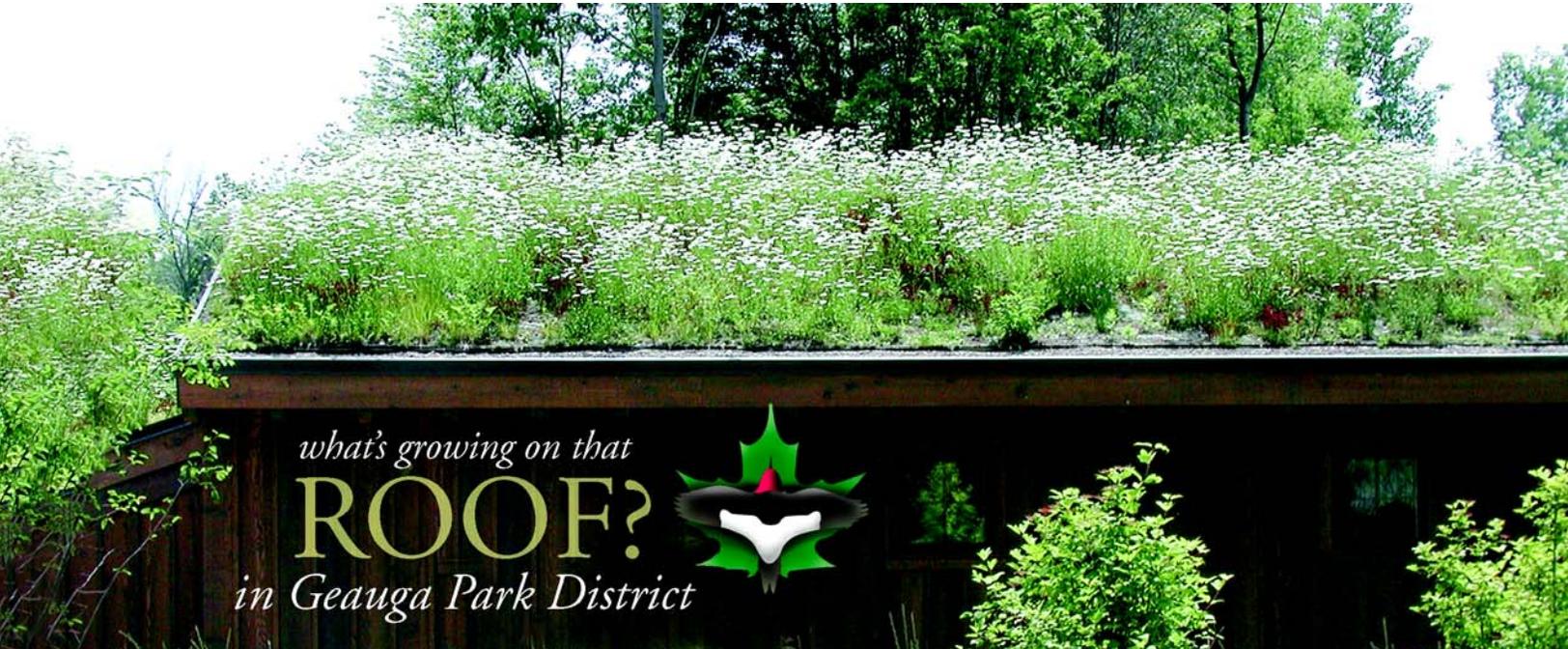
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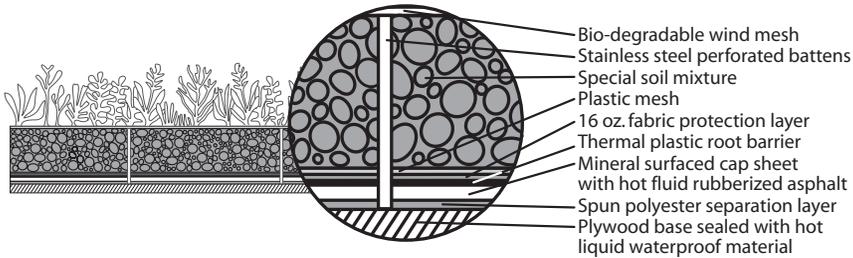
For more information about green roof technology, explore the following web sites:



what's growing on that
ROOF?
in Geauga Park District



What is a green roof made of?



As illustrated, the green roof is made in layers of man-made and natural materials. The base layers provide a waterproof seal for the roof, prevent leakage, and lay a foundation for the soils and plants.

The stainless steel battens and biodegradable wind mesh hold soils in place. A combination of shallow-rooted plants and a thermoplastic root barrier protects the underlying waterproofing system from root penetration. The soil mixture is very lightweight, and specially blended to provide a perfect environment for the plants.

Because of the high volume of snowfall in Geauga County, Geauga Park District's green roof building is the first in the Midwest United States with a 4/12 pitch, a steeper pitch than is typically used for a green roof.

