

Green Roofs for Small Structures

An information sheet prepared by the:



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Green roofs provide structural insulation, an area for pollinator (butterflies, bees, and others) plantings, water conservation, a reduction of heat radiating back into the surrounding air, and an opportunity to beautify a landscape once lost to drab roofing shingles.

More and more homeowners, businesses, and apartment dwellers are developing their roofs into garden spaces. This got the staff at the Belknap County Conservation District (BCCD) wondering if anybody had thought of using this 'green' technology on smaller structures like garden sheds and dog houses... of course, somebody had... so why don't we see more of this technology employed? We weren't sure, maybe more people just needed to see the technology being used! BCCD decided to design and construct their own green roof on a dog house for demonstration purposes. We first visited the Internet and found a few sites that provided design plans. Next we found a tradesman, Ward Bird of Picnic Rock Farm in Meredith, who was willing to construct the dog house. We are currently in the experimental phase with our plant selection. Funding for this project was provided by the NH Association of Conservation Districts.

Materials:

*Lumber and fasteners	Moisture pad	Drought tolerant plants
Moisture barrier for the roof	Planting medium (engineered soil)	Paint (optional)

*If your structure will provide shelter for pets BCCD recommends not to use pressure treated lumber as it may contain harmful chemicals. Some dogs will chew on the wood and it's better to be safe than sorry.

Cost for materials \$500.



Photos: The left and center images were used as inspiration for BCCD's green roof. On the right another design option. Images 'borrowed' from the Internet.

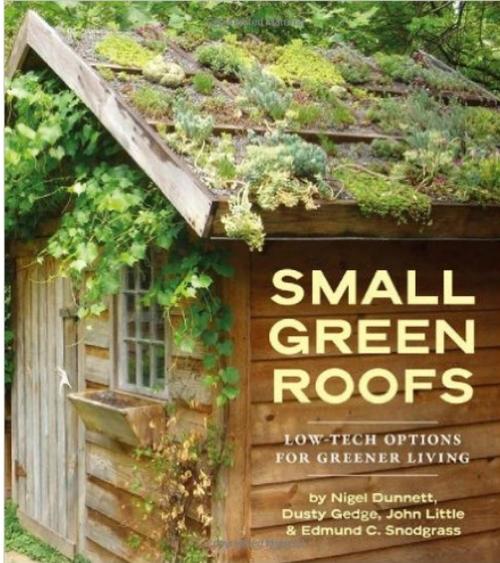
Other Resources:

NOTE: This list is not to be considered an endorsement by BCCD for the products, articles, or websites listed.

Amazon.com

Small Green Roofs: Low-Tech Options for Greener Living Paperback – April 27, 2011

by [Nigel Dunnett](#) (Author), [Dusty Gedge](#) (Author), [John Little](#)



Note: BCCD has this book on order. Check in with us later for our review. (Lisa Morin, BCCD)

YouTube has several videos on building a dog house and specifically dog house plans with a green roof.

Pinterest also appears to have some design plans for green roofs on dog houses.

Website:

Building A Green Roof On A Shed

http://www.ehow.com/how_5945639_build-pitched-green-roof.html#ixzz2qOuFflfw

Multiple articles refer to a website www.sustainablepet.com as a resource for building designs but it seems to be a clearing house for on-line sales. (Lisa Morin, BCCD)

Important Note on Plantings !!!!

Use only non-toxic plants and mulch in your dog house green roof plantings!!

The mulch you use matters. Do not use mulch containing cocoa bean shells as it is toxic to dogs. Opt for less toxic alternatives such as pine needles.

For a list of safe plants please visit the website of an organization such as the ASPCA and/or the Humane Society!!

Doghouses get a green roof with plants that cool the inside

July 2008

By Bettijane Levine Los Angeles Times Staff Writer

GREEN roofs are good. They clean the air, cool the house below, provide rest stops for birds and butterflies. If you work well with wood and want to try a green roof, why not start by building one for your dog?

Landscape architect Stephanie Rubin and her partner, sculptor Chris Isner, sell doghouses with rooftop gardens for \$1,000 to \$4,000. Your homemade version will cost a lot less -- and the dog in residence will appreciate a plant-topped refuge that is cooler, in every sense of the word, than anything else around.



To start, Rubin and Isner suggest that you come up with your own general design or scan for ideas on their [website, www.sustainablepet.com](http://www.sustainablepet.com). They won't mind if you filch. For a closer look at their doghouses, visit City Bakery in Brentwood.

