

Questions and Answers from the Green Roofs Webinar

February 5, 2010 - Hosted by K-State Pollution Prevention Institute

Speakers: Teresa Nelson, Roof Top Sedums LLC

Nikki Guillot, City of Lenexa

Questions

1. How much rainfall or inches of water are needed in a year for the plants to survive?
2. What prevents the foliage from 'overtaking' the roof?
3. Buffalo grass for roofs in western KS?
4. Do the live roof systems have to be tailored to the locale for where they are to be installed?
5. What is the life expectancy of the plant material?
6. What is the depth of the growing media & what is the substrate/media mix?
7. Can trees or shrubs be installed in green roofs?
8. Do you know of any cases where green roofs have become habitats for animals?
9. Will the plastic containers biodegrade over time?
10. What is the growing lead time? From placing of order to delivery to project site.
11. What roof support was done different from traditional roof?
12. What additional weight should be considered for live roofs?
13. How does mechanical and other rooftop equipment affect the design/effectiveness of green roofs?
14. What was the cost per sq ft?
15. How does a contractor get certified?

Answers

1. How much rainfall or inches of water are needed in a year for the plants to survive?

Roof Top Sedums: This really will vary depending on the regional climate, specific weather patterns, the plant material selected, the slope of the roof, and the soil depth of the system that is used. For our Midwestern region, we typically suggest that 1/4" per week is the minimum needed to sustain a sedum palette on a green roof in Iowa. If there are prolonged hot, dry, windy, and sunny conditions, the amount of irrigation would need to be increased. For areas in Missouri and Kansas, where increased temperatures and decreased moisture may occur, moisture requirements would need to be increased, possibly equal to 1/2" per week to keep a green roof actively growing.

In Michigan, 4 weeks during August was determined to be the maximum amount of time you would want a green roof to go without moisture. The plants were dormant at this point, and were not actively evapotranspiring to cool the roof surface. But within a few days of moisture, the plants were green and actively growing again.

2. What prevents the foliage from 'overtaking' the roof?

Roof Top Sedums: This would depend on the plant material that is used on the green roof. For the LiveRoof system in the Midwest, we use sedum, sempervivum, and allium varieties, so when a diverse mixture of varieties are used together, in a way they "self regulate" each other. If the green roof is actively growing and covered with vegetation, especially the sedum varieties seem to keep each other in check to create a dense carpet to discourage other plants from becoming established. If there is drought stress or bare spots on the green roof, there is potential for a more aggressive variety to take over a less aggressive variety in that area.

In addition, sedums will shrink back (depending on whether they are evergreen, semi-evergreen, or deciduous) and go dormant during the winter months. This will also help keep the plants in check and keep them from overtaking. Annual maintenance which includes trimming the plants during the spring will also help rejuvenate the plants and give them a consistent starting point to begin growing each season.

Other areas in the country may vary with plant aggressiveness issues, and consulting with a local grower who has tested plants for green roofs in that region would be necessary. Testing plant material and choosing proven varieties to use on green roofs for your region would be essential.

3. Buffalograss for roofs in western ks?

Roof top Sedums: We are testing several drought tolerant grass varieties for use in the LiveRoof system and should have some information next season.

City of Lenexa: From my experience with native plants & having seen a couple of green roofs (intensive) in the Kansas City area, I would hesitate to recommend deep-rooted native plants for a green roof. Buffalograss (*Buchloe dactyloides*) has a 12" root growth that isn't going to thrive in a shallow, hot dry, environment.

4. Do the live roof systems have to be tailored to the locale for where they are to be installed?

Roof Top Sedums: We as a Licensed Grower, we will tailor the plant mix according to the aesthetics of the building, requests from the owner or specifier, color schemes, and amount of sunlight and moisture that is available on the roof. We have several varieties that vary in aggressiveness, moisture, and sunlight requirements. Ultimately the specifier/owner chooses the plant material for their project. We are willing to help with selections, if requested to do so.

5. What is the life expectancy of the plant material?

Roof Top Sedums: The plants most commonly used for Midwest green roofs are mainly sedum varieties. Annual maintenance in the spring to cut back dead seed heads will help rejuvenate the sedums plants as well. Trimming the plants during the spring will create new cuttings and disperse seeds that will create new plants in the event that there is a bare spot on the green roof. Note that you do not want to trim sedums when they are flowering during the summer months. This will cause stress to the plants and potentially create thin areas of plant material and expose the soil to weed infestation and erosion.

Diversity is key to a green roof. There will be areas on the same roof that get different amounts of sunlight, and may dry out or stay wetter than other areas of the roof. Especially with sedums, if one variety does well in one area of the green roof, it will thrive and replace other varieties that may not perform as well in the same area. The green roof plant palette will likely change over time, and varieties that perform best in certain areas of the roof will find their places naturally.

6. What is the depth of the growing media & what is the substrate/media mix?

Roof Top Sedums: The LiveRoof system has 3 soil depths available: Lite = 2 ½" deep, Standard = 4 ¼" deep, Deep = 6" deep. Note that the modules that sit on the roof are actually shorter than the soil depth, and there is a layer of soil approximately 1" deep that covers the Lite and Standard modules, and a layer of soil approximately 3" deep that covers the Deep module.

The media used in the LiveRoof system is 94% inorganic by dry weight (in most regions, expanded shale is a key ingredient), conforms to German FLL granulometric standards, filters rainwater, and buffers acid rain.

City of Lenexa: Our green roof was the Standard model, consisting of the 4 ¼" media, as Teresa explains.

