Urban Green Infrastructures

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URBAN VULNERABILITY AND RESILIENCE

In the last decades a robust urbanization over the world occurred.

An increase in environmental problems:

Water management

- a great decreasing in soil retained water
- an increasing of the water surface flow
- risk related to storm runoff

Overheating and Heat Island effect

Energy consumption

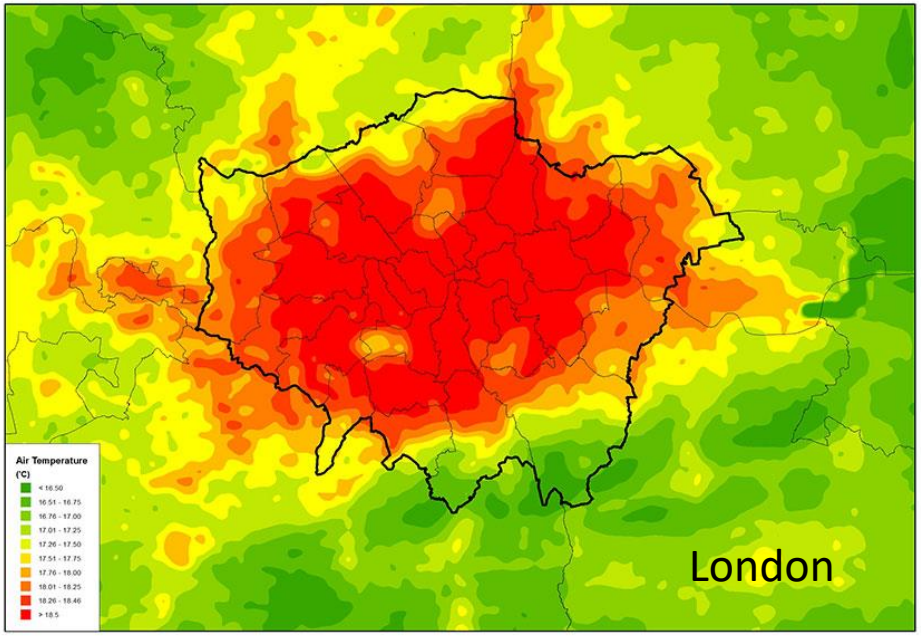
High pollutant load in urban water and air

Biodiversity reduction

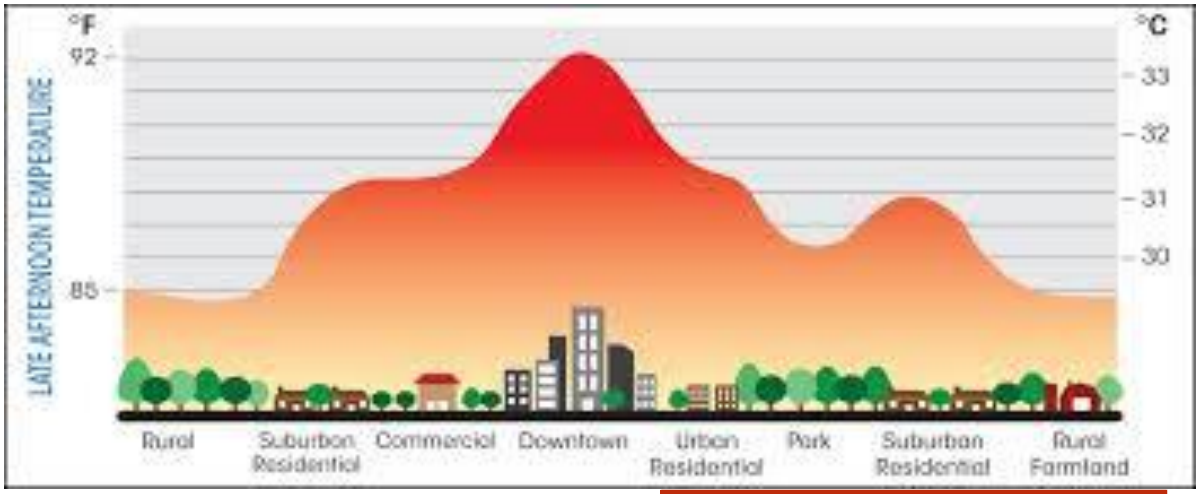
Soil scarcity

heat Island effect

dense cities characterized by high thermal conductivity buildings and crossed by paved roads and large waterproof areas (courtyards, squares, private and public spaces) accumulate a large amount of thermal energy that cannot be dissipate. That effect increases the temperature difference between urban and surrounding rural



"heat island" effect it can be seen that in urban area a peaks of heat occurs with a maximum over buildings and streets and decreases towards a minimum levels in the green urban areas, such as parks and gardens, and in suburban rural areas.



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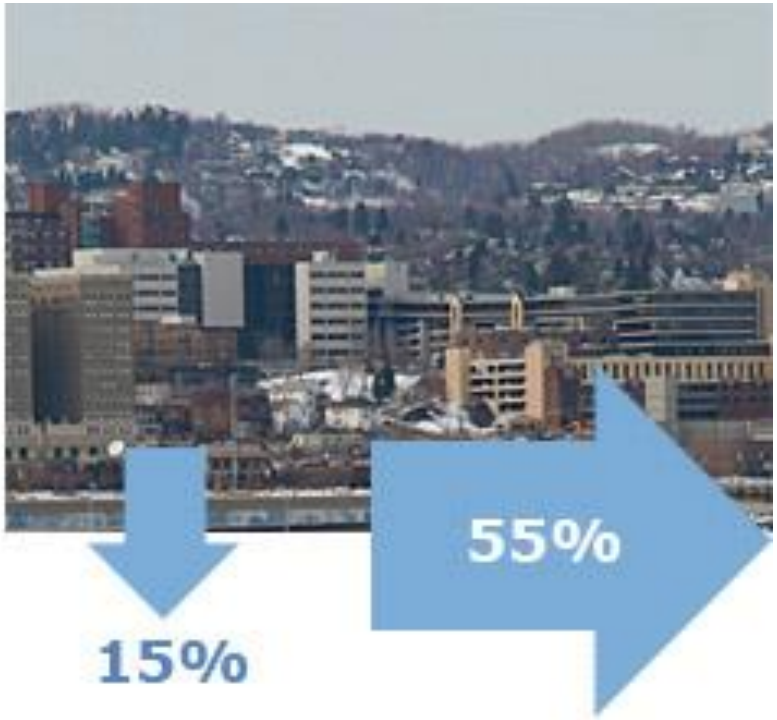
Runoff and Rain water infiltration



In its common usage, the word "resilience" is typically understood to describe a material's ability to recoil or spring back into shape after bending, stretching, or being compressed.

The term "resilience" has also its origins in the science of ecology.

In ecology, resilience has been described as the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state. Thus, a resilient ecosystem is considered to be one that can more effectively withstand external shocks and rebuild itself after experiencing those shocks.

Resilience in human social systems understands there to be the added capacity of humans to be able to some extent anticipate and plan for the future.

Resilience is conferred in both human and ecological systems by their capacities for adaptation to these external stresses and shocks.

URBAN RESILIENCE

the word “resilience” as an umbrella term for the planning and design strategies to help our cities develop the capacity to meet the challenges of the future

A Resilient City is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures so as to still be able to maintain essentially the same functions, structures, systems, and identity*

*Source: Working Definition, ResilientCity.org

Agenda 2030
United Nations
Sustainable Development Goals

Sept. 2015

https://ec.europa.eu/epale/it/resource-centre/

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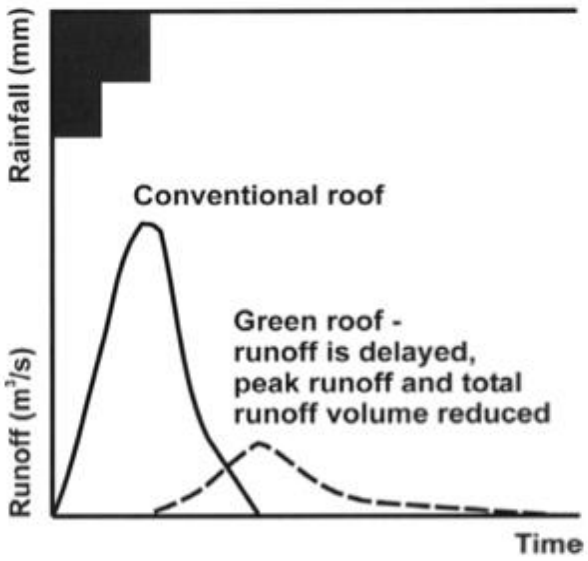
GREEN TECHNOLOGIES AS SOLUTION FOR WATER MANAGEMENT AND HEAT ISLAND EFFECT AT URBAN LEVEL

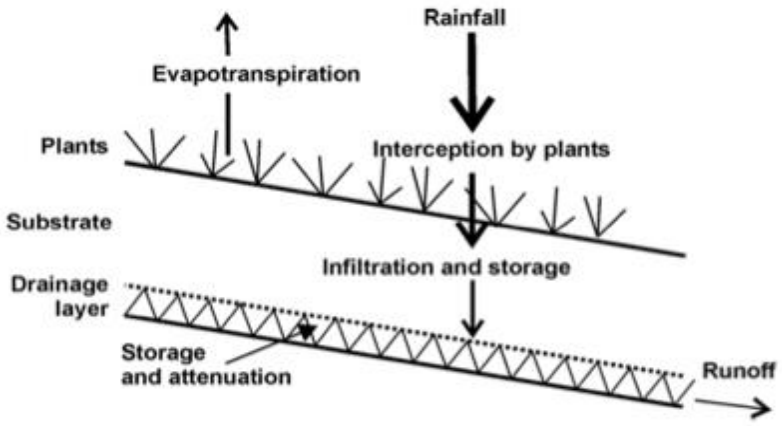
Green roofs, green streets, and vegetated walls are increasingly addressed and studied as elements that help cities to adapt and mitigate the effects of climate change, achieve environmental benefits, enrich architecture and life quality.

