13 = Selecting plant species for low maintenance extensive green roofs: a case study from North-East Italy

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Green roofs provide numerous fundamental benefits in urban environments and play a crucial role in redesigning cities to adapt to the effects of climate change. The harsh environmental conditions typical of urban building surfaces are being made even more difficult by global warming: the selection of plant species able to cope with such environments, and especially high temperatures, poor soil conditions and scarcity of water is essential for the development of the green roof technology. Plant ecology can provide the basic knowledge to select plant species and create plant assemblages best adapted to the specific structural characteristics of buildings, aesthetic needs, local conditions, and valuable to provide new areas for native biodiversity. Furthermore, the temporal dimension of plant cover changes over time represents a very interesting issue for the enhancement of green roof installations.
In spring 2016 experimental plots of extensive green roofs (EGRs) were installed on a building of the University of Trieste (NE Italy), which lies in the northern part of the Mediterranean area belonging to the Temperate macrobioclimate but showing a period of summer aridity. The research aimed to: a) select native species particularly resistant to extreme drought conditions useful to create EGRs mimicking natural communities; b) analyse the effects of different substrate depths on plant cover development; c) study the dynamics of the plant cover of EGRs over time. First findings at the fifth year of the research are here presented.
Selection of plants was based on biological, ecological and biogeographic features of native species, and phytosociological knowledge of plant communities occurring in the nearby natural areas: seeds of herbaceous and dwarf-shrub species were collected from dry karst grassland communities of *Scorzonero villosae-Chrysopogonetalia grylli,* including elements typical of pioneer open stages of *Sedo albi-Scleranthetea biennis*. Seeds were obtained by direct harvesting in grassland communities, with selection of material performed manually for each species.
Ten EGR experimental plots of 40 cm x 40 cm, arranged next to each other, with the substrate depth of 10 and 7 cm were used (5 randomly selected plots for each depth). The plots had no irrigation system: watering of plants was performed only during the first growing season, regularly after sowing and later only during extremely arid periods. No elimination of new species, not intentionally sown, was performed in order to study the dynamic process of the EGR plant cover. Two sampling campaigns were performed each year in late spring and early autumn; plant cover was visually estimated using 1% class interval.
Of the 40 grassland species initially sown, 25 were able to develop during the first year (with irrigation), but only 10 survived the second year (no irrigation) and even fewer (7) were present from the third year onward. In particular all perennial *Poaceae* species disappeared within the first year. The best performing species was *Sedum sexangulare*, which was able to cover wide areas densely, although its spreading leads to a decrease of the species richness, since where it prevails all the other species disappear quickly. Some grassland annuals proved to be excellent elements being able to establish themselves, cover large areas rapidly, fill open spaces left by suffering perennials, and recover after periods of severe drought.
Various new species from the surrounding areas were found in the plots: they are annual species belonging to the typical urban flora and linked to disturbed and uncultivated ruderal habitats. Over the years, waves of different ruderal species were observed, which however completely disappeared or drastically reduced the following years: no local annual species was able to establish itself like some grassland annual species.
The depth of the substrate affects the cover degree of vascular plants, but on thin substrates the bryophytes are able to colonize rather quickly the available open areas, proving to be effective elements for covering and stabilizing the substrate of shallow EGRs.
An approach based on a mix of perennial, annual and even bryophyte elements appropriately selected based on the knowledge of plant communities can provide valuable solutions for the development of plant coverings able to colonize/recolonize surfaces quickly, maintain themselves even if the water supply only depends on precipitation and resilient to environmental changes.

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