The configuration of the walls will vary depending on the size of your pet, but the composition of the roof will remain the same: It must be shaped like a sandbox and sloped gently, a maximum of 20 degrees. At the bottom of the slope, drill holes for two or three bamboo drainage spouts that will pull water away from the doghouse. The size of the holes should be determined by the diameter of the bamboo, about three-fourths inch to 1 inch. Cut the bamboo into lengths that will extend about 3 inches out from the holes you drilled.

Be sure seams are well caulked and the wood is well glued with a nontoxic, waterproof wood glue such as Titebond III. The designers suggest building with Forest Stewardship Council-certified red cedar, which they say repels fleas and ticks. Or you can use reclaimed wood treated with a product such as Safecoat Safe Seal to prevent off-gassing. Finish the frame with nontoxic, eco-friendly paint, stain or varnish; Rubin and Isner get theirs at [Architectural Coatings and Design Center](#) in Tarzana.

Using a paintbrush, cover the rooftop with two layers of melted natural beeswax, available where candle supplies are sold. Or use a rubberized roofing compound that's low in volatile organic compounds, or VOCs; one example is Elasto-Seal rubber undercoat primer by Snow Roof Systems.

Next add the drainage layer: Cover the roof's surface with 1 inch of gravel or 1-inch-diameter bamboo stalks split lengthwise and placed cut-side down. Cut a piece of landscape fabric slightly larger than the roof; lay it over the gravel or bamboo. Glue excess fabric to the roof box to keep soil from creeping under.

On top of the fabric, add a 4-inch layer of planting medium -- 60% pumice, 10% sand and 30% soil rich in organic material. Rubin suggests Supersoil, available at garden stores.

Finally, the plants: Rubin's rooftops are filled with pet-friendly, nonpoisonous, mostly native plants that require no pesticides or fertilizers. Her favorites include woodland strawberry (*Fragaria vesca*), beach strawberry (*Fragaria chiloensis*), stonecrop (*Sedum*, particularly *S. acre*), live forever (*Dudleya*), and common yarrow (*Achillea millefolium*). Sometimes she uses island bush snapdragon (*Galvezia speciosa*), coral bells (*Heuchera*) or blue fescue (*Festuca glauca*). All are watered as if they were growing in the ground.

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DIY green "roof-roof" for Fido

By [Frank Hyman](#) March 8, 2006

<http://www.indyweek.com/gyrobase/Content?oid=oid%3A28877>

[Photo by Frank Hyman](#)



The greenery on Lucy's new doghouse will blanket the roof as the plants spread.

Green roofs aren't just for far-sighted developers and bureaucrats. Homeowners and their dogs can enjoy them, too. Yep, dogs. Durham's possibly first green roof is on a dog house. Although Lucy, a black Lab, doesn't seem to care about her roof one way or the other, her owners now have one more place to garden, and it's a way more people can learn about green building.

Skill level: basic carpentry.

Ingredients for a 4' x 4' doghouse:

- Enough 6-inch wide pressure-treated (PT) lumber to make one "sandbox" on a flat roof (16 feet) or two sandboxes on a pitched roof (20 feet). (see photo)
- Galvanized screws and PT scrap wood to stiffen the edge of the roof.
- Weed block fabric and rubber pond liner, about 20 sq. feet. each
- Saw, hammer, drill, tape measure, stapler, scissors, clamps, etc.
- Peat moss, sand, PermaTill in a 1:1:6 ratio, handful of lime and rock phosphate. Enough to make a 4-inch deep bed or 5 cu. feet.
- At least 16 sedum, sempervivum and ice plants. Use more for faster coverage.

How to make it:

- 1) Enclose the roof with a "sandbox" of 6-inch planks. May need to clamp and screw wood scraps under the edge of the roof to make it sturdy enough.
- 2) Make the box an inch wider at its bottom edge so water can drain out. Staple pond liner to the bottom and sides of the box. Cut a slit at the bottom edge. Lay down weedblock fabric to protect the liner and staple the top edge to the inside walls as well, but *don't* slit the bottom of the fabric--it's there to keep the soil from pouring out the drainage slit with the rainwater.
- 3) Measure the dimensions of your box to see how much soil mix is needed. "Soil" mix for a green roof is actually soil/ess--otherwise it weighs too much. Mix peat moss, sand, lime, rock phosphate and Perma-Till--a pricey, lightweight gravel that holds lots of air, water and nutrients--in a wheelbarrow. Dampen with water and spread it into the box, nearly level with the top edge.
- 4) Install plants and finish with a thin mulch layer of Perma-Till. Water and weed as needed--probably not very often. Finally, invite friends over and see if you can start a trend.