New green technologies and infrastructures represent an excellent solution for rainfall water drainage and collection. improving the conditions of summer comfort, performing its thermal insulation as well as absorption of CO_2 and airborne fine particles.

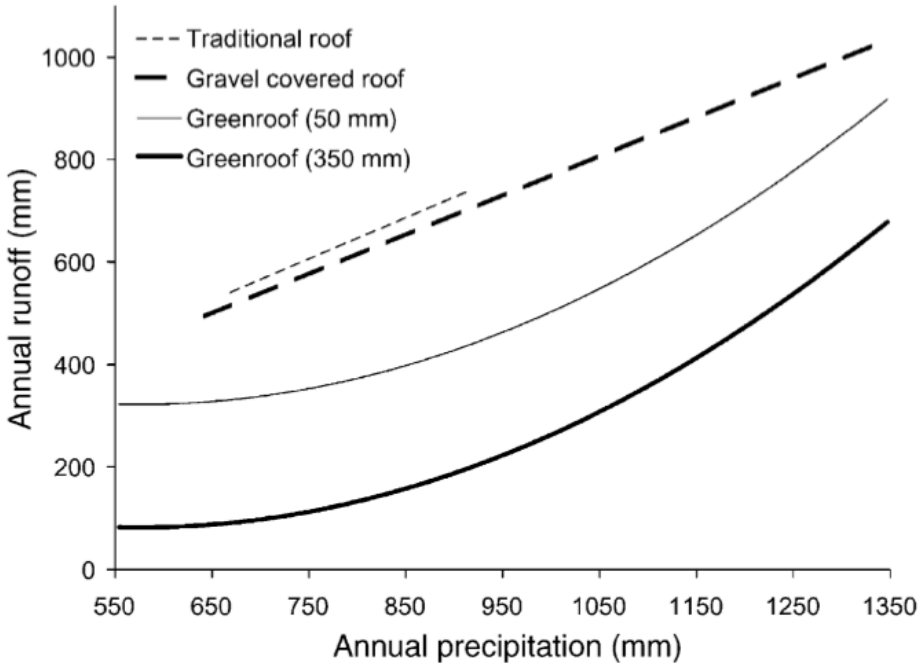
Runoff reduction

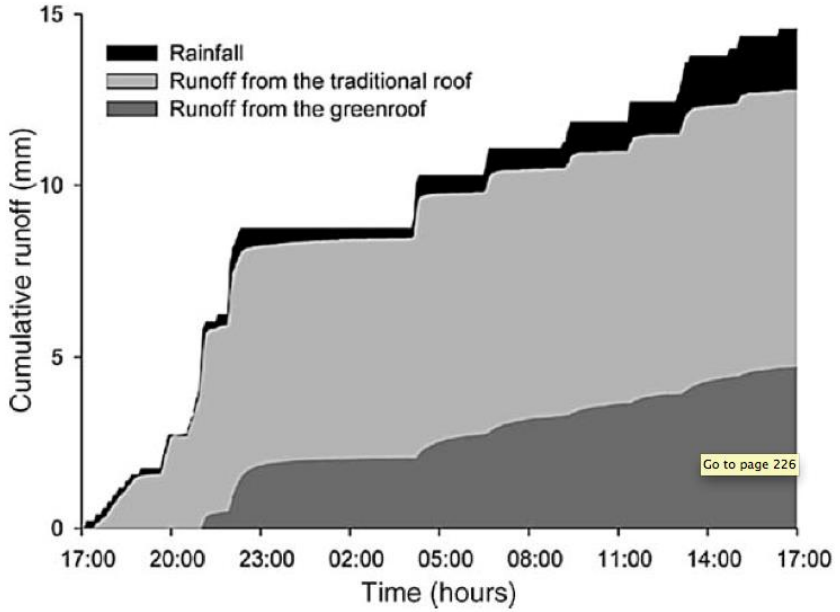


. Rainfall runoff response (schematic).

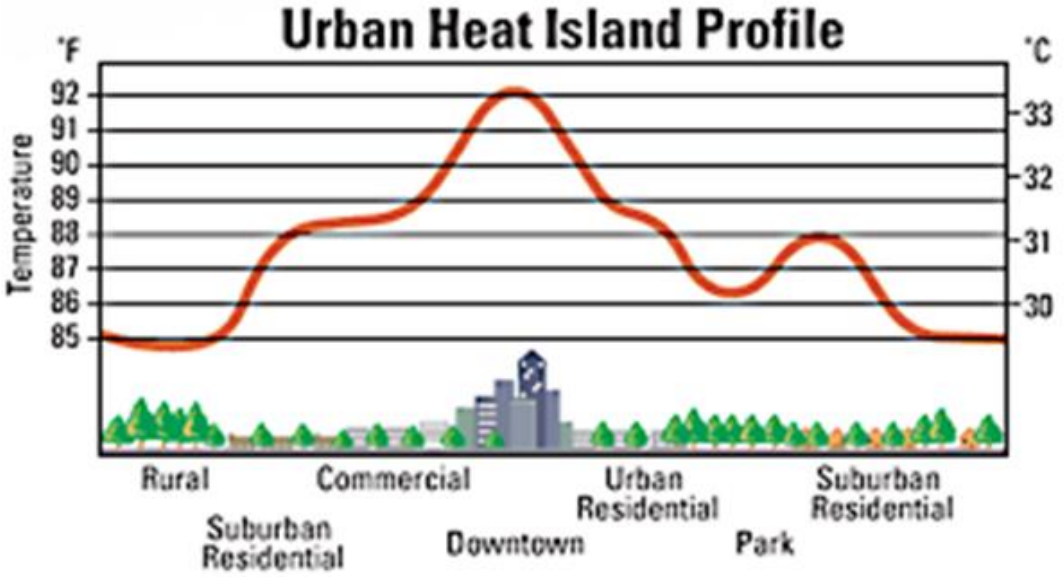


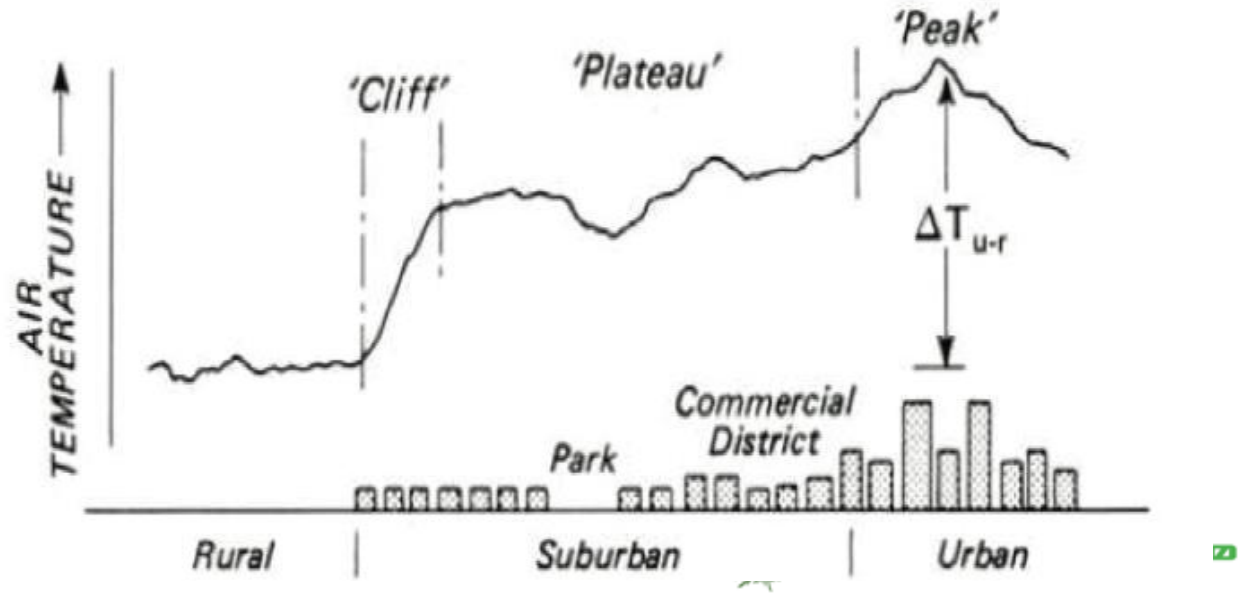
Green roof hydrological processes.

