

**Interreg
Danube Region**



Co-funded by
the European Union



SpongeCity

Improving urban climate change adaptation capacities by testing and promoting the 'sponge city' methodology on transnational level

Progress in the past 11 months

Balázs Borkovits, project coordinator, University of Pécs

EUSDR – National Hearing

03/12/2024, Budapest



A MISSION

supporting DR settlements with
research results, planning
capacities and tools,
transnational links

The concept

A **sponge city** is an urban area, which has been designed to cope with excess rainfall using a variety of techniques. It mitigates/prevents urban floods by providing the area with the ability to **naturally absorb the water**. It reduces the extent of impermeable surfaces and increases the amount of absorbent land: green surfaces, green walls, bioswales, inner-city lakes, rain gardens, permeable pavements. Supplementing this approach with **channeling and storage** systems also helps to counter water shortages.

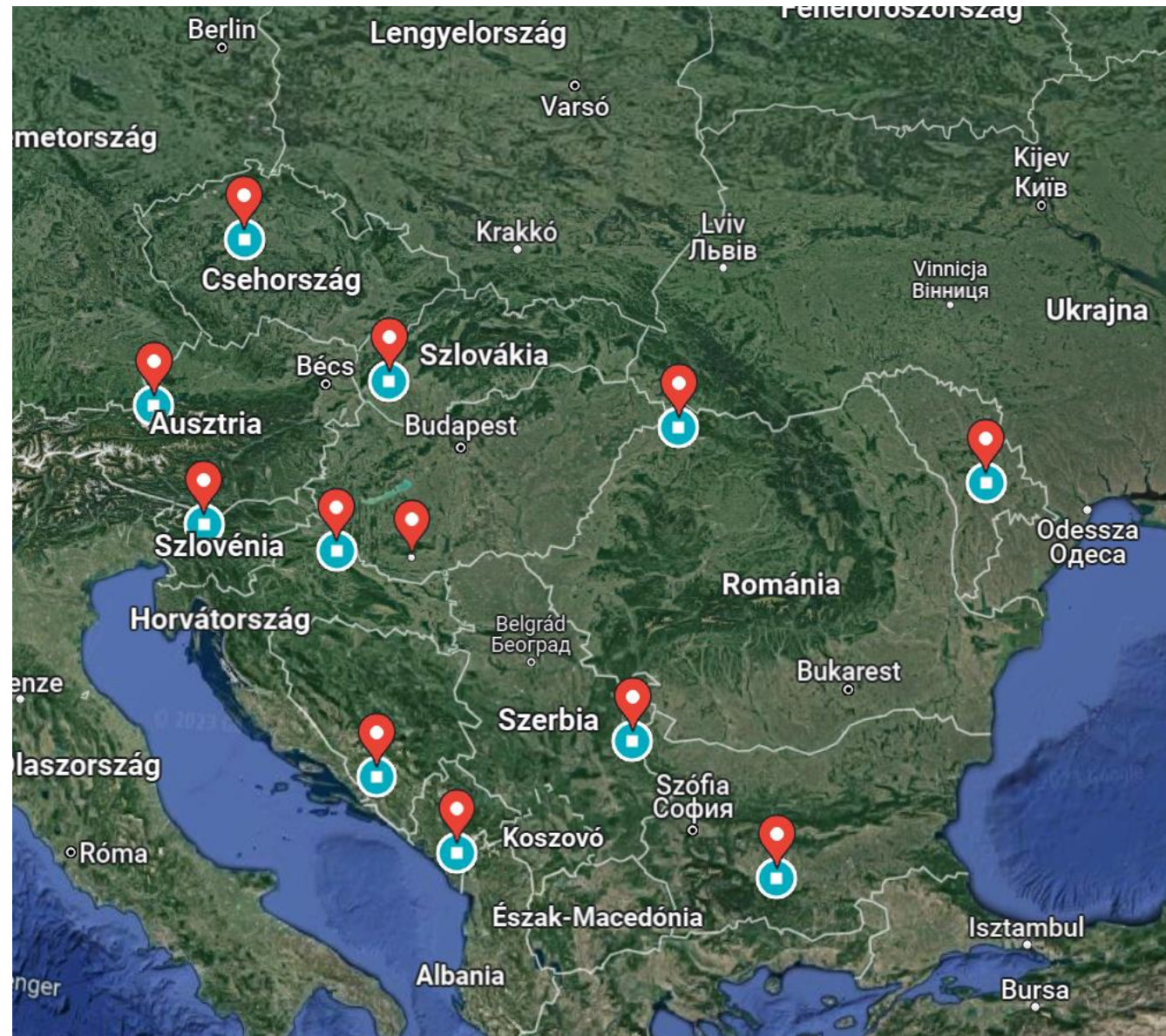


Partner	Country	Type
University of Pécs	HU	Higher Education
Koprivničke vode, Koprivnica	CR	Enterprise
Paris Lodron University, Salzburg	AT	Higher Education
BSC Kranj Regional Development Agency of Gorenjska	SI	Sectoral Agency
Prague 9th District (EUDA)	CZ	Local PA
University of Ss Cyril and Methodius	SK	Higher Education
University of Mostar	BiH	Higher Education
Municipality of Chisinau	MD	Local PA
Regional Development Agency Eastern Serbia	RS	Sectoral Agency
ASPECT-Management and Intercultural Relations	BG	Sectoral Agency
Capital City Podgorica	MNE	Local PA
Satu Mare County Intercommunity Development Association	RO	Sectoral Agency
E-Zavod	SI	Sectoral Agency

Udruženje za tehnologiju vode i sanitarno inženjerstvo	RARIS
Poslovno udruženje komunalnih preduzeća KOMDEL	RARIS
Međunarodni centar za istraživanja i obuku o urbanom odvodnjavanju, Univerziteta u Beogradu	RARIS
Grad Zaječar	RARIS
danube connects das magazin für die donauländer	PTE
Agencija za vodno područje Jadranskog mora	SUM
Orašul Livada	ADISM
Pécsi Városfejlesztési Zrt	PTE
Grad Koprivnica	KC VODE
Община Пловдив	ASPECT
Kék Bolygó Klímavédelmi Alapítvány	PTE
Országos Vízügyi Főigazgatóság	PTE
Salzburg Land	PLUS
City of Trnava	UCM
Trnavský samosprávy kraj	UCM
Obec Tomášikovo	UCM
Občina Tržič	BSC KRANJ
Regionalni razvojni svet Gorenjske	BSC KRANJ
Stadt Salzburg	PLUS
Grad Mostar	SUM

Target settlements

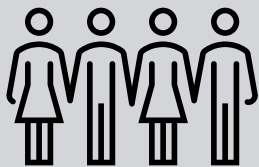
- **Two large cities:** Chisinau (670,000), Plovdiv (343,000)
- **Four medium-sized cities:** Pécs, Salzburg and Podgorica (ca.150,000) and Mostar (113,000)
- **Five smaller cities/districts:** Koprivnica (31,000), Prague 9 (50,000), Trnava (65,000), Zajecar (59,000)
Livada (5000), Tržič (3670)



