Ingenieurbüro Blumberg

Wetland roofs, a versatile and innovative type of green roof

A wetland roof is a special type of extensive green roof. A roof is evenly planted with wetland or marsh plants which will be regularly irrigated on a daily basis. Besides the aesthetic aspect, this particular type of roof may also offer significant functional advantages.

Possible fields of use

Wetland roofs are natural air-conditioning systems. During the spring and summer months, the heat of the rooms below will be eliminated by the evaporation of the water. When it becomes colder in autumn or winter, a wetland roof is, due to its additional heat insulating effect, an excellent protection against an extensive heat loss.

The FAL cowshed roof in Brunswick (2006)

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Water accumulating mats planted with wetland plants (helophytes) are applied on the roof and work as a natural air-conditioning system.
Both the plants themselves and the microorganisms living on their roots remove nutrients from the water to be used for their growth and for their metabolism. Wetland roofs may not only be used for the retention and purification of stormwater, but also for domestic, agricultural and industrial waste water. The purified water may be reused for irrigation or for sanitary facilities (greywater recycling).

Water feeding pipes of the FAL cowshed in Brunswick (2006)
The wetland roof (834 m²) improves the climate within the cowshed and increases the milk yield because of the improved keeping conditions

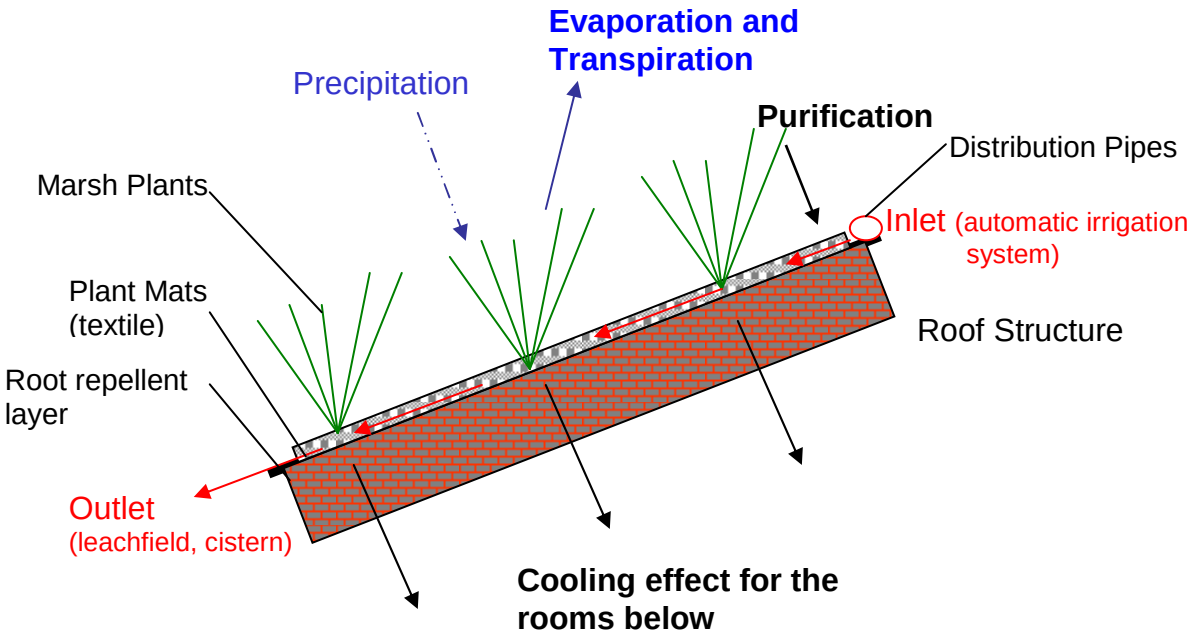
Wetland or marsh plants are especially appropriate for the filtration of airborne particles (dry deposition), due to the very active vegetation mainly during the summer months. The dust particles accumulate on the surface of the vegetation layer and will then be rinsed into the mats by rainwater. There, a large part of the matter will be absorbed as plant nutrients.
The protection of the roof skin against extreme weather conditions ensuring an increased durability of the roof is another positive aspect of wetland roofs.
A wetland roof passable on foot may be also used as a roof garden and recreation zone. Moreover, such a kind of roof will be of course an aesthetic and optical enhancement of the building.