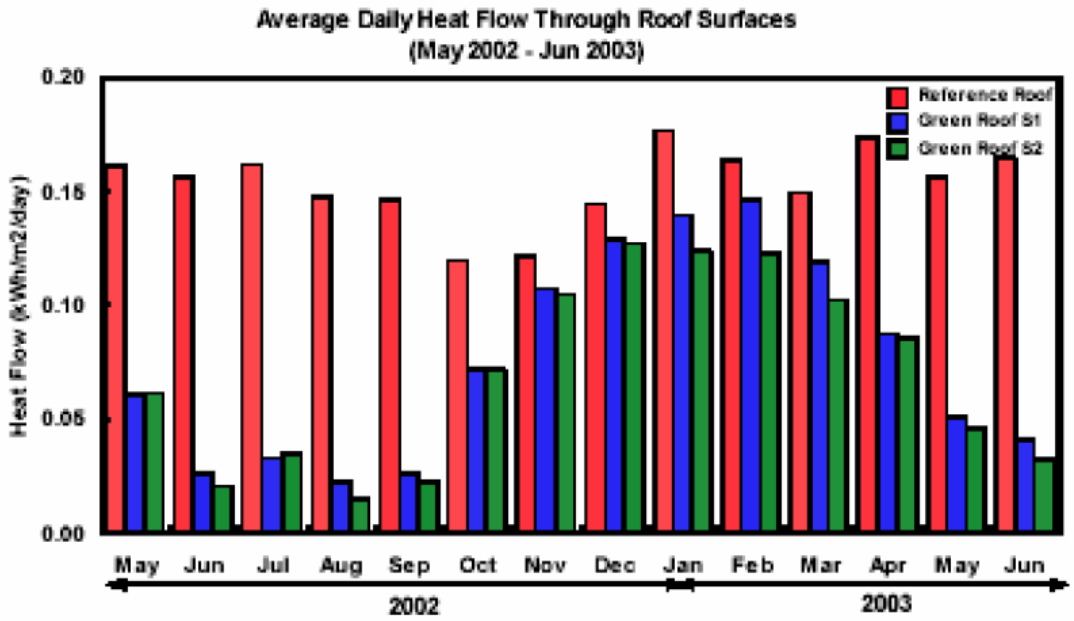




Urban Heat Island Effect







URBAN GREEN TECHNOLOGIES AND INFRASTRUCTURES

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Green Infrastructures are technologies and practices that reproduce natural processes by the use of natural or engineered systems

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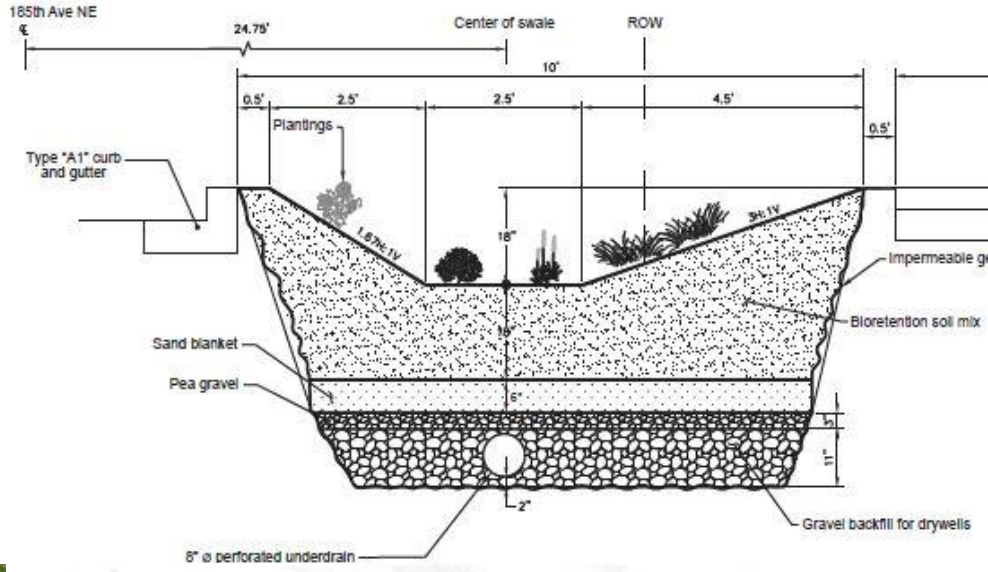
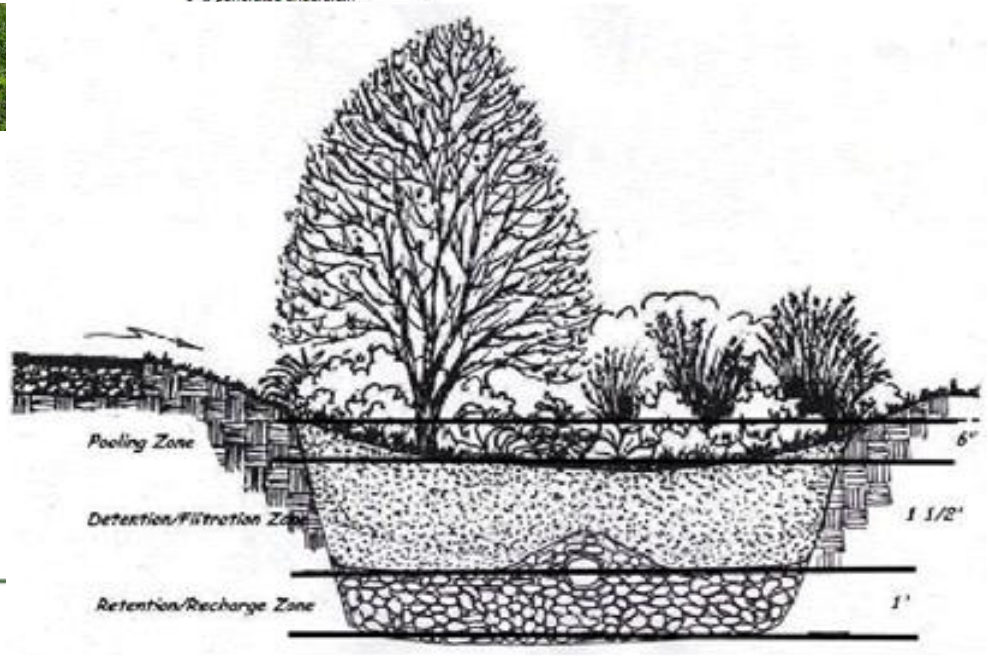
Green Walls and Green Facades





Infiltration areas
green streets,
rain gardens

PARKING

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Urban Horticulture

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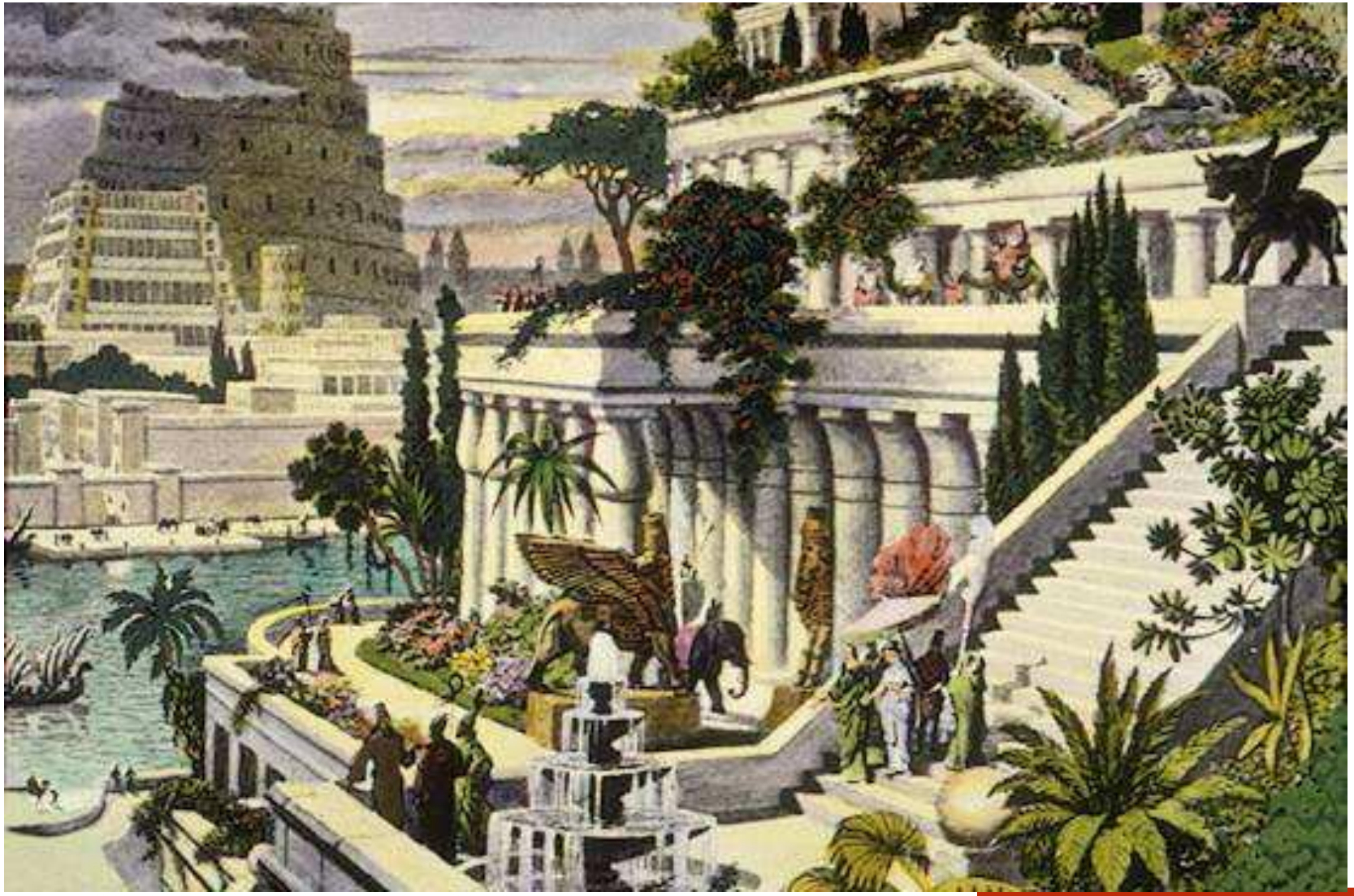
Green Roofs

Babilonia Gardens 590 b.C



Rome, mausoleo di Augusto (29 a.C.)