The process

1

Building local and transnational communities



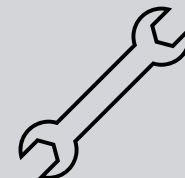
2

Analysing features and current management approaches



3

Providing toolkit for local decision makers



4

Testing the tools, main-streaming results



Results of period 1



DR network: 166 settlements have been involved

Taking part at trainings, feedbacks for toolbox

Regional stakeholder meetings: 19 meetings have been organised

Geographical survey of the involved settlements

Elevation, topography, annual precipitation, heavy rainfall events, flash floods, water scarcity, expectations, soil texture, sealed surfaces

Infrastructural survey of the involved settlements' water management characteristics:

sewage system, cleaning infrastructure, pumping stations, inhabitants, stormwater directed to sewage plant – overflows, drinking water network and wells, water level changes, groundwater depletions, rainwater network, water retention

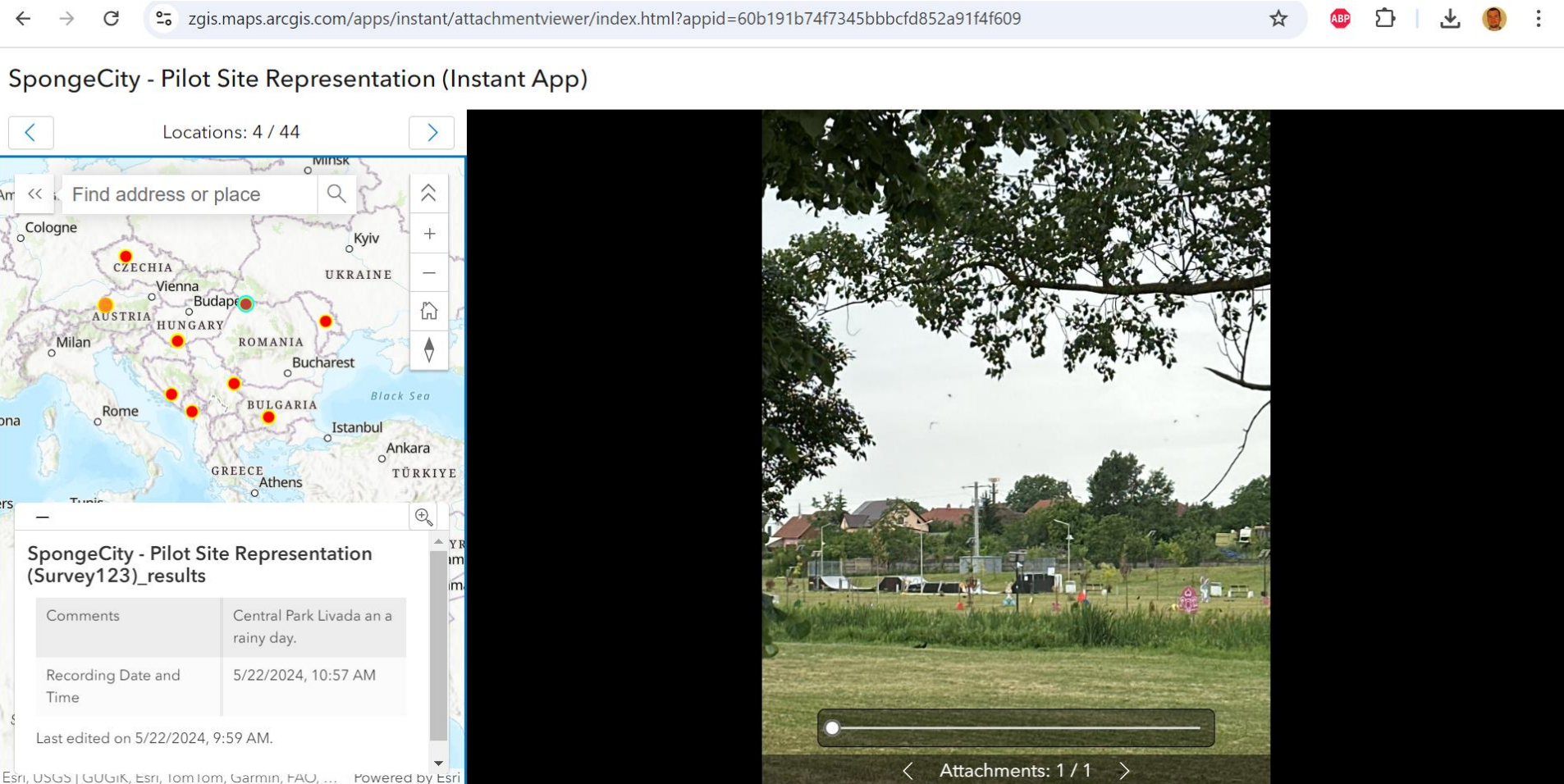
All pilot settlements have been mapped.



Results of period 1

<https://zgis.maps.arcgis.com/apps/instant/attachmentviewer/index.html?appid=60b191b74f7345bbbcbfd852a91f4f609>

Pilot site representation



The screenshot displays the ArcGIS Instant App interface. At the top, the browser address bar shows the URL: zgis.maps.arcgis.com/apps/instant/attachmentviewer/index.html?appid=60b191b74f7345bbbcbfd852a91f4f609. Below the browser bar, the app title is "SpongeCity - Pilot Site Representation (Instant App)".

The main content area is split into two panels. The left panel shows a map of Europe with several red location markers. A search bar at the top of the map says "Find address or place". Below the map, a metadata table is visible:

SpongeCity - Pilot Site Representation (Survey123)_results	
Comments	Central Park Livada on a rainy day.
Recording Date and Time	5/22/2024, 10:57 AM
Last edited on 5/22/2024, 9:59 AM.	

The right panel shows a photograph of a park area with trees and a building in the background, taken on a rainy day. At the bottom of the photo, there is a progress bar and the text "Attachments: 1 / 1".