Structure and principle of a wetland roof

The selected types of wetland or marsh plants will be pre-cultivated on mats of non-woven material for one year before becoming part of a wetland roof structure. For the cultivation, textile base mats for plants are used with a considerable water accumulating capacity ensuring at the same time a mechanical protection for the roof skin. After approximately four months, they will be completely penetrated by roots, and the mat strips are then ready to be installed on the roof.

Installation of the plant mats

Ecoroof



Structure and principle of a wetland roof

A penetration of the roots into the roof and the resulting destruction of the roof skin is prevented by a substructure consisting of a root barrier layer and non-woven material (textile). Since wetland or marsh plants need a certain degree of humidity, an artificial irrigation system adaptable to the season will be necessary for which a water distribution pipeline network with several outlets with exactly defined distances between them will be installed on the ridge of the roof.

Outlet of the water feed system

Irrigation along the ridge

The rainwater usually stored by cisterns will be pumped on the plant mats in intervals and thus ensures a sufficient irrigation.
The water flowing through the mats takes up the heat of the rooms below. Thus, heat is withdrawn from the building and therefore a heating of the room air will be avoided due to the intermittent irrigation and the evaporative heat loss generated by the evapotranspiration of the marsh plants and because of the irradiation shielding by the lush vegetation also during the summer months.
After the water has run through the planted mats, it will be collected in the gutter and trickled away into the subsoil via downpipes, or it will be accumulated in a rainwater cistern and then again be pumped back on the roof.

Characteristics of the plants

The automatic irrigation of the green roof is effected by means of an irrigation computer. The selected wetland plants appropriate to be planted on a roof, will be cultivated by a special growing procedure and require, besides a sufficient supply of water, only few nutrients. Therefore, a strong fine root system will develop which offers excellent conditions for aerobic bacteria and intensely penetrates the textile mats.
The root and rhizome network works like a screen and filters suspended matter out of the water.

Purple loosestrife (Lythrum) and monkey flowers (Mimulus) on a wetland roof (2006)

A wetland roof is an energy saving air-conditioning system with numerous particular ecological functions which offer promising advantages especially for global centres of population like megacities, for example.

Our Ethiopian trainee, Mr. Fekadu, on the ridge of the FAL wetland roof in September 2006

Summary of the efficient components of a wetland roof

1. Compensation of temperature amplitudes (of the roof skin, of the building, of the ambient microclimate) and cooling
   - due to the irradiation shielding
   - due to the evapotranspiration* of the artificially irrigated roof caused by the lush roof vegetation even during the summer months.

2. Stormwater discharge reduction (retaining 60 % of runoff and thus reducing stormwater fees).

3. Increase in durability of the roof by a temperature reduction and protection against a direct impact of UV-radiation leading to a reduced surface ageing (reduced membrane replacement costs).

* For the evaporation of 1 g of water, an energy amount of 2.450 kJ will be removed from the ambient air and will only released back into the atmosphere during the condensation process.

4. Compensation of the surface impermeability (factor ≥ 50 %).

5. Considerable reduction of the need for technical air-conditioning (supplied by fossil sources of energy) because of a passive cooling of the building (energy savings).

6. Improvement of the microclimate and contribution to the prevention of an overheating of urban conglomerates during the summer months (hot spots).

7. Filtration of dust emissions and of other air polluting matters.

8. Higher short-wave radiative reflexion compared to a dark bitumen roof.

9. Reduced roof loads due to a substrate-free planting procedure with only one textile water accumulating mat on which the selected types of wetland plant have been pre-cultivated. This procedure ensures that the roof surface is fully covered by plants after one period of vegetation.

10. Possible design as a roof garden (flat roof) with a highly aesthetic component due to the variety of usually untypical types of roof plants like wetland or marsh plants (aquatic macrophytes) and by the animals belonging to such a kind of ecosystem (e.g. butterflies and birds) instead of succulent or grass roofs with their poor vegetation during the summer months. Employees use the roof space for recreation during breaks.

11. Possible use as a roof sewage treatment plant (treatment wetlands) both for municipal and for industrial waste water (constructed wetlands, reed bed treatment systems) for greywater recycling and for stormwater treatment (benefits of natural water purification).

12. Irrigation system that is activated by means of an irrigation computer automatically when water in the drainage layer gets low.

Wetland roofs are a model of low-cost, low-maintenance, functional and ecological green roof application.
If you are interested we provide individually tailored ecoroof-systems as a tool to transform our urban landscape into a natural system that can support and sustain us. The implementation of a widespread green roof infrastructure can demonstrate how cities can meet the environmental challenges we face.