Italian Renaissance

In Iceland, since IX century a.C. Roof covering

Farm house in Keldur, Iceland.

"earth sheltered" houses,
an ancient form of passive solar, sustainable architecture.
It's the practice of "packing earth against building walls for external thermal mass, to reduce heat loss and maintain steady indoor temperature."

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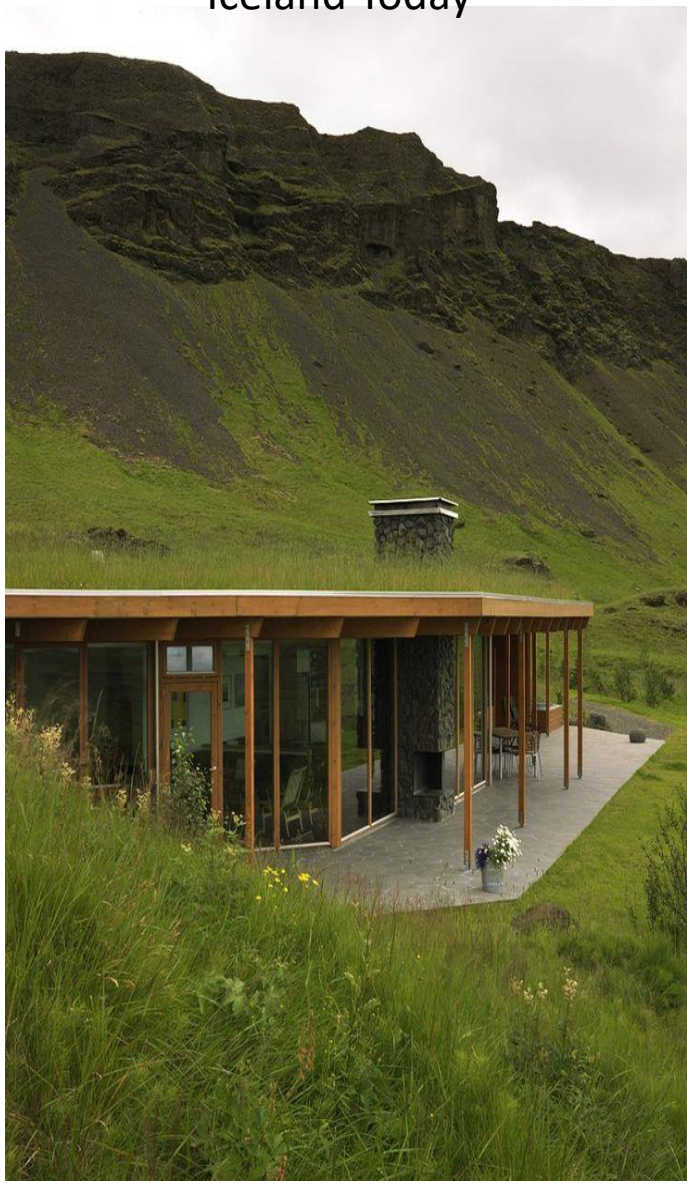
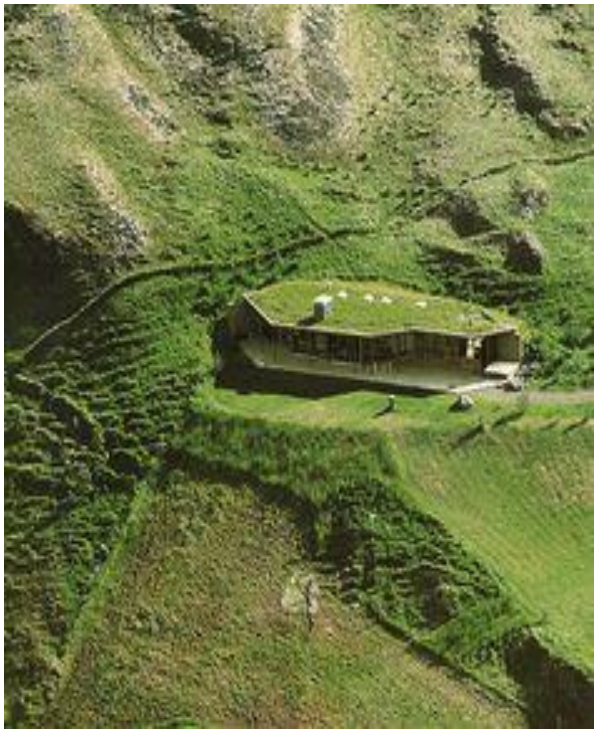
Iceland Today





Gata house in Fludir, Iceland by architect Valdimar Harðarson

Norway

Green Façade, Lleida, Spain.

Traditional green façades as thermal passive protection systems of the building.

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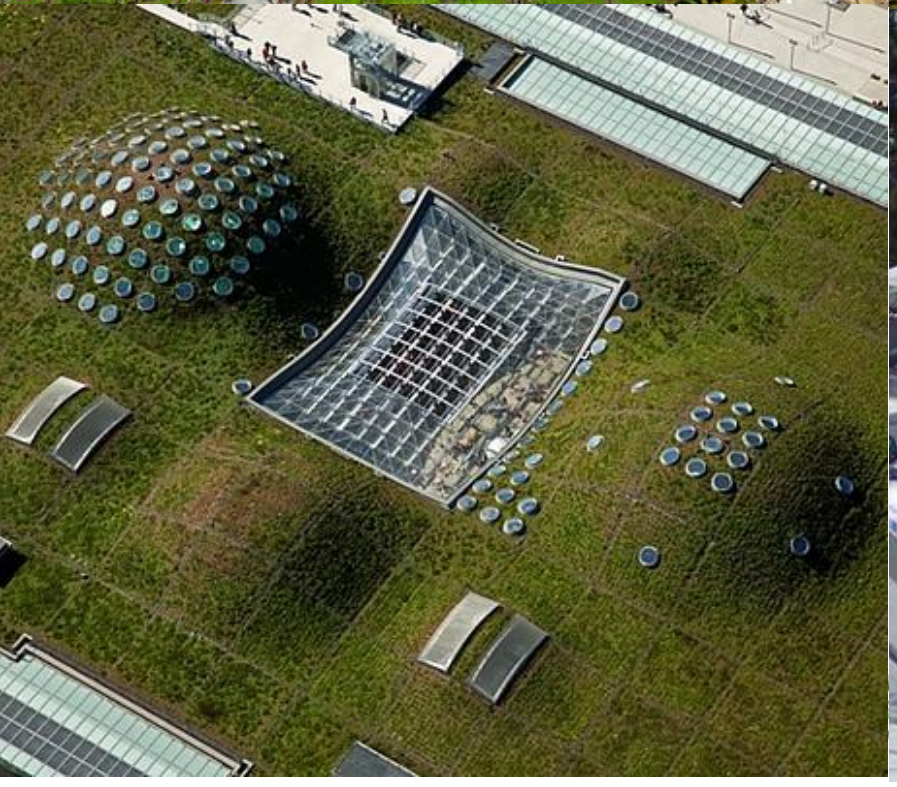
California Science Academy



Delft (NL) University Library

The Confederation of Indian Industry-Godrej Green Business Centre in Kondapur, Hyderabad.