Toolbox



<https://spongecity.sen2cube.at/>

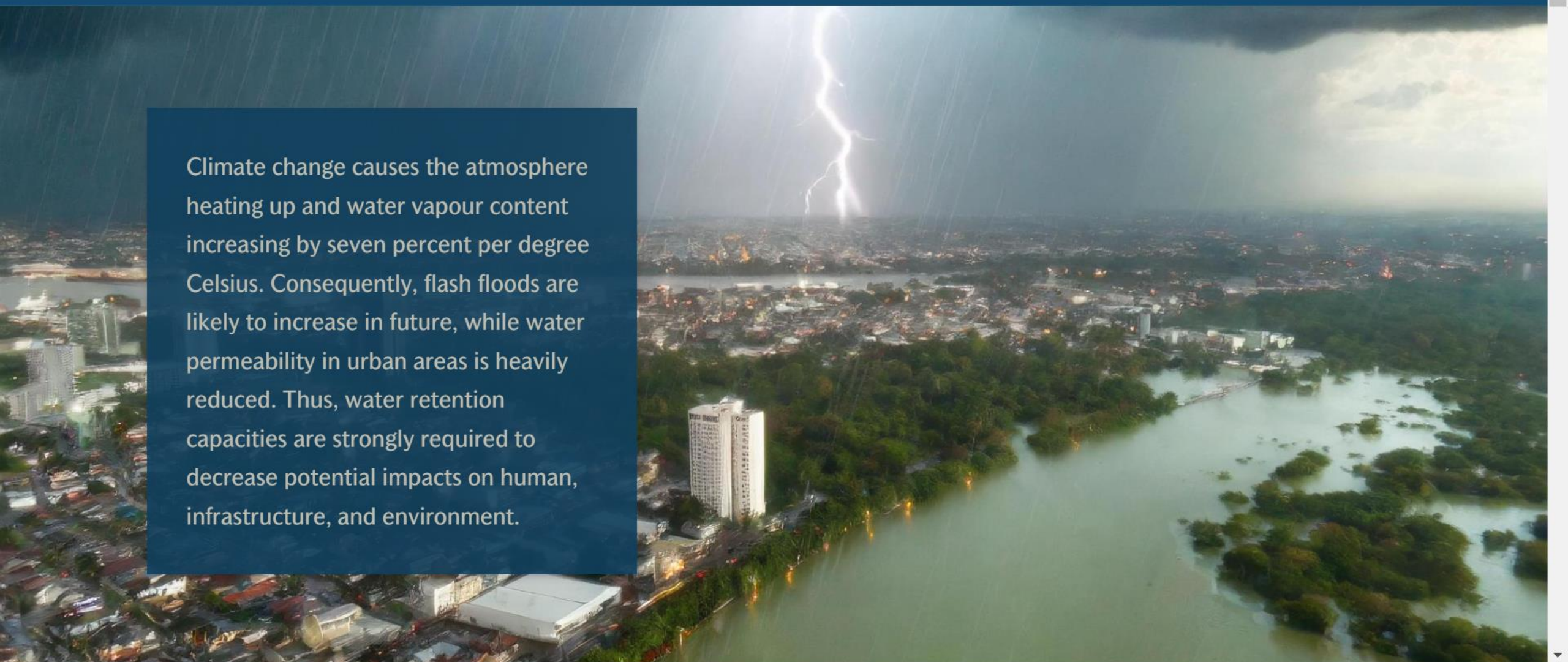


SpongeCity

Analysing water retention capabilities in urban areas with Earth Observation tools

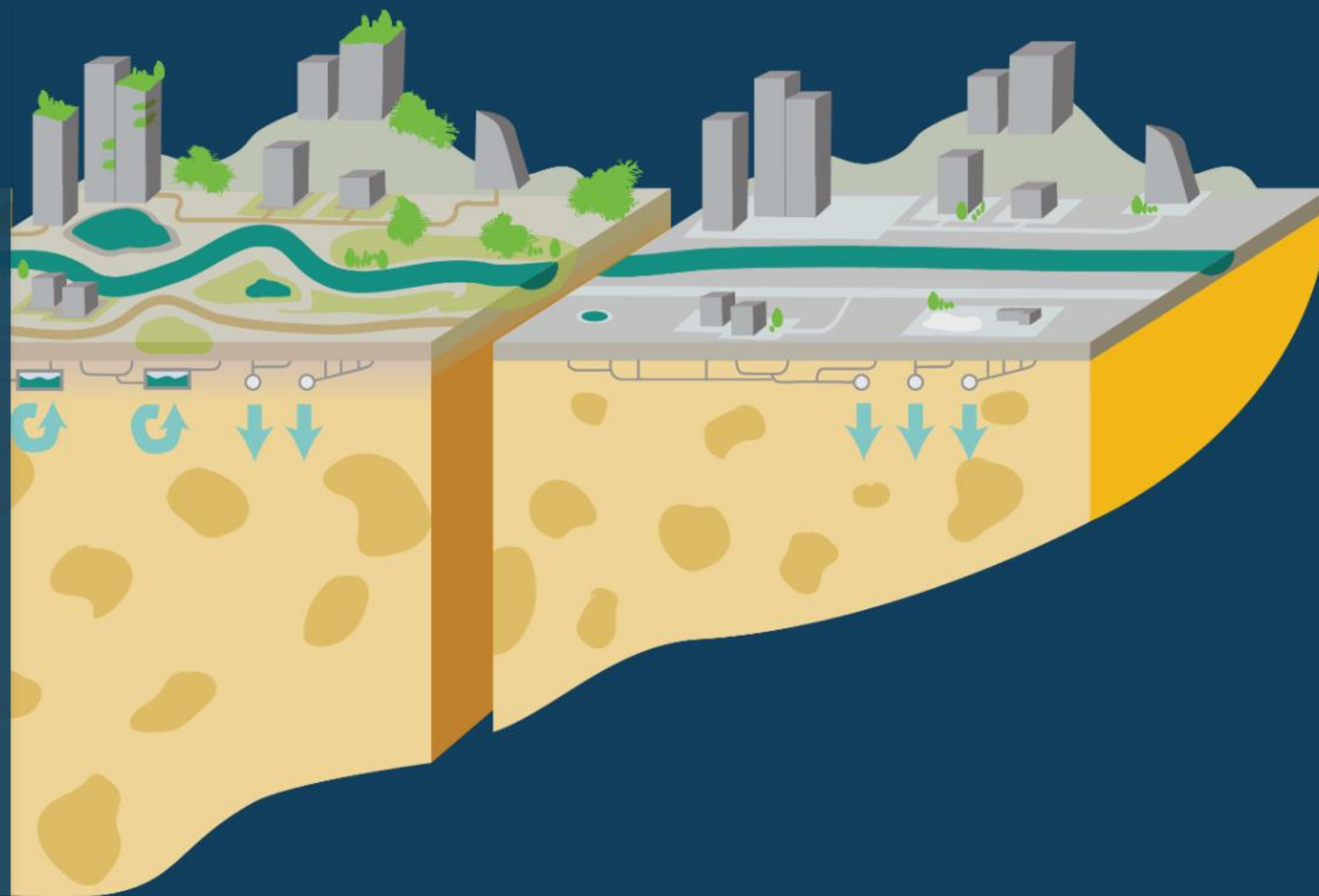
Dirk Tiede, Martin Sudmanns, Thomas Strasser, Nyi Nyi Nyan Lin, Yana Nikolova, Hermann Klug

21 October 2024




Climate change causes the atmosphere heating up and water vapour content increasing by seven percent per degree Celsius. Consequently, flash floods are likely to increase in future, while water permeability in urban areas is heavily reduced. Thus, water retention capacities are strongly required to decrease potential impacts on human, infrastructure, and environment.

The sponge city concept is an urban design approach that aims to enhance a city's ability to absorb, store, and reuse rainwater, reducing flooding and improving water management. It incorporates green infrastructure like permeable pavements, green roofs, wetlands, and parks to mimic natural hydrological processes, allowing rainwater to infiltrate into the ground or be stored for later use. This approach mitigates flooding and heat. It helps to manage drought and improves urban ecosystem biodiversity. A good water quality and water storage provides more sustainable and resilient cities.