(Note from BCCD: Avoid the use of pressure treated wood as it may be harmful if chewed by your pet.)

INTRODUCTION TO GREEN ROOFS

Green roofs are roofs that are substantially covered with living plants. Although historical and archaeological evidence suggests that green roofs have been built for more than three thousand years, widespread acceptance has always been limited by the structural cost of supporting heavy soils and by the technical challenges of low-slope waterproofing. Recent advances in membrane waterproofing technology combined with the development of lightweight thin-profile green roofs have finally made green roofs practical for most new construction: there are now more than one billion square feet of lightweight green roofs!

WHY BUILD GREEN ROOFS? Although the structural, waterproofing, and drainage requirements of green roofs will always make them more expensive than bare roofs, green roofs offer significant long-term economical and environmental advantages that more than justify the higher initial cost:

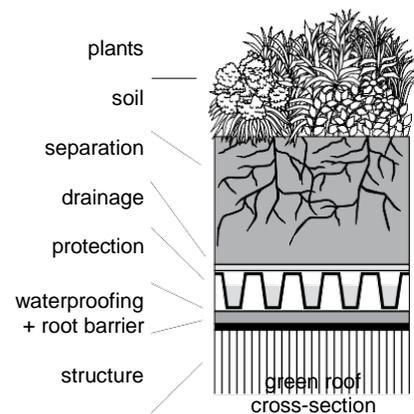
- Green roofs are visually attractive. The variegated coloring of flowers, grasses, and wild herbs is more appealing than stark black or white monolithic surfaces. Green roofs can transform urban wastelands into urban gardens.
- Green roofs are energy-efficient. They are cool in the summer and can be as effective as white roofs in reducing the urban heat island effect. The thermal mass of the soil reduces heat gain and loss by averaging temperature extremes.
- Green roofs significantly reduce stormwater runoff, typically retaining half to three-quarters of the annual rainfall and retarding the runoff of most of the remainder.
- Green roofs are permanent. By shielding the waterproofing from the sun and reducing temperature swings, synthetic membranes can last fifty years and more.

ANATOMY OF A GREEN ROOF: A modern green roof requires eight functional layers:

sturdy roof structure: Green roofs must typically support 25 to 100 pounds more load per square foot than conventional flat roofs. New roofs, whether made of wood, steel, or concrete, can be designed to support green roofs at minimal additional expense. Existing roofs almost always require costly structural reinforcing.

reliable waterproofing membrane: Leaks in green roofs can be very difficult to identify, and repairs or replacement can be expensive. For a long, maintenance-free life, green roof waterproofing must be sufficiently elastic to withstand building movement, must withstand ponded water, must be non-biodegradable, and must be resistant to root penetration. Some rubber and plastic sheet-applied and liquid-applied membranes meet these criteria but most asphalt products do not.

root-barrier/ponding membrane: If the primary waterproofing system is not resistant to root penetration, it can be covered with a secondary root-barrier membrane. Secondary membranes are also used with some green roof systems where water is intentionally ponded so that the primary waterproofing membrane still drains.



tough protection mat: A synthetic mat protects the waterproofing or root barrier/ponding membrane from mechanical damage during construction and roof maintenance. Protection mats typically weigh 500 to 900 grams per square meter (15 - 27 ounces per square yard). Mats with enhanced water storage and capillarity are preferred for some green roof systems.

water-storing drainage layer: It is desirable to store water in green roofs to help plants survive through periods of dry weather. However, the dry-climate plants that thrive on green roofs will not survive unless excess water is rapidly drained from the plant root zone. The optimal combination of water storage and rapid drainage can be provided by several water-storing drainage products including well-graded granular inorganic media, dimpled plastic sheets, and ribbed fabric laminates.

non-clogging separation fabric: For the water storage and drainage layer to function properly, it must be kept free of soil. A synthetic soil separation fabric serves this function, but the fabric must have a structure that resists clogging from fine soil particles such as silts and clays.