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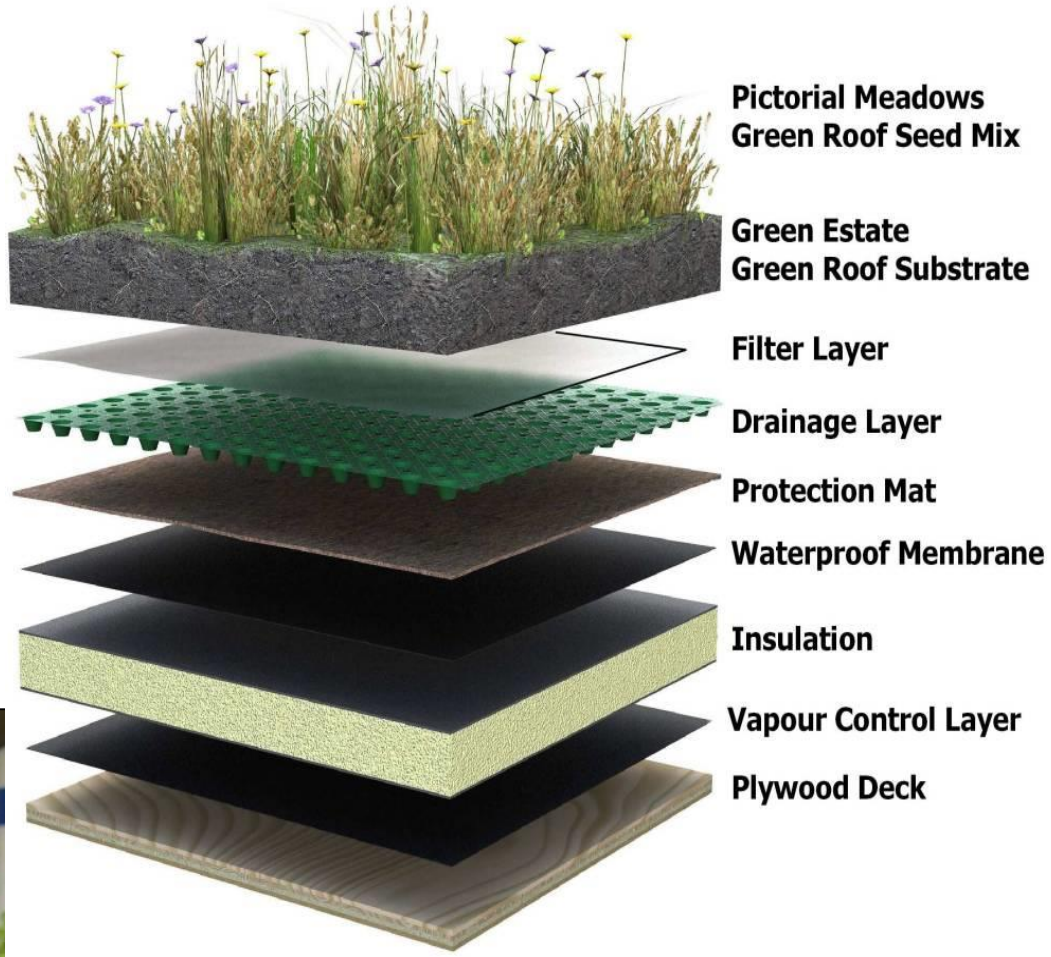
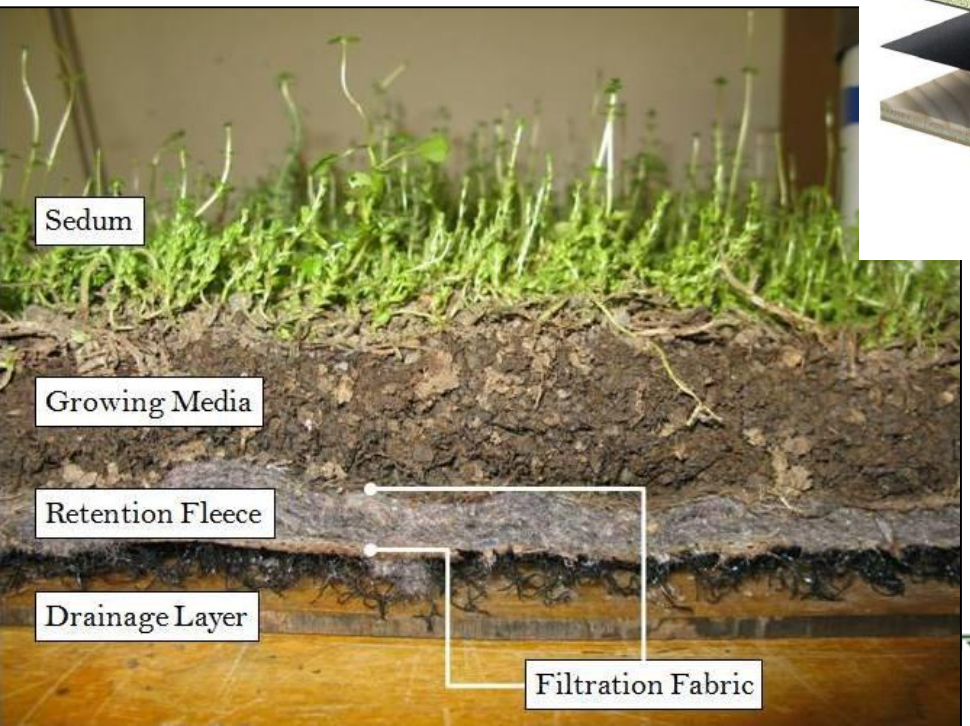
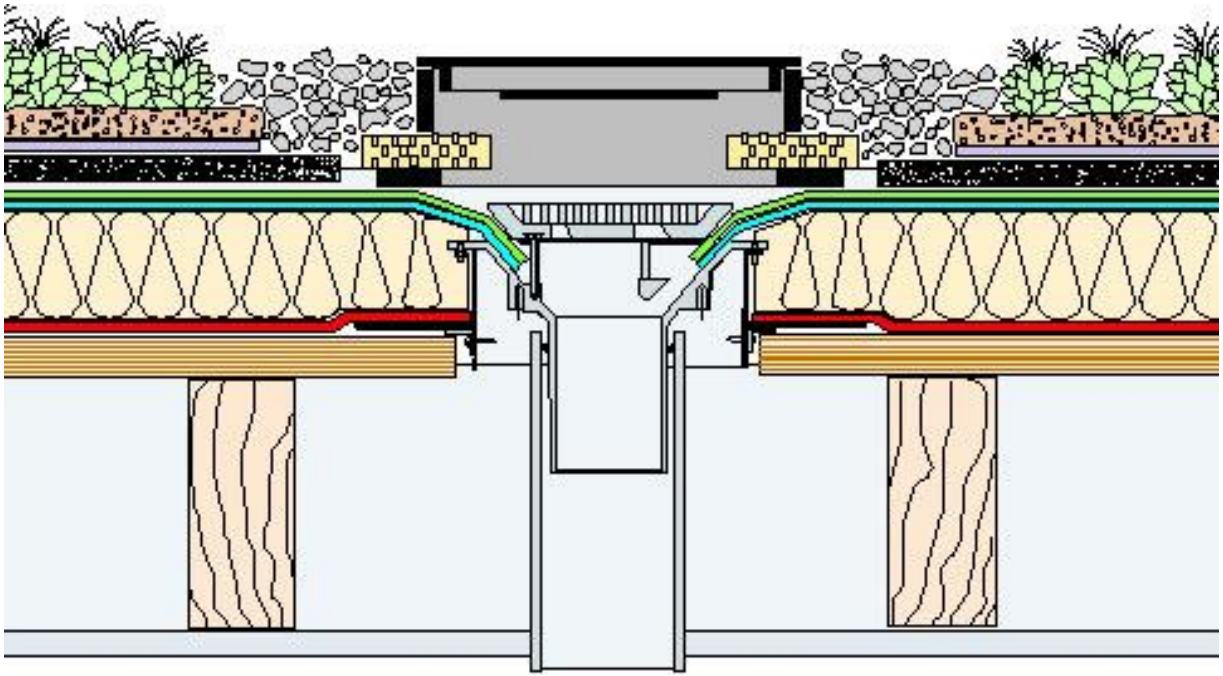
Green roofed Colorado home buried into the earth to save energy, by Lucy Wang

Green Roof

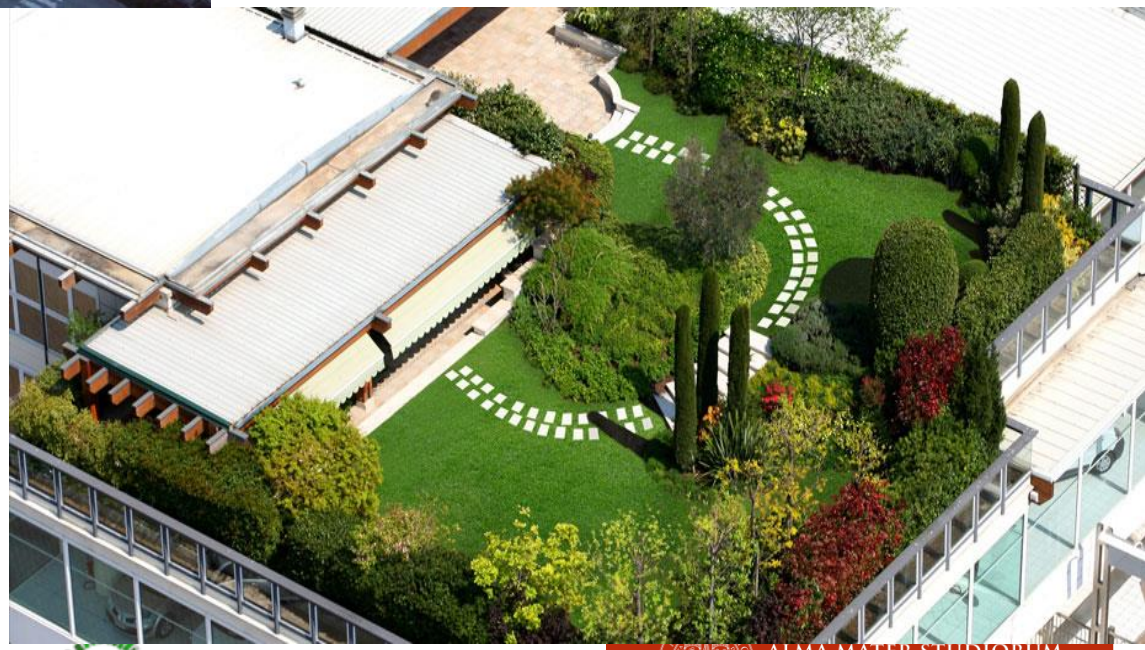

Pictorial Meadows
Green Roof Seed Mix
Green Estate
Green Roof Substrate
Filter Layer
Drainage Layer
Protection Mat
Waterproof Membrane
Insulation
Vapour Control Layer
Plywood Deck


