

## Roof Gardens: Looking Up, Thinking Green and Keeping Cool.

By Ken Friedman, WCMGA Master Gardener

Roof gardens in Wisconsin? Seriously? Most of us have been to Al Johnson's Swedish Restaurant in Sister Bay to stare (up) at the goats on the grass. According to the UWEX and industry sources, roof gardens can have it going on right here in Winnebago County, too. Green roofs can control storm water, replace green spaces lost to construction, improve air quality, extend the life of roof surfaces, and greatly reduce solar heat gain, which reduces cooling costs in commercial and residential buildings.

Roof gardens are classified as intensive, extensive and ultra-extensive. Intensive gardens are accessible landscapes designed for aesthetics, accessibility and, occasionally, production as well as LEED points. The typical intensive roof garden has 12 inches to two feet or more of soils capable of supporting large trees and extensive shrubbery. Intensive gardens add a lot of weight: 80 to 150 pounds per square foot or more for larger plants, sculpture, buildings, mechanical systems and extensive foot traffic. Planning must include careful analysis of structural and mechanical requirements to place and support these loads. Common sense suggests trees should be placed on or very near vertical and horizontal structural supports. Complex systems may be required for handling maintenance requirements, water and waste materials. Pathways required for access and maintenance will add complexities of weight, vibration and differential stresses. Accessible intensive gardens are most commonly found on major commercial or institutional buildings. The Chicago City Hall roof garden would be one example. Soil temperatures in the garden approximate ambient temperatures rather than the 160+ degrees commonly measured on asphalt roofs. That is a lot cooling gratis from mother nature. At \$125 per sf. (compared with \$8-\$12 per s.f. for residential roof gardens), the City Hall Roof Garden was expensive to install. But significant, annual, year-round energy savings give the citizens of Chicago a better return on their \$25 million investment than, say, the Cubs.

Like Al Johnson's aerial pasture, extensive roof gardens serve primarily as building elements with minimal requirements for (human) access or maintenance. Extensive roof gardens have up to 8 inches of soil. Added weight starts at about 12 pounds per square foot and goes up to 50 pounds per square foot for deeper soils and larger plantings. Typical plantings are sedum (varieties of sedum) and other xerographic perennials, although small bushes and small trees may be viable in 8 to 10 inches of soil. The ideal plant choices will need NO WATERING after the first year or two. Ultra-extensive gardens have between one and four inches of soil. Ultra-extensive roof plantings should be limited to no-mow (or goat-mow) grasses, native shallow root perennials and sedum. Annuals may be planted at accessible edges of extensive and ultra-extensive gardens, provided additional water is available and excess

drainage requirements are taken into consideration. Miniature goats keep weight down, but may be incompatible with maintaining annuals in bloom.

All roof garden designs must consider plant choices, soil and substrate composition for plant nutrition, water retention and erosion control, water requirements, drainage and protection of the underlying roof systems. Even the most minimal roof garden should have a tough impermeable membrane above the roof to avoid penetration by roots or leaching chemicals. Above the impermeable membrane, roof gardeners will need a drainage system and a moisture retention mat under the growth medium. Minimizing erosion may require wind resistant permanent mulching systems. More extensive systems may include filtering cloths, root barriers and insulation layers. Sloping roofs are no problem, although slopes of more than 45% may require retention systems to keep the hanging roof garden hanging on. The UWEX Solid and Hazardous Waste Environmental Center publishes a guide including suppliers of green roof technologies. There is even one company that offers completely self-contained roof garden squares that can be placed on an appropriate prepared surface.

Adventurous Master Gardeners might be tempted to experiment with homemade garden squares installed on top of aging garden sheds and other accessory structures. Otherwise, check with an architect to be sure that the roof of residential, commercial or institutional buildings can support the weight of a fully watered (or frozen) garden plus the required live load. Building codes for Winnebago County require residential and commercial roof systems support live (i.e. snow) loads of at least 30 pounds per square foot in addition to all other loads, such as your roof garden. This is an important number. For comparison, an inch of water or ice, 3-5 inches of old snow or 10-12 inches of new snow weigh in at 5.2 lbs per square foot. An architect can also help estimate what thermal efficiencies you can expect from going green up top.

As for me, I am looking for ways to reclaim a limestone quarry for horticultural tourism without having to import six cubic feet of dirt for every square foot of plantings. Simplified green roof design – simplified because there is no need to build or protect a roof - could provide some interesting solutions.

Sources:

1. ASLA/City of Chicago: <http://www.asla.org/meetings/awards/awds02/chicagocityhall.html>
2. Carlisle-Syntec, Inc. : [http://www.carlisle-syntec.com/index.cfm?act=Green\\_roofgarden#](http://www.carlisle-syntec.com/index.cfm?act=Green_roofgarden#) (pictures of roofing systems; defining "ultra-extensive")
3. Residential Architect Online: [www.residentialarchitect.com/Industry-news.asp?sectionID=283&articleID=426435](http://www.residentialarchitect.com/Industry-news.asp?sectionID=283&articleID=426435)

4. US. EPA : <http://www.epa.gov/hiri/strategies/greenroofs.html>  
(Extensive/Intensive Definitions)
5. Wis. Admin. Code. Chapter. Comm. 21
6. UWEX / UWM : Building Green Sources, including Green Roof Technology:  
<http://www4.uwm.edu//shwec/publications/cabinet/reductionreuse/615.SG.0502%20Update%202.pdf>