Science for Environment Policy

Plant characteristics can predict ecosystem services provided by green roofs

Simple characteristics of plant species — such as height or leaf size — can be used to predict the ecosystem services provided by the green roofs they grow on, a new study suggests. The researchers suggest that their method could be used to screen the thousands of potential plant species in order to optimize green roof design.

Green roofs on buildings are able to provide multiple 'ecosystem services' such as the reduction of heat loss from buildings in winter, the retention of stormwater and the provision of habitats. However, the delivery of such services may be dependent on the characteristics of the plant species grown on them.

For this study, the researchers investigated whether simple traits of plant species can be used to indicate the different ecosystem services that they might provide if they were part of a green roof. They measured four traits of 21 plant species in their natural habitats: plant height, the average leaf area and leaf weight of each species and the 'specific leaf area', which is the leaf's area divided by its weight. The team then ran experiments with the 21 plant species grown separately in trays across a single green roof between 2007–2011.

Throughout the experiment the researchers recorded four properties of the green roof ecosystem: the density of the plant growth, the rate at which species covered the tray, the amount of sunlight reflected by the green roof and the accumulation of snow on the roof during winter (as this affects the temperature of the soil). The researchers could then relate the four simple measurements taken from the plants in their natural environments to the properties they would show as part of a green roof. For example, they found that taller plants were more likely to cover the roof at a faster rate.

The researchers also examined the ecosystem services provided, which were measured as the amount of stormwater captured, temperature changes in the soil during summer and winter, and changes to soil composition e.g. the amount of nitrate removed. In a final step the researchers used the four plant traits to predict ecosystem service provision. For example, leaf size could indicate the density of plant growth which would subsequently influence the temperature regulation provided by the green roof.

These are important results, the researchers say, as they show that simple measurements can be used to identify plant species that could optimise green roof ecosystem services.

The authors recognise that their current predictions were made using populations of single species and suggest that further work should be done to consider the provision of ecosystem services from species mixtures. They also warn that there may be differences between how the species grow in natural habitats and on the green roof. For instance, species that require fertile environments may experience population crashes due to the limited resources on green roofs.

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