Sedum
Growing Media
Retention Fleece
Drainage Layer
Filtration Fabric

water collection



extensive



intensive

Green Roof
at Engineering School University of Bologna

HOBO WEATHER STATION

MONITORING THE GREEN ROOFS

Device Information

General | Communications

Status: Logging every 05 min
Memory: Wrapping
Battery Level: 100%
Nickname: hobin0
Serial Number (SN): 10348460
Model: HOBO U30 Station - Wi-Fi
Firmware Version: 2.006

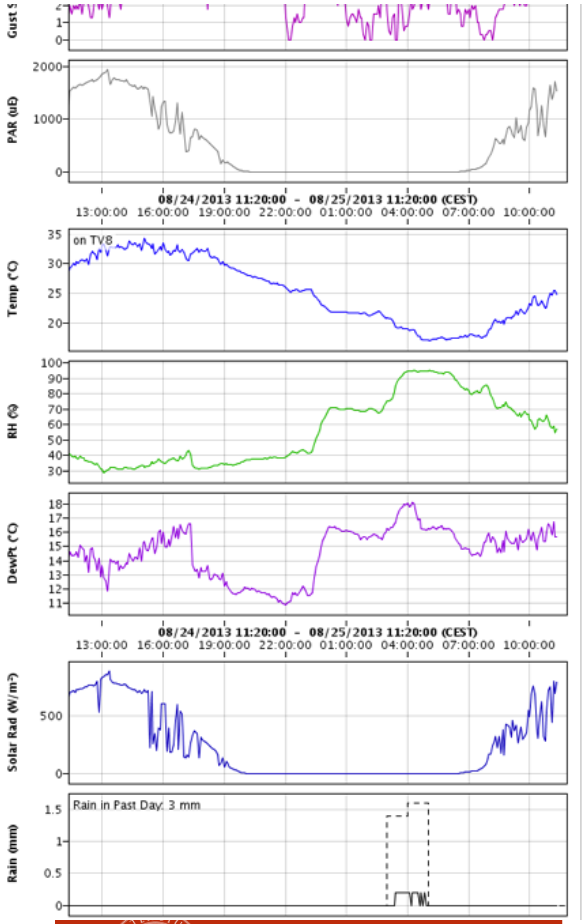
Latest Conditions

Relay State: Deactivated (Open)
Voltage: -0.204 V
Current: 0.000 mA
Wind Direction: NNE 18 °
Wind Speed: 1.0 m/s
Gust Speed: 2.8 m/s
PAR: 1539 uE
Temperature (on TV8): 24.75 °C
RH: 57.0 %
Dew Point: 15.68 °C
Solar Radiation: 798 W/m²
Rain: 0.0 mm
Battery: 4.59 V

Latest Connections

Expected to connect 1 day ago
Yesterday at 11:22 CEST
Yesterday at 10:22 CEST
Yesterday at 09:22 CEST
Yesterday at 08:22 CEST
Yesterday at 07:22 CEST

Full Log



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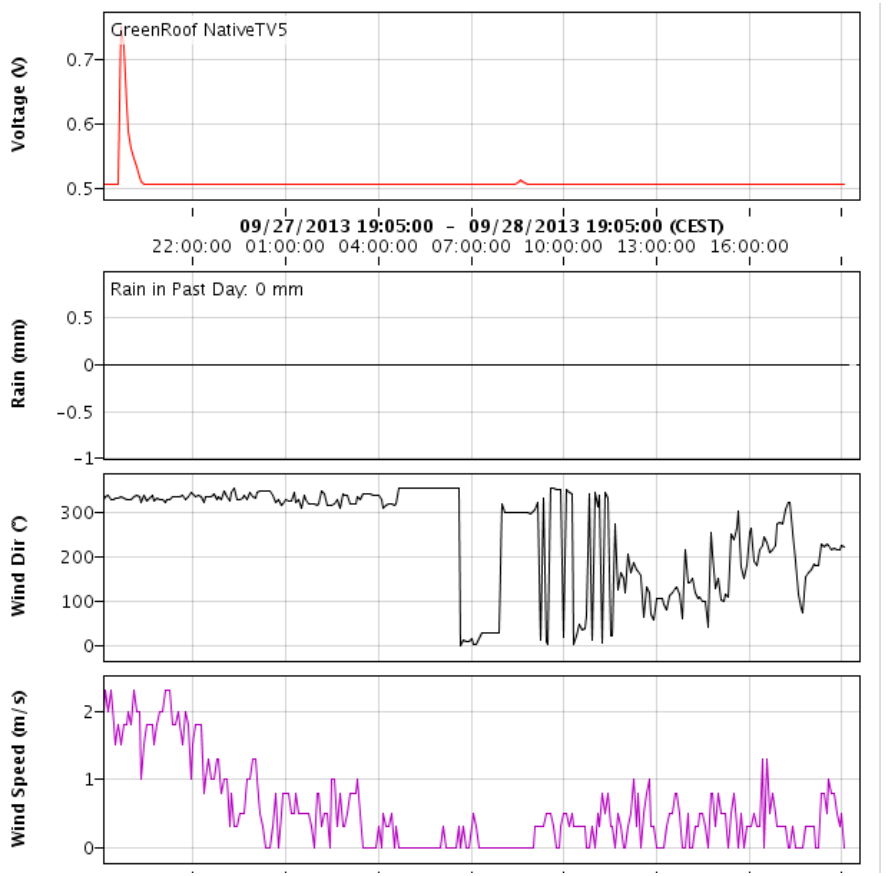
MONITORED PARAMETERS

T amb Temperature (°C)
T soil Soil Temperature (°C)
P Rain water, precipitation (mm)
Rh Relative Humidity (%)
Solar Rad (W/m^2)
Par (Photosynthetic active radiation)
Wind speed (m/s)
Wind direction (°)
Run off 1– Surface weir (mm) (ml^3)
Run off 2– In pipe weir (Voltage)
(ml/min flow rate) (ml3 volume) (mm depth)



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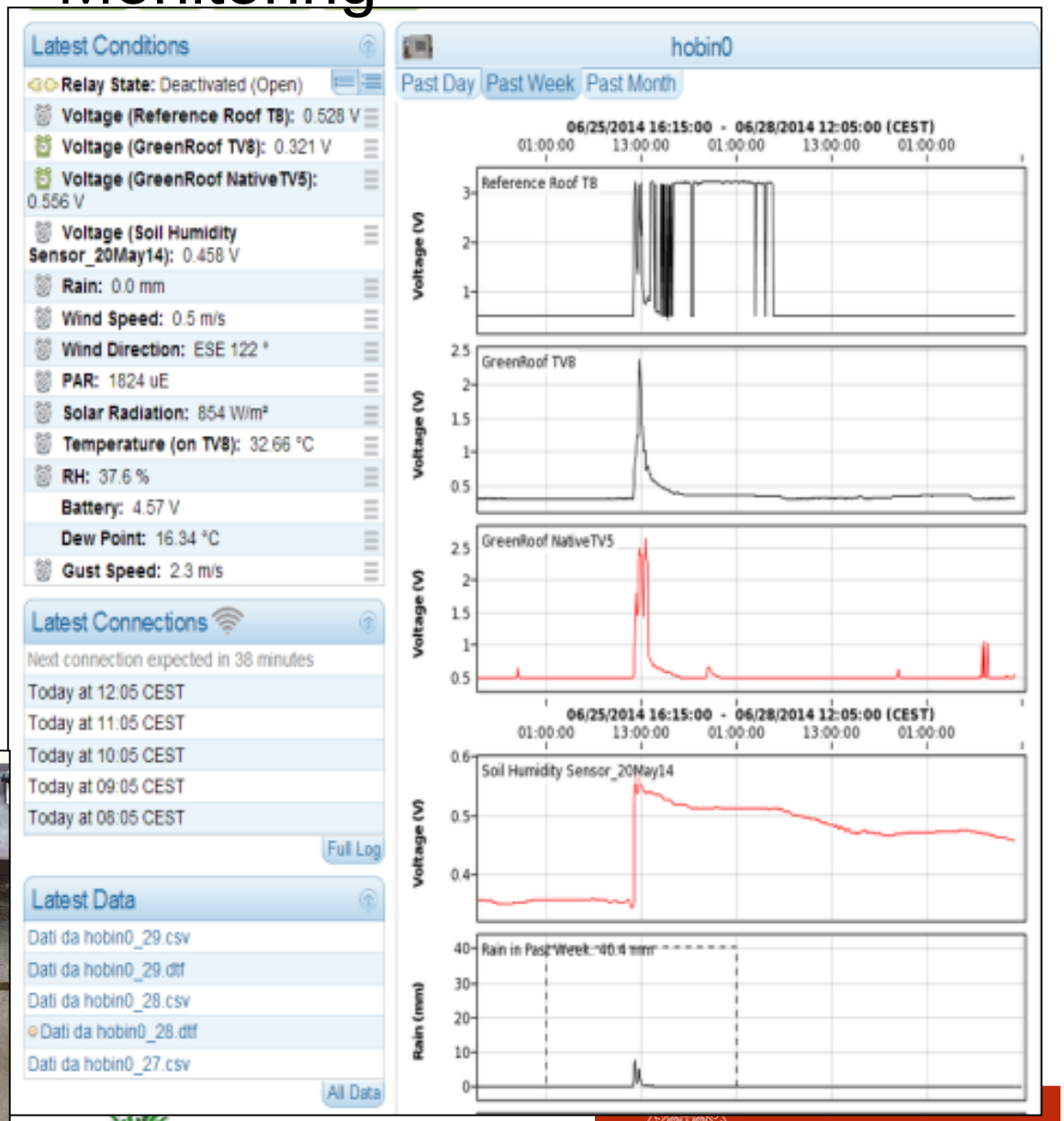
Monitoring