Benefits of a green roof . . .

Over time, the higher costs associated with green roof construction are offset by:

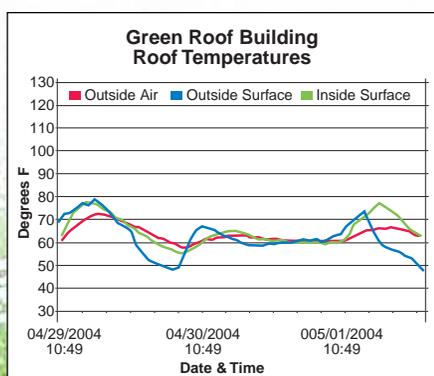
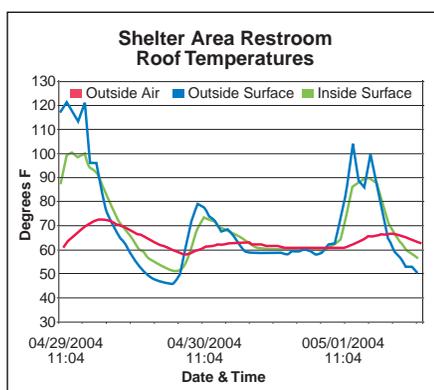
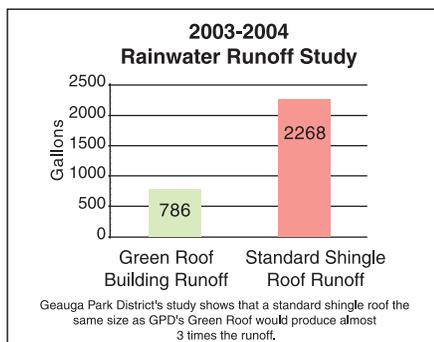
- Filtration of airborne toxins
- Stormwater runoff control
- Doubled roof lifespan
- Aesthetics
- Reduced noise inside building
- Wildlife habitat
- Improved water quality of areas surrounding building
- Enhanced insulation for lower heating/cooling costs

Geauga Park District performed a 1-year study, comparing rainwater runoff and insulation benefits of the *green roof* with those of a standard shingle roof at a nearby shelter area restroom, which is referred to as the "control" building. Neither structure is insulated or climate controlled.

Reduced Rainwater Runoff

The greatest asset of a *green roof* is that it slows rainwater runoff during heavy storms. Rain or snow melt normally evaporates, soaks into the ground, off into streams and wetlands, and/or works its way into groundwater aquifers. With large amounts of rainfall or snow melt in a short time, a standard shingle roof overloads sewer and drainage systems causing flooding and erosion. These surges of water also wash pollutants and mud into local waterways. A green roof slows storm water by absorbing it through the soil and the root system, then gradually releasing water to the downspouts with no adverse effects.

In the Park District study, runoff from the green roof building continued 4–5 hours longer than that from the control building during heavy and moderate rains. This results in less of an impact upon the surrounding area.



Increased Insulation Properties

The second major benefit of green roof technology is increased insulation, with the level of performance dependent upon many variables. Factors include moisture content, placement of the building, temperature variation and building design. Practically speaking, a green roof should be used as a supplement to common insulation materials.

In the Geauga Park District study, neither structure was insulated or climate controlled. Note the dramatic difference in temperature fluctuations between the green roof and control building shown in temperature graphs. The data demonstrates that the green roof provides a measurably higher level of insulation.



Prairie Cinquefoil

What is growing on that roof?

Geauga Park District selected a variety of plants that have shallow root systems, are non-invasive, and are tolerant of drier conditions, such as sedums, succulents, and prairie species. The roof is not irrigated or watered in any way, and is dependent only on rain or snowfall for moisture. Unwanted plants sometimes establish themselves in the roof by natural seeding. Once a year these plants are removed.

Selected plant species include:

- Bellflower or Harebell (*Campanula rotundifolia*)
- Biting Stonecrop (*Sedum acre*)
- Chives (*Allium schoenoprasum*)
- Maiden Pink (*Dianthus deltoides* "Leuchtfunk")
- Ox-eye Daisy (*Chrysanthemum leucanthemum*)
- Prairie Cinquefoil (*Potentilla arguta*)
- Prairie Spiderwort (*Tradescantia bracteata*)
- Pussytoes (*Antennaria neglecta*)
- Rose Vervain (*Verbena canadensis*)
- White Stonecrop (*Sedum album*)
- Wild Stonecrop (*Sedum ternatum*)
- Yellow-fruited sedge (*Carex annectans xanocarpa*)



Chives



White Stonecrop



Bellflower



Wild Stonecrop

How do costs compare?

The initial cost to construct a green roof for a building this size is roughly double the cost of a standard shingle roof. However, since the lifespan of a green roof is double that of a conventional roof, in the long-run the costs balance out.