Green Infrastructure Fact Sheet

Planting for stormwater management

THE UNIVERSITY OF MELBOURNE

Green Infrastructure Research Group

See girg.science.unimelb.edu.au for more information

Why is managing stormwater important?

One of the most important environmental benefits of a green roof is to reduce urban stormwater runoff. It is important because the large volumes of stormwater that flow over impermeable city surfaces can severely erode and pollute local waterways (creeks and rivers). This significantly affects waterway health; for example, it causes a loss of habitat for wildlife.

Factors affecting a green roof's stormwater management performance

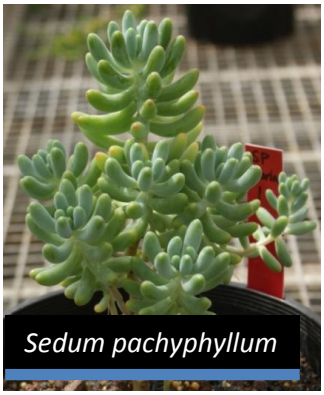
- Life-form of plants
- Surface cover and planting density
- Substrate depth and composition
- Slope of the roof
- Design of drainage layer (below substrate)

How does a green roof reduce stormwater?

Both the substrate and plants of a green roof have an important role in reducing stormwater. The substrate acts like a sponge to hold water, and the plants then use this water. Designed effectively, runoff from a building roof following small rainfall events can be completely eliminated, and the flow from larger rainfall events can be delayed.

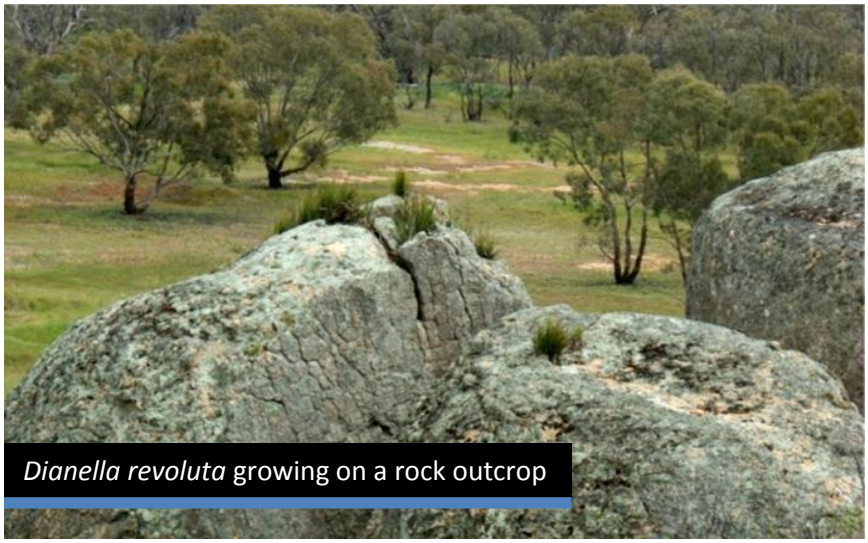
Why is plant selection important in reducing stormwater?

Plant selection significantly influences the amount of stormwater runoff from green roofs. To be effective at reducing runoff, green roof plants need to readily use water (in transpiration) when it is available to them; this dries out the green roof substrate and creates capacity to absorb future rainfall. The plants must also be able to survive when water is not available. Designing green roofs to maximise stormwater reductions therefore requires plants that are tolerant of extremes in water availability, and can balance survival under drought conditions with effective water use during and after rain events.



Sedum pachyphyllum

Succulent plants (species adapted to retain water in thick and fleshy parts) that are commonly grown on green roofs are not very effective at this. For example, the most common species used on European and North American green roofs are from the *Sedum* genus. *Sedums* have succulent leaves and high water use efficiency, making them tolerant of drought. However, their conservative water use makes them ineffective at reducing runoff. Roofs planted with succulent species have been found to have higher runoff than roofs planted with grasses and other plant types.



Dianella revoluta growing on a rock outcrop

For stormwater management, we look to natural habitats with plants that may be pre-adapted to the harsh green roof environment; in particular, habitats characterized by high temperatures, shallow soils, and highly variable water availability. An example of such a habitat is rock outcrops.

Plant research at Burnley

A greenhouse experiment at Burnley[1] identified several granite outcrop species which could be used on green roofs to improve stormwater management. These species use large amounts of water when it is available, which reduces runoff. They are also tolerant of drought, so they survive when water is scarce. Although all granite outcrop species were more adaptable to extremes in water availability than a commonly planted *Sedum* species (*Sedum pachyphyllum*), some species were better than others. Four of the monocot species were particularly good, as was the herb *Isotoma axillaris*. These species all had some degree of root, stem or leaf succulence, making them well adapted to drought stress. Apart from physiological traits, the size of the plant when mature is also an important consideration, as smaller plants generally deplete soil water at lower rates. We recommend that green roofs be planted with species that have a diversity of life-forms and drought avoidance strategies, to ensure both performance and survival.

Recommended species list for reducing stormwater

- *Arthropodium milleflorum*
- *Stypandra glauca*
- *Dianella admixta*
- *Lomandra longifolia*
- *Isotoma axillaris*

Stypandra glauca

Isotoma axillaris

Dianella admixta

Lomandra longifolia

Arthropodium milleflorum

[1] Farrell, C., et al., *High water users can be drought tolerant: using physiological traits for green roof plant selection.* Plant and Soil, 2013.

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