meteorology station

Water Levels



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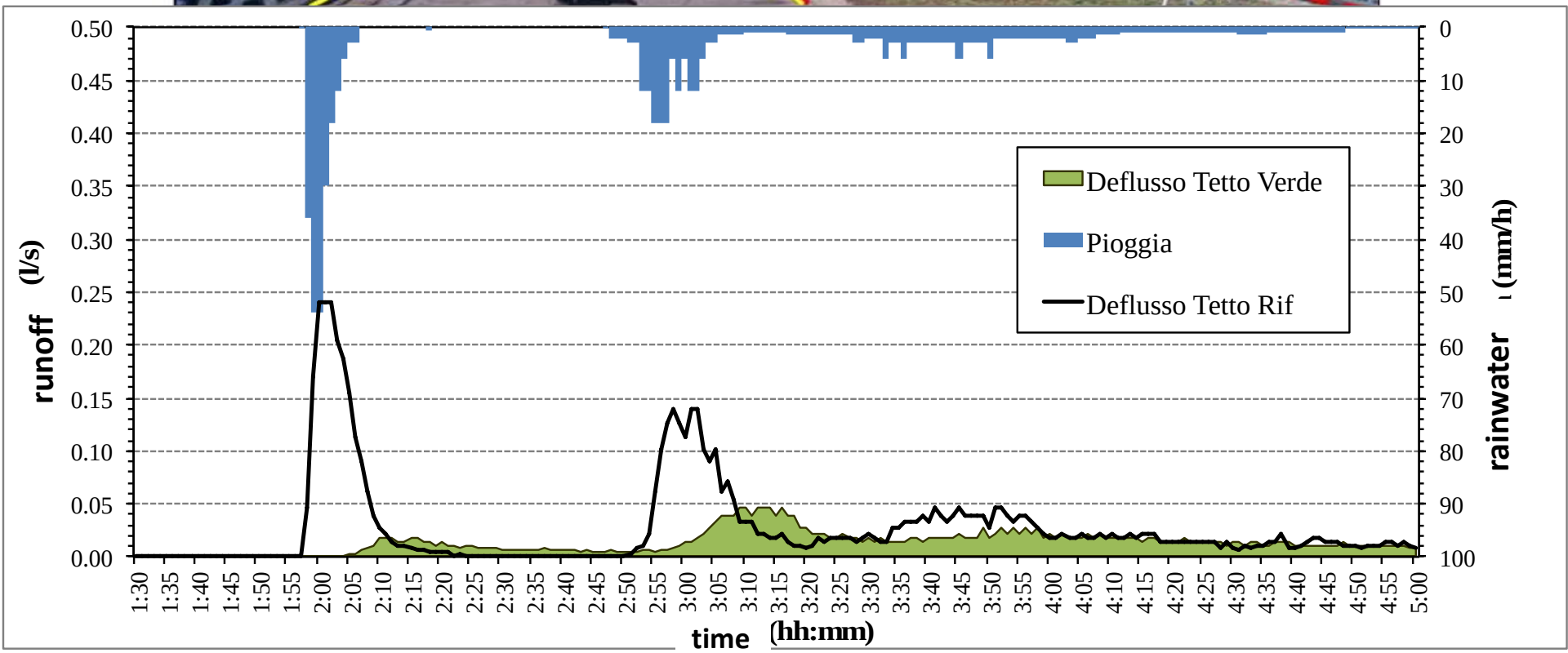
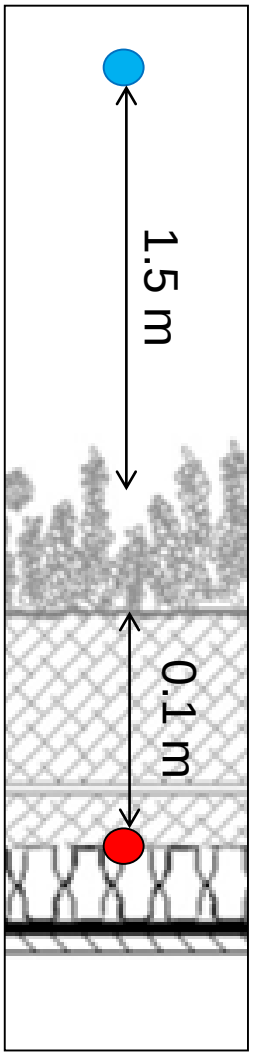
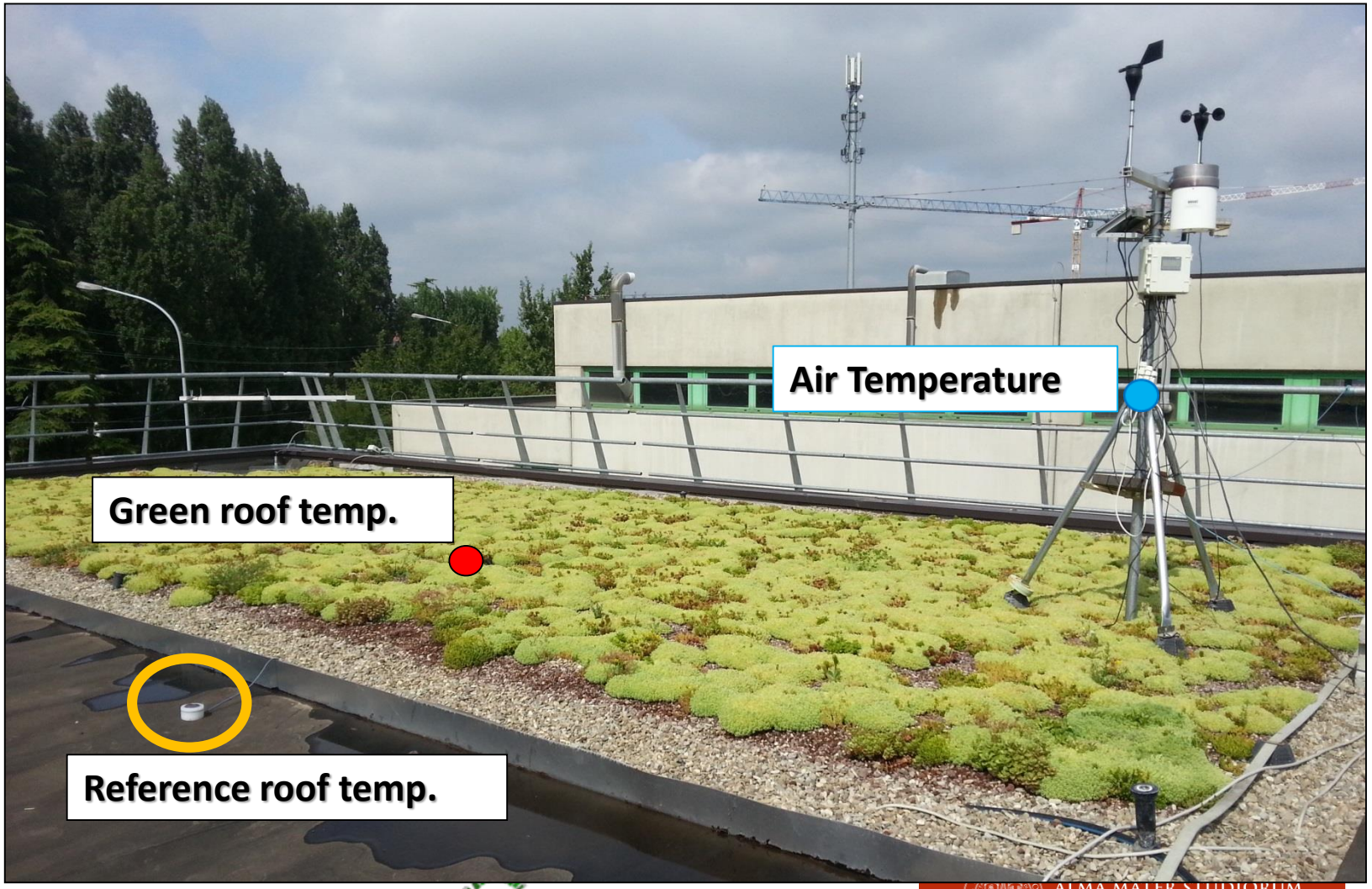
Hydrological analysis

