Plant Resilience on Green Roofs for Climate Extremes

By Ryan Vasseur

The heat dome of 2021 in the Pacific Northwest and subsequent extreme heat and drought throughout the Summer require a deep rethinking of how green roofs are designed and maintained. Stewards of green roof plants and soils need the right tools to allow them to thrive despite increasingly difficult conditions. Scientists tell us that we are now dealing with an aridification of our climate exacerbated by climate change that will see once impossible conditions such as the heat dome and prolonged drought become a recurring possibility. The green roof ecosystem requires resilient and regenerative solutions.

Biodiversity of plants

Biodiversity of plants on green roofs that are extremely drought tolerant is of high importance. Green roofs represent some of the most extreme micro-climates that we have as they are often fully exposed to sun and the elements and have lower soil profiles which retain less moisture. This will vary based on region but we have observed the following plants to be extremely drought tolerant in the Lower Mainland of British Columbia. In addition to handling extremely hot and dry conditions many of these plants are multi-functional providing habitat for birds and insects, food for pollinators, are medicinal, and capable of building healthy soil.

This is far from a complete list but plants that we have observed to perform well in difficult green roof conditions over several years of maintenance visits include:

- Agastache
- California Poppy
- Dutch clover
- Echinacea
- Fireweed
- Godetia
- Goldenrod
- Heathers
- Lavender
- Lupin
- Nodding Onion
- Oregano
- Pearly Everlasting
- Red crimson clover
- Rudbeckia
- Sedum (Various Species)
- Yarrow
- Several grass species mixed within sedums and wildflowers such as Rye Grass, Western Fescue, Idaho Fescue, and others

Biodiversity of soil microorganisms

An emerging conversation, microorganisms bind aggregates together, bacteria with the production of alkaline glues and fungi through filamentous hyphae. Most green roofs are highly deficient in fungal species but have adequate levels of bacterial species. This is due to the disruptive processes of building a green roof (fungi do not survive easily when they are highly disturbed in processes such as tilling and soil mixing, bacteria tend to thrive during disturbance).

Biodiversity of plants is connected to biodiversity of soil microorganisms. A healthy variety of plants will attract and maintain a variety of microorganisms and vice versa.

Healthier Plants

Plants that are photosynthesizing to a high potential will be much healthier. They will secret more sugars that feed the microorganisms which create aggregates within green roof soil and exchange soluble nutrients with plant roots. So how do we get plants to be healthier?

1) Foliar Sprays

Well designed foliar sprays can give plants the nutrients, micronutrients and sugars that they need. It is important to note that plants need much more consideration that the usual N-P-K listed on commercial fertilizers.

Recommendations for DIY foliar sprays for green roofs include:

-Epsom salts for magnesium
-Molasses or decarbonated Coca-Cola for simple sugars (they help attract beneficial microorganisms in a symbiotic relationship as plant roots feed microorganisms with sugar). Molasses also contains iron and Coca-Cola phosphorus.
-Liquid Seaweed for micronutrients such as iron, calcium, manganese, and more.
-Apple cider vinegar is a prebiotic and probiotic and helps build microorganism populations on leaf surfaces.
-Humic Acid helps encourage fungal species in soil.

2) Compost Teas

Healthy soils contain high levels of beneficial microorganisms. When we have highly disturbed soils such as on green roofs these microorganism are often killed before they can settle on the green roof. Compost tea helps add beneficial microorganisms to the green roof area.

3) Healthy Compost (when practical to bring to the green roof)

If a crane or elevator is available then it is strongly recommended to do a thin layer of healthy compost (even half an inch will be beneficial) to the vegetation on the green roof.

4) As close to full plant coverage as possible on extensive and semi-intensive roofs (95% and up is recommended). Where large gaps exist in plant coverage dark soil will absorb more sunlight, heating up and drying out the soil much more quickly. This must be analyzed and addressed every Fall and Spring. If shortcomings in plant coverage are discovered then they can be resolved with seeds or sedum cuttings.