7. Can trees or shrubs be installed in green roofs?

Roof Top Sedums: These types of plants could be used in intensive systems (over 6" deep), but would require additional engineering and design of the roof. Irrigation would likely be required as well. Keep in mind that the root of woody plant material is very aggressive and could penetrate some roof waterproofing systems.

8. Do you know of any cases where green roofs have become habitats for animals?

Roof Top Sedums: Green roofs can definitely create an environment for beneficial organisms, including insects, bacteria, and fungi. Green roofs can also attract birds and other small animals. Nesting of rare birds has already occurred on one 2007 Michigan LiveRoof installation.

9. Will the plastic containers biodegrade over time?

Roof Top Sedums: The LiveRoof system is designed to protect the plastic modules from sunlight by covering the modules with a layer of soil. The LiveRoof plastic modules have a 20 year warranty against material defects and photo degradation.

10. What is the growing lead time? From placing of order to delivery to project site.

Roof Top Sedums: Ideally, as soon as you know you have a project, the better. We need 3 months to grow a project, and typically like to have at least 1-2 months prior to growing to gather supplies and plan for the project. We know that this extra lead time is not always possible, so we are flexible depending on the size of the project and the time of the year that the project needs to be completed. Listed below is our absolute minimum time frame for completing projects:

<u>Contract Deadline</u>	<u>Planting Deadline</u>	<u>Target Delivery Date</u>
March 1, 2010	May 1, 2010	late July 2010
April 1, 2010	June 1, 2010	late August 2010
April 15, 2010	June 15, 2010	mid September 2010
May 1, 2010	July 1, 2010	late September 2010
June 1, 2010	August 1, 2010	April, May, or June 2011

11. What roof support was done different from traditional roof?

Roof Top Sedums: (Nikki will probably be best to explain this for Lenexa.) Having an existing roof structure reviewed by an engineer is necessary to determine if the building can support the weight of the green roof. New buildings will need to have the weight of the green roof taken into account during the design phase of the building.

City of Lenexa: I misspoke during the webinar when we talked about structural components on our green roof. I have clarified with our structural engineers & architects. While the standard roof trusses on this project support 25 psf, the installed green roof has an additional "live load" of 30 psf which brings the total bearing to 55 psf. The trusses in the green roof area were light gage metal on 24" centers, consist with the other areas of the roof but of a more substantial material. The additional project cost of the more substantial trusses in the green roof area was \$3500, which pencils out to an increase of \$2 psf.

12. What additional weight should be considered for live roofs?

Roof Top Sedums: The LiveRoof system has 3 types of modules available with different weights:

LiveRoof Lite = 15-17 lbs per sq ft saturated and vegetated

LiveRoof Standard = 27-29 lbs per sq ft saturated and vegetated

LiveRoof Deep = 40-50 lbs per sq ft saturated and vegetated

City of Lenexa: Our engineers allowed for the maximum range of the Standard system and used 30 lbs/sq ft as the design load.

13. How do mechanical and other rooftop equipment affect the design/effectiveness of green roofs?

Roof Top Sedums: When designing around mechanical equipment, if hot air will be venting out of the equipment onto plants or if a lot of heat will radiate from the equipment, green roof plantings should begin 18" or 24" away from the equipment installed to ensure that green roof plantings will not be damaged.

City of Lenexa: We had a couple of pipes that came up into our green roof and the contractor was able to simply frame around the pipes & cut the units to fit.

14. What was the cost per sq ft?

Roof Top Sedums: Module cost per square foot nationally starts from \$12.66 to \$14.50 list price (depending on the region) and can go down as low as \$9.63 for orders over 40,000 square feet. There are several price breaks within this range depending on the square footage ordered. Module shipping costs will vary regionally, but can range from \$0.40 cents per square foot locally (50 mile radius) to \$1.50 per square foot (over 300 mile radius).

Installation costs for LiveRoof typically range from \$2.00-\$5.00 per square foot, but this can vary regionally, and will depend on the complexity of the green roof design, accessibility of the roof area, and if custom cutting of the modules is necessary.

Maintenance costs for traditional green roofs can range from \$1.00-\$2.00 per square foot annually. LiveRoof maintenance costs usually range from \$0.05 to \$0.20 cents per square foot annually.

Overall cost of the LiveRoof green roof system (slip sheet and installation, module and module delivery, module installation, RoofEdge edging as needed) typically can average \$19-20 per square foot (quoted from one of our installers in Missouri). Irrigation system and installation would NOT be included in the above estimate (irrigation is estimated around \$1 per sq foot of green roof).

City of Lenexa: Our cost/sq ft was right around \$40. That cost reflects the installed price of our green roof from the actual invoice we received from our contractor. It includes labor & materials for the sheeting & LiveRoof. Our Fire Station has almost 1700 sq ft of green roof at a cost of \$67,240 installed.

15. How does a contractor get certified?

Roof Top Sedums: We can certify contractors to install the LiveRoof system. It is a two hour class that we teach throughout the year and upon request. There is an application and agreement that the installer must agree to fill out. During the class, we cover an installer standardized procedure document during the class. The installer must follow the procedures in this document during LiveRoof system installations.

City of Lenexa: Unrelated to the LiveRoof system (to my knowledge) is the Green Roof Professional Accreditation offered through the Green Roofs for Healthy Cities initiative. They offer course on media, installation, waterproofing, design, etc. I understand their course is eligible for LEED credits but I'm not familiar with the particulars. Here's a link to their website: <http://greenroofs.org/index.php/eduprogram>