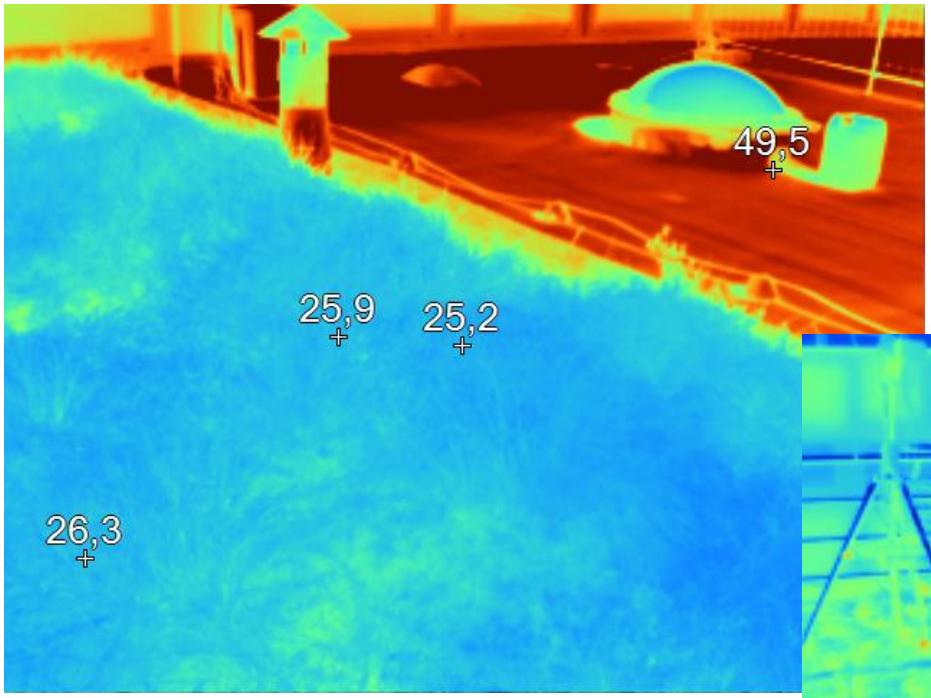


Temperature and Heat Island Effect

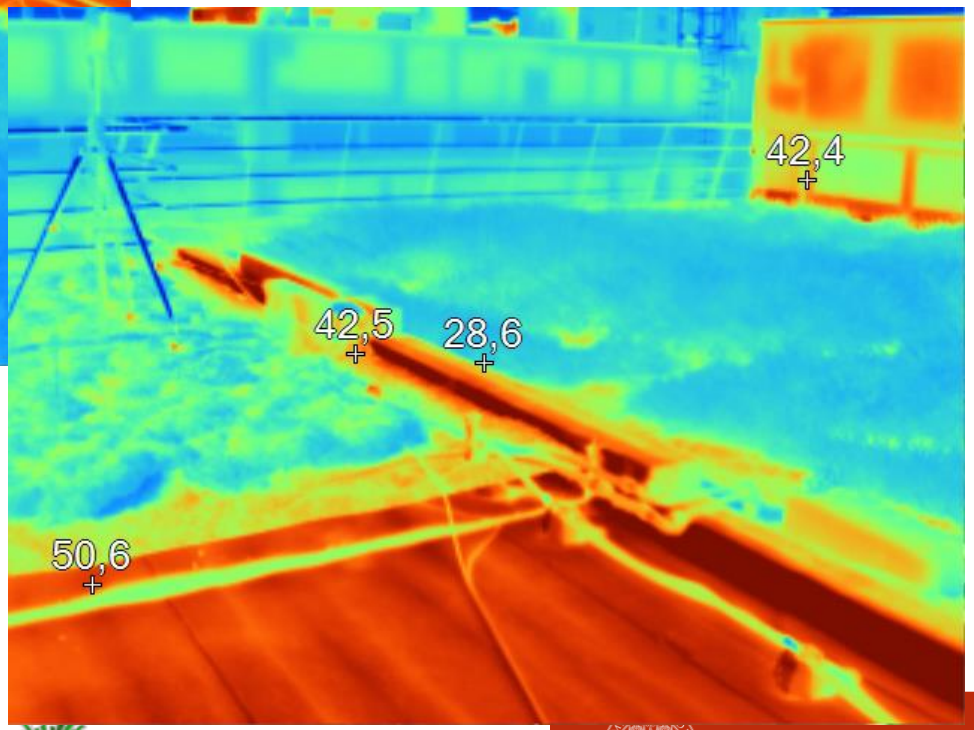




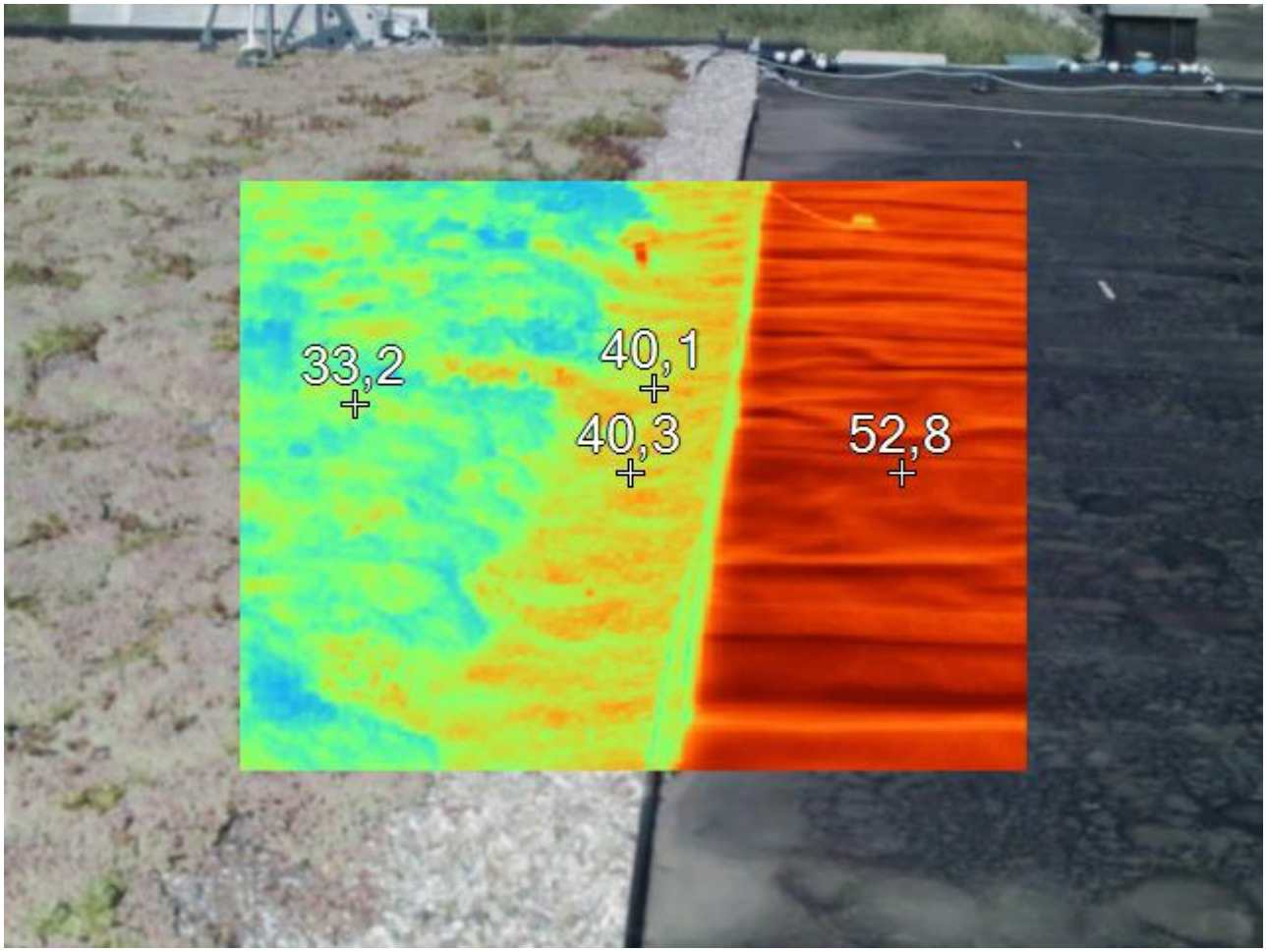
Thermography



September 2018



Thermography



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