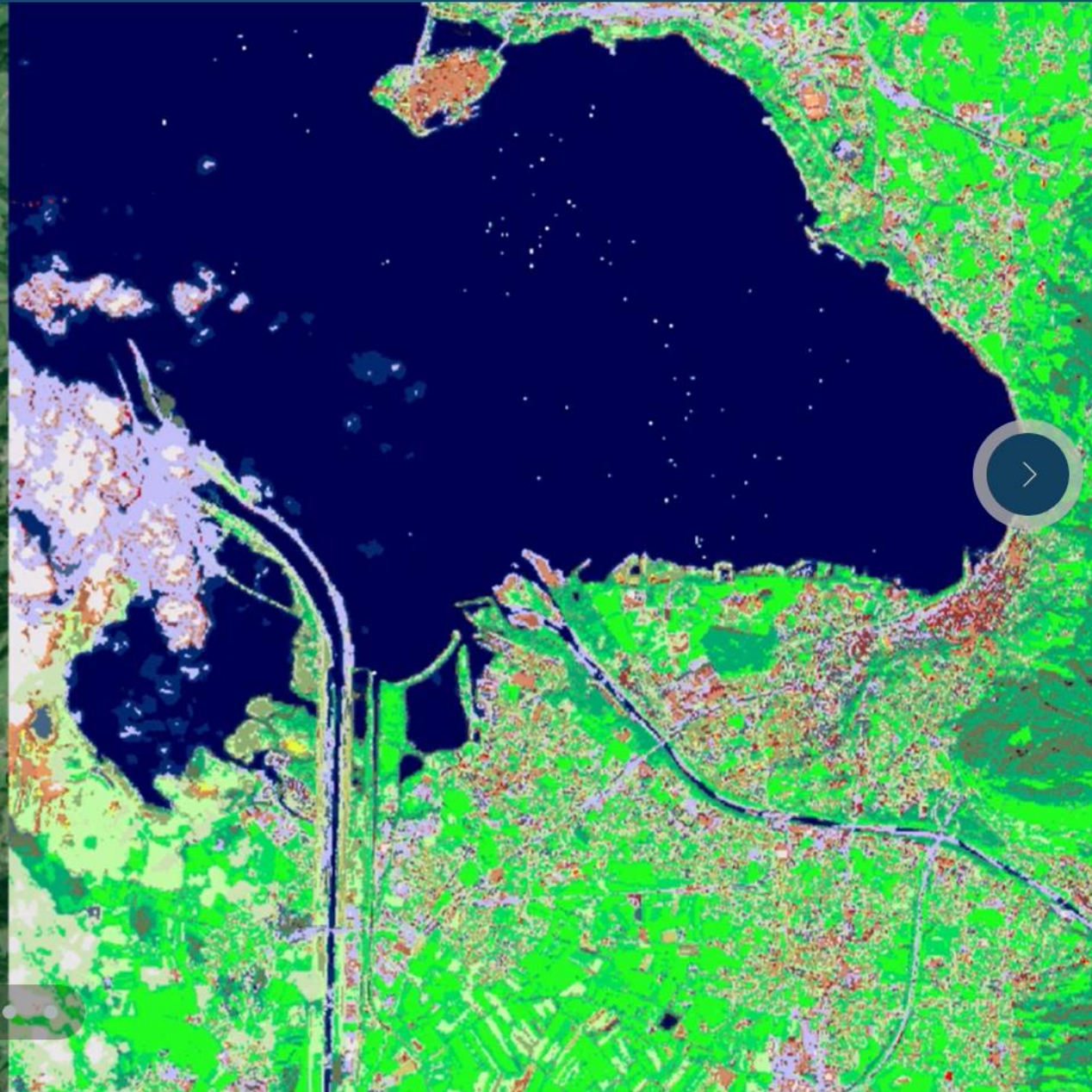


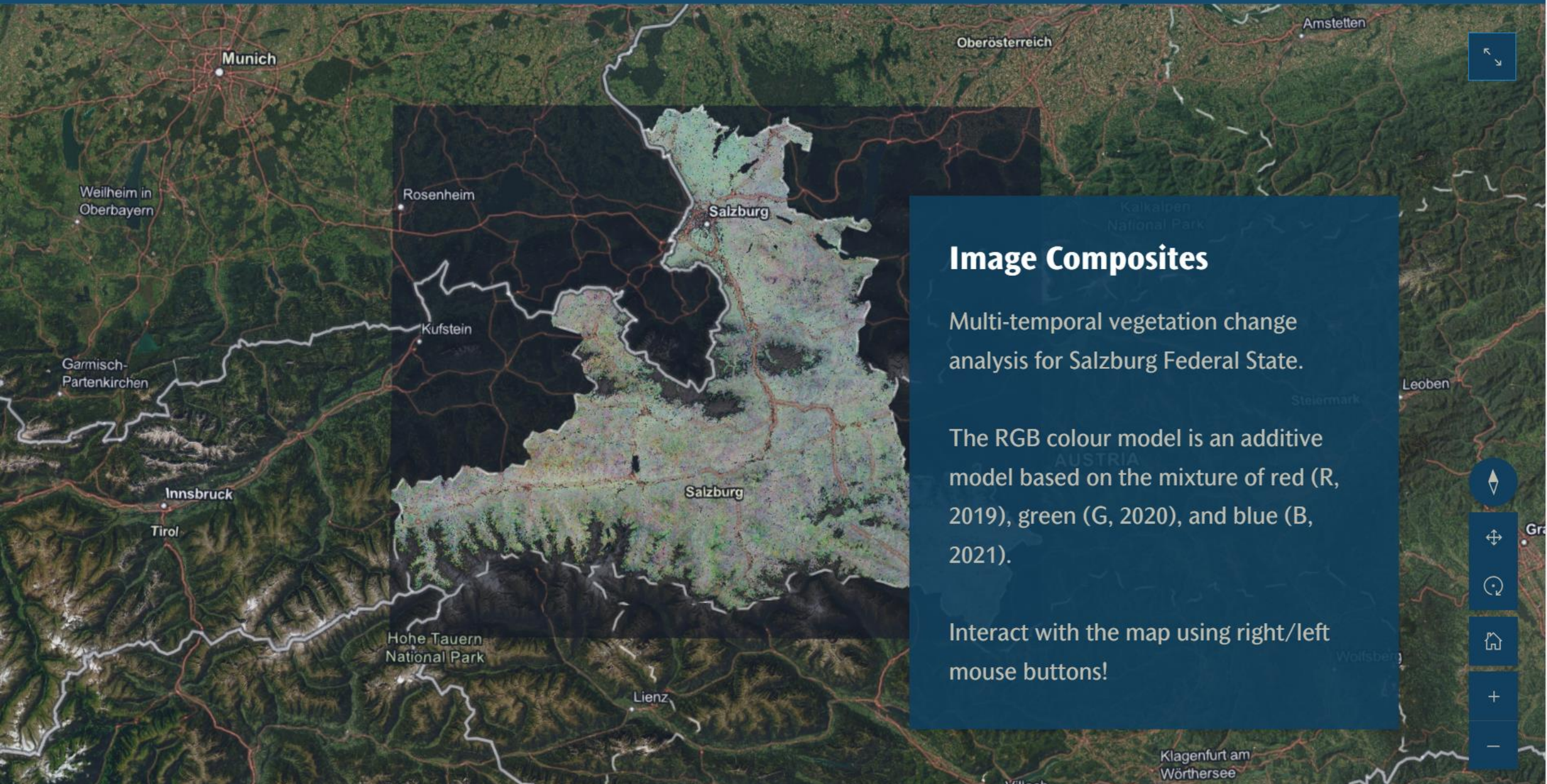


Earth Observation is used to provide continuous and independent data on urban areas to support the management and monitoring of its ability to ensure water retention capacities. Timely changes on surface sealed areas, vegetation, soil, and inland water bodies can be retrieved for defined periods.



