The phrase “new frontier” brings to mind some of society’s greatest advancements. The exploration of the western US, the moon, and the deep ocean are just a few examples that come to mind. The “new frontier” is also often the topic of Hollywood blockbusters. Rarely does an actual new frontier present itself to the average person. That rare occurrence, however, is happening now in the landscaping industry. While landscaping may not have the glorious persona of Hollywood, there is a new frontier on the horizon and it is the green roof.

What Are Green Roofs?
Modern, traditional roofs serve the general purpose of keeping the elements—wind, snow, and rain—out of a structure while also being part of the overall insulation system. A variety of designs serve this purpose and differ based on the size, large or small, and use, commercial or residential, of the structure. While they may take aesthetics into account, most traditional roofs have been designed to fulfill structural functions.

Green roofs need to serve the same purpose as traditional roofs, but do so while supporting a landscape. A typical green roof includes, from the bottom up: 1) the physical support structure of the roof, 2) a water barrier including a root barrier, 3) a growing medium that could be soil or a soil-less mix, and 4) vegetation. A green roof often requires a drainage system specifically suited to its design, and an irrigation system may be added to sustain the growth of vegetation. Ultimately, the green roof is as functional as a traditional roof, but in a more environmentally friendly way.

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LEARN MORE about the design and implementation of green roof technology from David Yocca, RLA, AICP, LEED AP. Attend “Ecological Vegetated Roof Systems—The Emerging Culture of Green Roofs” at the 2008 LCA Winter Workshop on Tuesday, February 12.
contribute to the general well-being of residents of the building and the neighborhood. Green roofs can have a greater aesthetic value than some traditional roofs. Green roofs also better insulate the interior of buildings from exterior noises. If the green roof is accessible, participation in maintenance, growing plants, and simply having access to a green space potentially increase the quality of life.

Green Roof Landscapes vs. Traditional Landscapes

There are two different types of green roofs. Intensive design green roofs are less self-sufficient and require continued maintenance over time. This green roof landscape is analogous to landscapes planted with annuals that are changed often throughout the year. Intensive green roofs are usually accessible, contain walkways and benches, and are often designed to be pleasing to the eye. This is what most would think of when they hear the words “roof garden.” Extensive design green roofs require less maintenance and become maintenance-free when the vegetative community becomes self-sufficient. The only visitors to these green roofs are landscape managers.

The up-front cost of constructing green roofs is currently more expensive than a traditional roof, but green roofs have the potential for savings in other areas. Materials used to construct traditional roofs often lead to greater temperatures on the roof. Dark colored materials absorb sunlight and heat up. The cumulative heating effect of roof tops and other hardscapes in a city contributes to the heat island effect. You experience this when you drive into the city from the country and notice an increase in temperature. In contrast to traditional roofs, green roofs have a cooling effect. Vegetation on green roofs also absorbs the sun’s energy, but the temperature does not increase as dramatically. Vegetation shades the non-biological materials beneath them. Plants that absorb sunlight also have the ability to regulate their own temperature through evapotranspiration. These two processes cool structures and decrease the heat island effect.

The materials used to build green roofs also add to cost savings. In addition to their cooling effects outside, green roofs also better insulate the interior of structures from external heat and elements. As a result, less air conditioning may be needed in the summer for structures with green roofs. In addition, green roofs tend to last longer than traditional roofs. Snow, rain, wind, and UV rays break down the exterior materials of traditional roofs, and temperature fluctuations can contribute to their degradation. Vegetation and growing medium shield the materials underneath from the weather and UV radiation and ameliorate rapid changes in temperature.

In general, green roofs are green spaces in city environments, and they can contribute to the general well-being of residents of the building and the neighborhood. Green roofs can have a greater aesthetic value than some traditional roofs. Green roofs also better insulate the interior of buildings from exterior noises. If the green roof is accessible, participation in maintenance, growing plants, and simply having access to a green space potentially increase the quality of life.

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As with traditional landscapes, irrigation is important for green roofs, but may be more important because vegetation growing on a roof does not have access to ground water. Green roof plants must exist on rainwater alone, if an irrigation system is not installed. As a result, some have proposed a garden community of drought tolerant species to avoid the costs of installing an irrigation system. With an irrigation system, however, a greater set of species can be planted in the green roof landscape. Drainage sys-
tems for green roof landscapes must be designed to allow rainwater to soak into the growing medium while also allowing enough drainage so the roof itself isn’t compromised.

