

# Green Roofs – Introduction and Overview

Brian T. Forschler

Department of Entomology, University of Georgia, Athens, GA

The concept of placing plant material in the infrastructure of man-made construction, known as living architecture, has captured the imagination of ecologically minded architects, builders and property owners. The term Green Roof references the concept of using the upper portion of a building as a habitat for plants (Green Roofs, 2014). All Green roofs have 4 major components – a waterproof and plant-root barrier, a drainage/storage level, a filter-fiber layer, a deposit of growing medium and a cover of vegetation.

The justification for use of this technology includes improvement in urban water quality, energy conservation, aesthetics and quality of life (Villareal *et al.* 2004, Castleton *et al.* 2010, Mentens *et al.* 2006, Gettler and Bradley Rowe 2006, Fuller *et al.* 2007, Carter and Butler 2008, Fuller and Irvine 2010, Francis and Lorimer 2011). A number of studies have surveyed the avian and plant populations associated with green roofs and found an increase in biodiversity in structures incorporating living architecture (Miller *et al.* 2001, Baumann 2006, Baumann and Kasten 2010, MacIvor and Lundholm 2011, Cook-Patton and Bauerle 2012, Madre *et al.* 2013). Surveys of arthropod communities associated with green roofs have involved a number of taxa but inevitably from an ecological perspective and nothing has been published on entomological pests associated with green roofs (Schindler *et al.* 2011, Braaker *et al.* 2014).

Recently publications have critically analyzed many of the aforementioned features of the living architecture movement and question the unmitigated benefit(s) of the green roof concept (Simmons *et al.* 2008, Henry and Frascaria-Lascoste 2012, Mullen *et al.* 2013). Niche theory intuitively predicts that any human-built habitat will be occupied by some life form and from a pest management perspective that generally involves a synanthropic species whose populations could build to the point of pest status. An informal survey of three green roofs on the University of Georgia campus prior to this meeting found fire ants on each roof although none of the building residents complained of infestation. Pest populations associated with living architecture could provoke an intervention aimed at reducing the infestation that might include remodeling and/or repairing components of a green roof to application of a pesticide.

This symposium will provide information on this growing segment of the urban architecture in the United States and raise topics certain to be points of conversation with PMP's, property owners and regulatory lead agencies in the coming decade. The pest management community should be aware of the potential for pest issues associated with this burgeoning urban landscape feature including, legality of pesticide application to green roofs, tenant/landlord responsibilities, PMP responsibilities and opportunities to serve as a resource on pest issues for property owners interested in living architecture.

## Literature Cited

- Baumann, N. 2006. Ground-nesting birds on green roofs in Switzerland: preliminary observations. *Urban Habitats*. 4:37-50.
- Baumann, N. and Kasten, F. 2010. Green roofs – urban habitats for ground-nesting birds and plants, in urban biodiversity and design, *In* Müller, N., Werner, P. & Kelcey, J. G.(eds.) *Urban Biodiversity and Design*. Oxford: Wiley-Blackwell, pp. 348-362.
- Braakere, S., J. Ghazoul, M.K. Obrist, and M. Moretti. 2014. Habitat connectivity shapes urban arthropod communities: the key role of green roofs. *Ecology* 95: 1010-1021.
- Carter, T. and C. Butler. 2008. Ecological impacts of replacing traditional roofs with green roofs in two urban areas. *Cities and the Environment*. 1(2) article 9, pp.17.
- Castleton, H. F., V. Stovin, S. B. M. Beck, and J. B. Davison. 2010. Green Roofs; Building energy savings and the potential for retrofit. *Energy and Buildings*. 42: 1582-1591.
- Chace, J. F., and J.J. Walsh. 2006. Urban effects on native avifauna: a review. *Landscape and urban planning*. 74: 46-69.
- Cook-Patton, S.C. and T.L. Bauerle. 2012. Potential benefits of plant diversity on vegetated roofs: a literature review. *J. Environ, Mgt*. 106: 85-92.
- Francis, R. A. and J. Lorimer. 2011. Urban reconciliation ecology: the potential of living roofs and walls. *J. Environ. Mgt*. 92: 1429-1437.
- Fuller, R.A., K.N. Irvine, P. Devine-Wright, P.H. Warren, K.J. Gaston. 2007. Psychological benefits of greenspace increase with biodiversity. *Biol Lett* 3:390–394.
- Fuller, R.A. & Irvine, K.N. 2010. Interactions between people and nature in urban environments, *In* Gaston, K.J. (ed.) *Urban Ecology*. Cambridge: Cambridge University Press, pp. 134-171.
- Getter, K.L. and D. Bradley Rowe. 2006. The role of green roofs in sustainable development. *HortScience*. 41: 1276-1285.

Green Roofs. 2014. <http://www.greenroofs.org/>

Henry, A. and N. Frascaria-Lascoste. 2012. The green roof dilemma – Discussion of Francis and Lorimer (2011). *J. Envir. Mgt.* 104: 91-92.

Madre, F., A. Vergnes, N. Machon, P. Clergeau. 2013. Green roofs as habitats for wild plant species in urban landscapes': first insights from a large-scale sampling. *Ecological Engineering.* 57: 109-117.

Maclvor, J.S. and J. Lundholm. 2011. Insect species composition and diversity on intensive green roofs and adjacent level-ground habitats. *Urban Ecosystems.* 14: 225-241.

Mentens, J., D. Raes, and M. Hermy. 2006. Green roofs as a tool for solving the rainwater runoff problem in the urbanized 21st century? *Landscape Urban Plan* 77:217–226.

Miller, J.R., J.M. Fraterrigo, N.T. Hobbs, D.M. Theobald, and J.A. Wiens. 2001. Urbanization, avian communities, and landscape ecology. Pages *In* J.M. Marzluff, R. Bowman, and R. Donnelly, (eds) *Avian Ecology and Conservation in an Urbanizing World.* Kluwer, New York. Pp. 117-137.

Mullen, J.D., M. Lamsal, and G. Colson. 2013. Green Roof Adoption in Atlanta, Georgia: The Effects of Building Characteristics and Subsidies on Net Private, Public, and Social Benefits. *Environmental Science & Technology* 47: 10824-10831.

Schindler, B.Y., A.B. Griffith, and K.N. Jones. 2011. Factors influencing arthropod diversity on green roofs. *Cities and the Environment* 4(1) article 5, 20 pp.

Simmons, M., Gardiner, B., Windhager, S. and Tinsley, J. 2008. Green roofs are not created equal: the hydrologic and thermal performance of six different extensive green roofs and reflective and non-reflective roofs in a sub-tropical climate. *Urban Ecosystems* 11: 339-348.

Villareal, E.L., Semadeni\_Davies, A., Bengtsson, L. 2004. Inner city stormwater control using a combination of best management practices. *Ecological Engineering* 22: 279-298.