Every five days Sentinel-2 data from the Copernicus mission provide high temporal resolution images across the globe. In case of overlapping orbits scenes are available every two to three days (146 images per year)!





Colour Coding

White / pastel colours

Often vegetated areas calculated by the number or cloud free scenes during a year.

Dark colours

No vegetation during all years under consideration.

Intensive colours

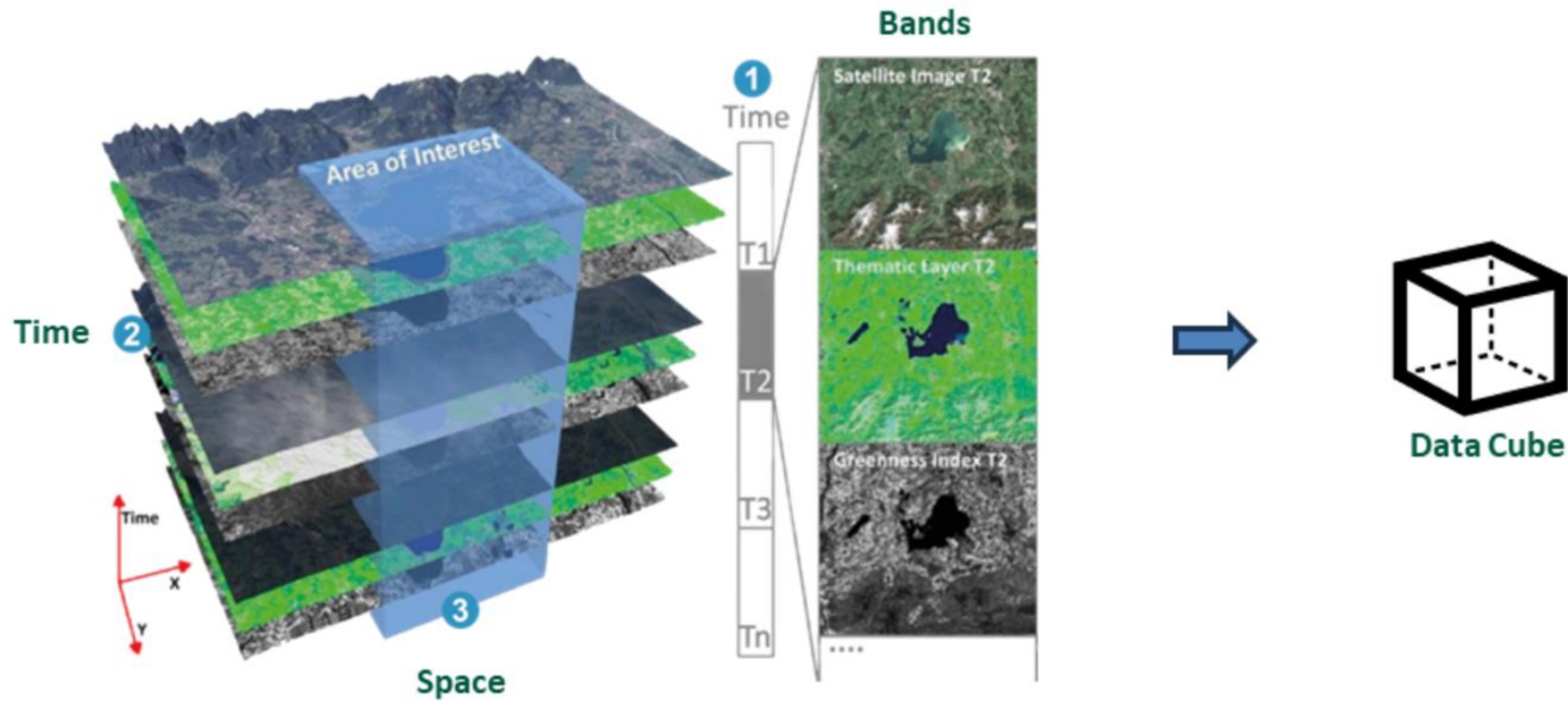
Mixture out of RGB channels indicating vegetation growth in at least one of the three years (areas with changing vegetation).





EO Data Management

Data Cube



Source: www.spatial-services.com/en/data-cube-en/



RGB colour definition per year

Interpretation

Red: Vegetation in 2019, limited to no vegetation in 2020 and 2021.

Green: Vegetation in 2020, limited to no vegetation in 2019 and 2021

Blue: Vegetation in 2021, limited to no vegetation in 2019 und 2020

Yellow: Colours are in between 2019 (red) and 2020 (green) and mean vegetation cover in these years, but limited to no vegetation in 2021 (blue is missing)

The screenshot displays a GIS application interface with three main panels:

- Contents Panel (Left):** Shows a search bar and a drawing order list. The 'Map' layer is selected, with sub-layers for 'Hybrid Reference Layer', 'Vegetation_yearly_2019_2020_2021...', and 'World Imagery'. Under 'Vegetation_yearly...', an RGB legend is visible: Red for 'Veg_2019', Green for 'Veg_2020', and Blue for 'Veg_2021'.
- Map Panel (Center):** Displays a satellite-style map with a semi-transparent vegetation overlay. Labeled streets include 'Fürstenweg', 'Alpenstraße', 'Salzach', and 'Austraße'. A building footprint is outlined in grey. The status bar at the bottom shows a scale of 1:6,184 and coordinates 13.0790379°E 47.7653257°N.
- Geoprocessing Panel (Right):** Configured for the 'Sen2Cube (Dynamic)' tool. The 'Parameters' tab is active, showing:
 - 'Currently Available Factbases' set to 'Austria'.
 - 'Knowledgebase' is empty.
 - 'Area of Interest' set to 'Default'.
 - 'Start Date' and 'End Date' are empty with calendar icons.
 - 'Comment' is an empty text field.
 - 'Save as Favourite in your Sen2Cube Account' is unchecked.
 - 'Output Directory' is an empty folder selection field.
 - A 'Run' button is at the bottom right.

Click to enlarge!