The growing medium in green roofs has to be more permanent than traditional landscapes. Decomposition of organic matter may shrink the substrate. This may decrease the ability of the roof to trap water. Fertilizer applications need to be done with care because nutrients may leach from the soil and travel to aquatic ecosystems through storm water.

The most suitable species to plant on green roofs, as well as the potential pests that may affect them, is yet to be fully elucidated. Much research on these issues is currently underway. Many people endorse the use of native species on green roofs. However, it is not yet known if these species are the most suitable. Some pests that attack plants in conventional urban landscapes are potential problems for green roof landscapes as well. However, very little research has been done to identify which pests might occur in these systems. Green roofs do have the advantage that non-flying pests like deer and moles will have difficulty accessing them.

Environmental Benefits of Green Roofs

The greatest benefits of green roof landscapes are to the environment, especially to aquatic environments. Unlike traditional roofs, green roofs are pervious to rainwater. Some rain water will be absorbed by the growing medium and either taken up by the vegetation or released slowly over time. Rain water landing on an impervious traditional roof runs off quickly into storm drains that rapidly transport water to streams. This causes streams to rise quickly after storms, which leads to flooding and the destruction of habitat for stream organisms. The slow release of water from green roofs lessens the chance of flooding.

Storm water is usually not treated before it enters streams. Often, it contains oils, toxins, and nutrients picked up when it runs over streets, parking lots, and other impervious surfaces. These pollutants can affect stream organisms and may eventually travel downstream to marine systems such as the Chesapeake Bay. Water absorbed by green roofs won’t contribute pollution to aquatic environments because it never gets the chance to pick up these pollutants.

Some scientists have also suggested that green roofs may be one way to
help stop global warming. Plants take up carbon during photosynthesis. Carbon emissions, that are usually greater in heavily populated areas, are a primary factor contributing to global warming. Thus, green roofs may be able to reduce the effects of carbon emissions in populated areas and help fight global warming.

The New Frontier
Green roofs are not a new invention. Various cultures throughout history have created structures with vegetated roofs. Germany is considered the current leader when it comes to modern green roof use and technology, and the green roof industry is rocking in Germany. The green roof industry in the US is in its infancy. The industry needs individuals trained in the design, construction, and maintenance of green roofs. For example, the added expense to green roofs is partially caused by the lack of trained professionals to design, build, and maintain them.

Even though green roofs are not as popular in the US as in other countries, the green roof is becoming an increasingly popular option in the green building movement, especially in the DC metropolitan area. Green roofs can be used as storm water best management practices (BMPs). Similarly, The US Green Building Council (USGBC), a nonprofit organization that promotes environmentally-friendly, sustainable building practices, has developed the Leadership in Energy and Environmental Design (LEED) Green Building Rating System in order to assess the quality of green buildings. Green roofs are one aspect of building designs that can help certify the project as a green building through this program.

Since the success of green roofs depends on the success of the overall design and the growth of vegetation, landscape architects and landscape contractors both have an opportunity to expand their businesses into this new industry and be at the forefront of a movement that may have substantial benefits for the environment. This new frontier is a great business opportunity for nurseries, landscape contractors, irrigation contractors and landscape architects.

The green roof phenomenon may not be exciting enough to be the subject of a Hollywood film, but it is certainly at the forefront of a new frontier for builders, landscape contractors and environmentalists alike.

The following websites were used as sources of information and are good resources for finding out more about current green roof initiatives and research.

http://www.hrt.msu.edu/greenroof/
http://hortweb.cas.psu.edu/research/greenroofcenter/history.html
http://www.epa.gov/hiri/strategies/greenroofs.html

Robert Smith is a Ph.D. student at the University of Maryland, Department of Entomology. His research focuses on the impacts of urbanization on insect communities in small headwater streams.

Michael Raupp, Ph.D., is a Professor of Entomology at the Maryland Cooperative Extension. He develops integrated pest management programs for landscapes and urban forests. His weekly column on insects in the landscape can be found on the internet by searching “Bug of the Week” or by visiting the following link: http://raupplab.umd.edu/bugweek/