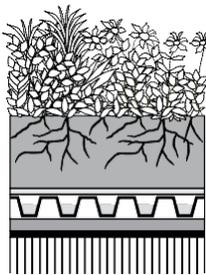
engineered soil: Green roof soil is not ordinary soil. It must be lightweight, have good water storage characteristics, have a low organic content, have suitable chemical parameters, and have a good distribution of particle sizes.

appropriate plants: Green roof plants must survive in the green roof environment which is often hot and dry. Thin green roofs usually require sedums and herbs, whereas thicker green roofs can often accommodate a wide range of native plants.

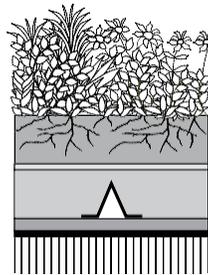
GREEN ROOF SYSTEMS

It is useful to categorize green roofs by drainage type and nominal thickness. The combination of these factors determines the structural load, the allowable slope, the type of vegetation supported, and the rainwater retention characteristics.

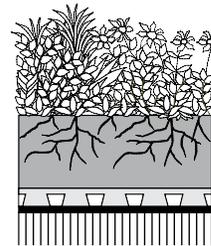
DRAINAGE TYPE: Drainage Type P utilizes *drainage plates*, waffled plastic sheets that store water above and drain water below. Drainage plates are lightweight, are easy to install, and are available in two sizes to meet the drainage and water storage requirements of almost any green roof. Drainage Type G utilizes a lightweight, porous inorganic *granular media* embedded with slotted plastic triangular drainage conduit. Granular media is heavier and is more labor-intensive to install than drainage plates, but provides a superior environment for plant root growth. Drainage Type M utilizes a *drainage mat*, a multi-layer fabric mat that combines soil separation, drainage, and protection functions into one product. This system is the fastest to install and creates the thinnest and lightest green roof assembly. However, its water storage and drainage capacity is limited, so it is primarily used for sloped roofs not suitable for Drainage Type P or Type G.



Drainage Type P
Drainage Plate

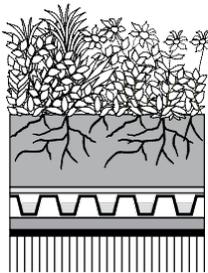


Drainage Type G
Granular Media

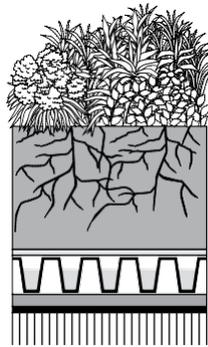


Drainage Type M
Drainage Mat

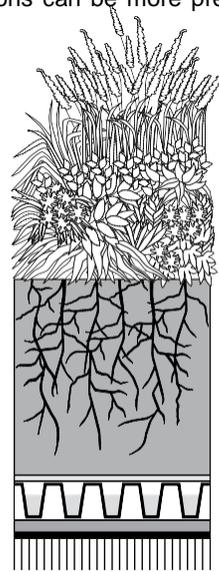
NOMINAL THICKNESS: The *nominal thickness* of a green roof is the approximate total height of the soil and drainage components that constitute the green roof system, excluding the roof structure, insulation, waterproofing, and plants. It is common practice to use the term *extensive* to describe green roofs that are very thin and will only support hardy, drought-resistant vegetation such as sedums, herbs, and perennials; *intensive* to describe green roofs that are thick enough to support a wider range of vegetation including grasses, shrubs, and small trees; and *semi-intensive* for roofs that are somewhere in between. These distinctions can be more precisely quantified by the four thickness ranges shown below:



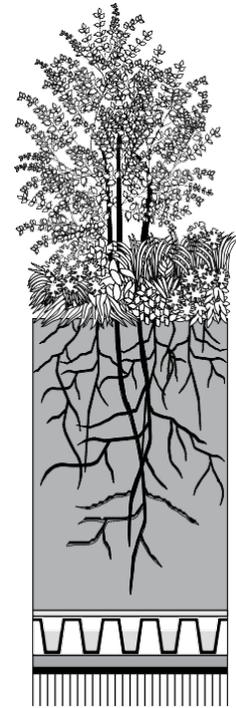
Thickness Type 1
3" to 4" sedums, herbs



Thickness Type 2
5" to 7"
sedums, herbs, perennials



Thickness Type 3
8" to 11"
perennials, grasses, shrubs



Thickness Type 4
12"+
grass, shrubs, trees