SpongeCity Toolbox

Analysis & Insights

- 🌿 Land Use and Land Cover Changes
- 🌿 Urban Sprawl
- 🌿 Green Spaces
- 🌿 Surface Sealing
- 🌿 Vegetation Condition
- 🌿 Water Body/Surface
- 🌿 Slope, Drainage & Watershed
- 🌿 Urban Heat Island
- 🌿 Urban Surface Temperature
- 🌿 Heat Hotspots
- 🌿 Landslide
- 🌿 Flood Risk



Introduction

Overview



EO Data



Toolbox



Outputs



Users



Actions

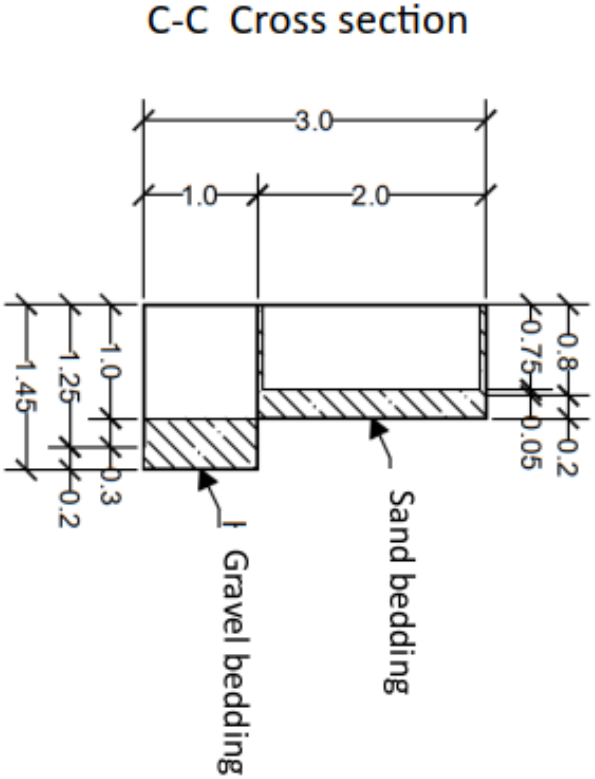
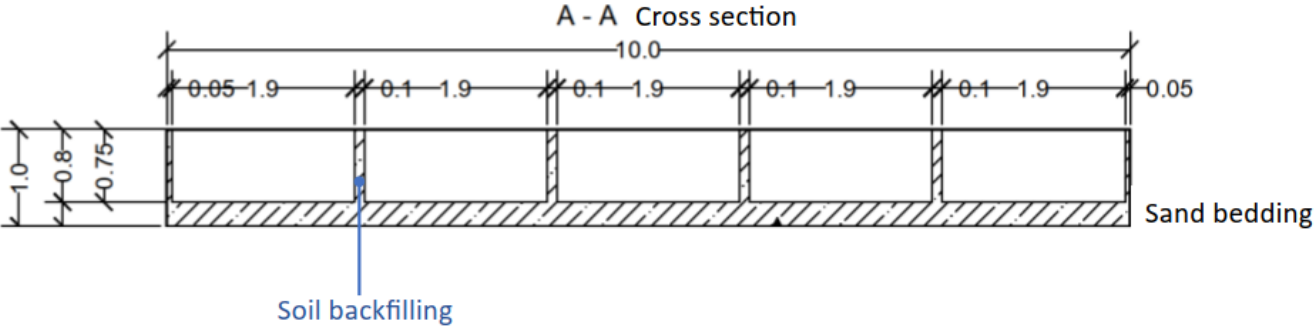
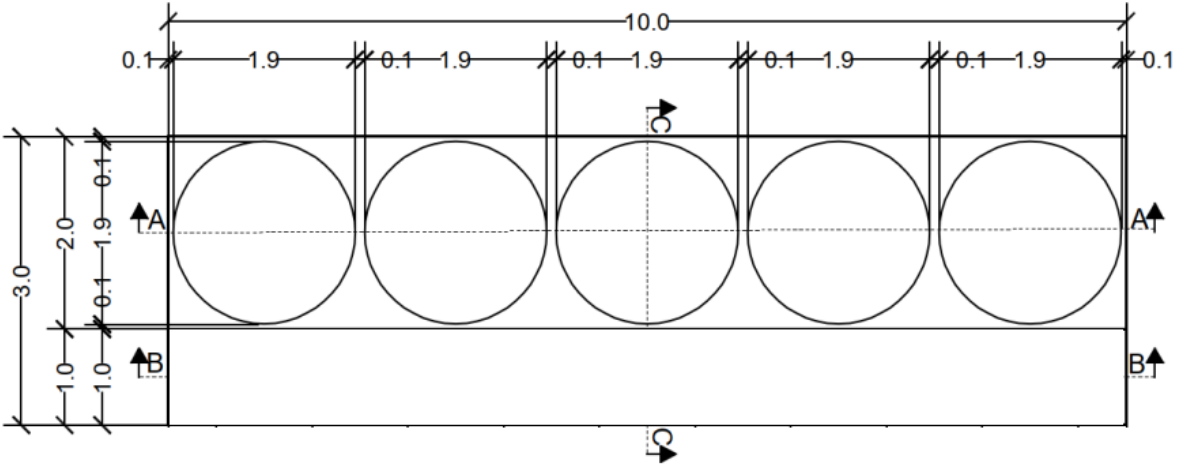


Raingardens

Raingarden – University of Pécs



Site plan



Technical description

Raingarden of ca 30 sqm were installed, subdivided into 5 small units:
5 circular plastic tanks with a diameter of 190 cm each.

The tanks are individually drained to measure throughflow and enable the calculation of storage and permeability of the different media.

Compositions:

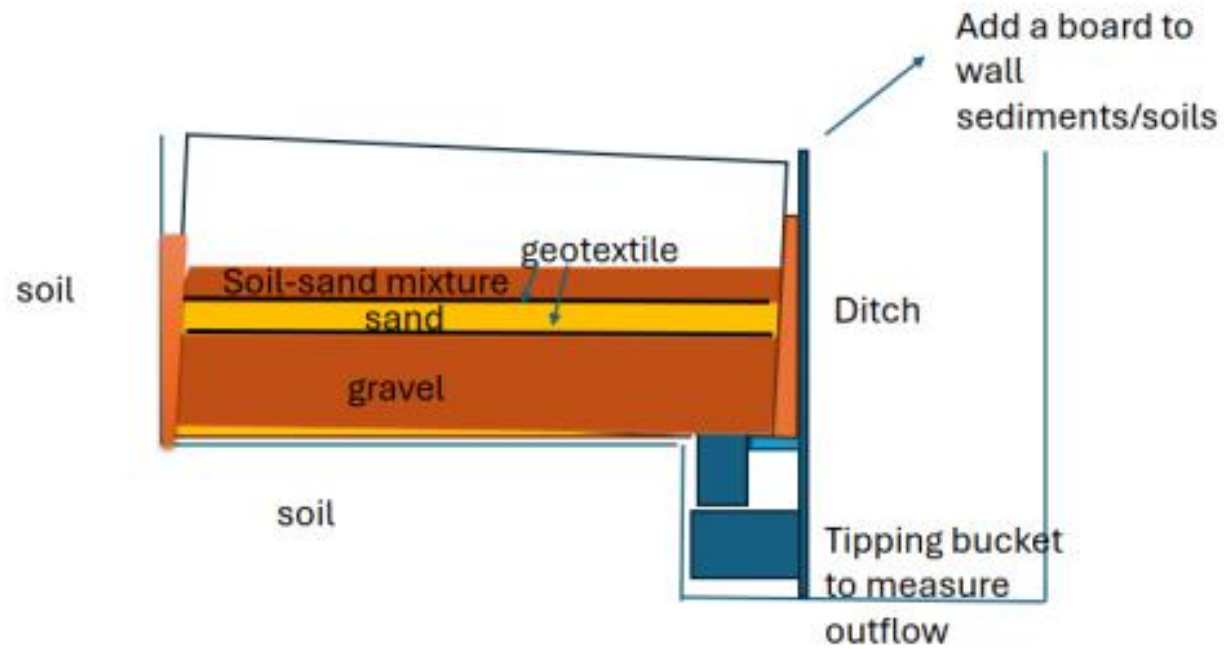
Cells 1 and 2: 100% potting soil

[Cell 1 does not contain plants, while Cell 2 does]

Cell 3: 10% sand, 90% potting soil

Cell 4: 20% sand, 80% potting soil

Cell 5: 30% sand, 70% potting soil





Sensors and loggers: Meter Group Inc., Pullman, WA

ZL6 logger



Teros 12 TDR,
soil moisture
sensor



Teros 21 water
potential sensor



Atmos-41 all-
in-one
weather
station

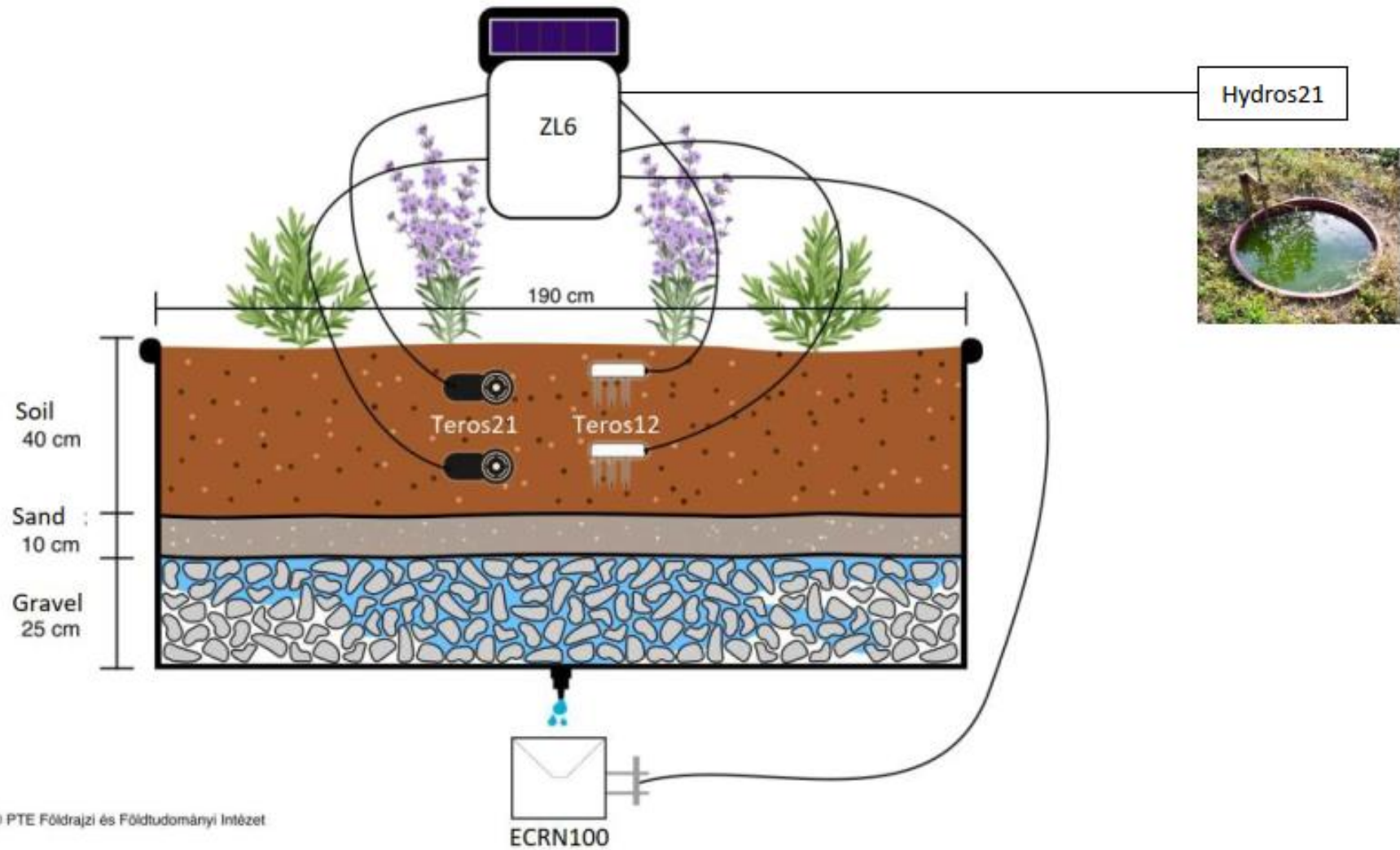


ECRN-100 Rain Gauge

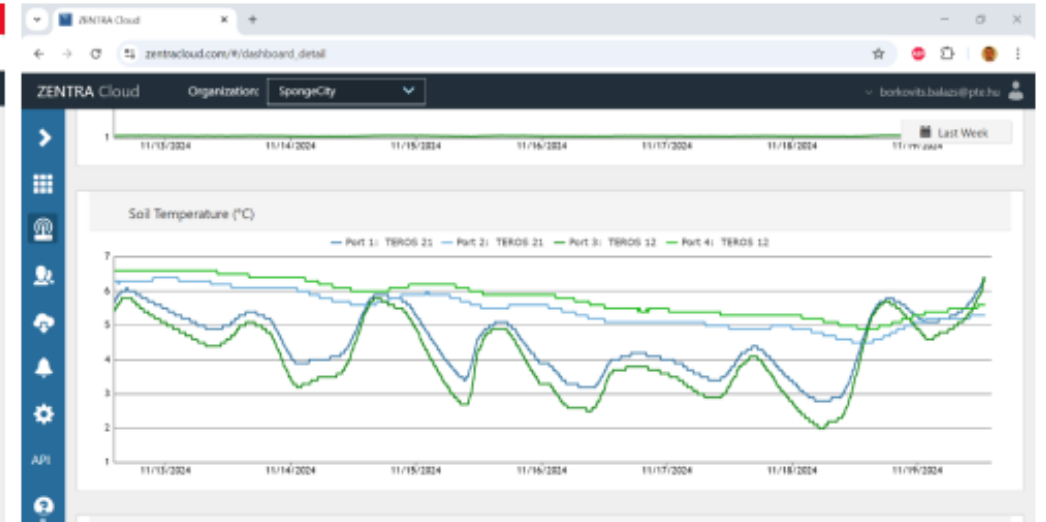
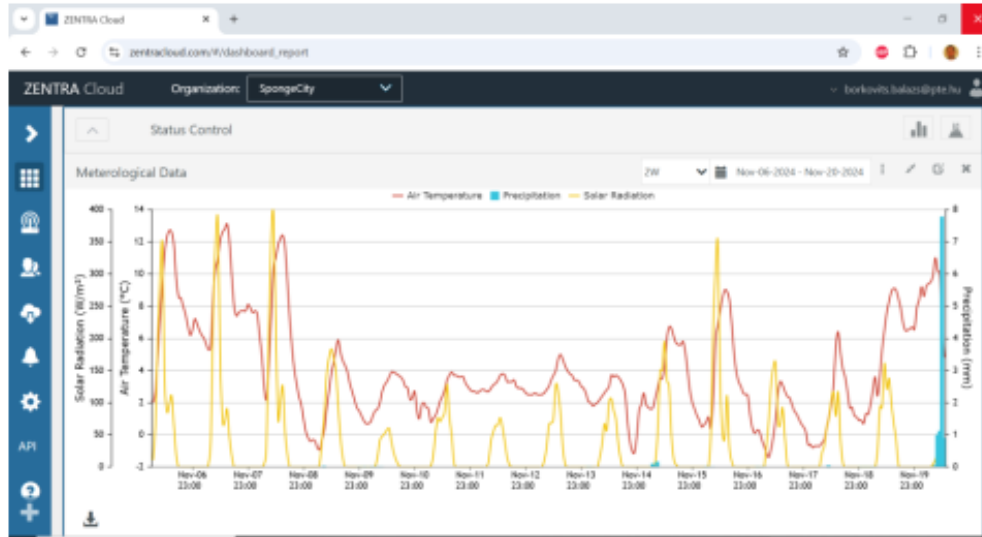


Hydros21

Installing sensors



Cloud-based data storage



Organization: SpongeCity

SpongeCity_1_West

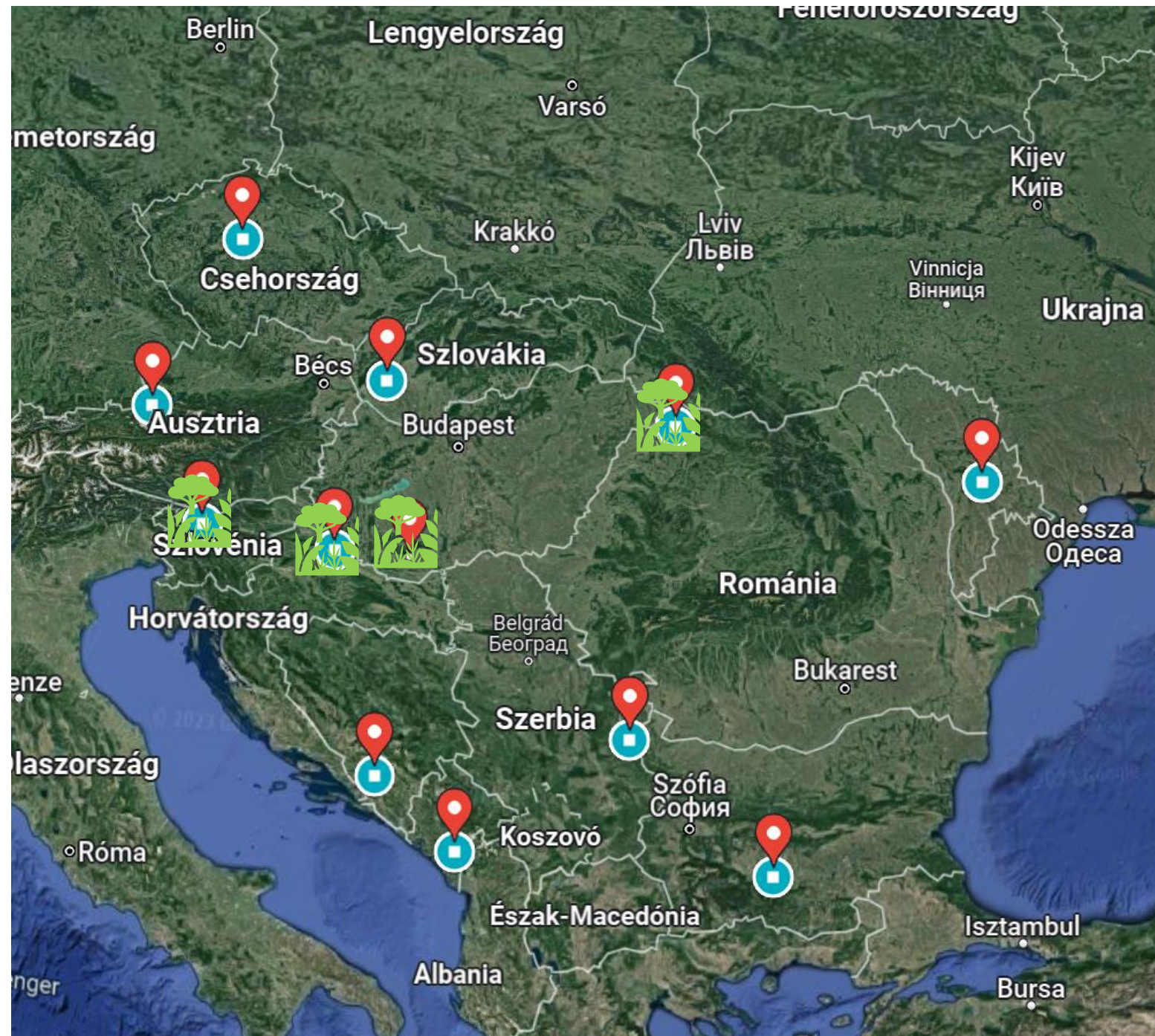
Port	Device	Parameter 1	Value 1	Parameter 2	Value 2	Parameter 3	Value 3
Port 1	TEROS 21	Matic Potential	-0.1 kPa	Soil Temperature	6.4 °C		
Port 2	TEROS 21	Matic Potential	-0.1 kPa	Soil Temperature	5.3 °C		
Port 3	TEROS 12	Water Content	0.399 m³/m³	Soil Temperature	6.3 °C	Saturation Extract EC	1.256 mS/cm
Port 4	TEROS 12	Water Content	0.235 m³/m³	Soil Temperature	5.6 °C	Saturation Extract EC	3.514 mS/cm
Port 5	0 cm ECN-100	Precipitation	0.0 mm	Maximum Precipitation Rate	0.0 mm/h		
	Battery	Battery Percent	100%	Battery Voltage	7968 mV		
	Barometer	Reference Pressure	97.40 kPa	Logger Temperature	5.5 °C		

Organization: SpongeCity

Organization Members	System Status	Report Status			
Username	Name	Role in Organization	Permissions		Add
gaci@gemma.tk.pte.hu	Gábor Varga	Principal Investigator	User		Remove
rym.pw@gmail.com	Yining Ma	Graduate Student	User		Remove
borsoa.t.pte@pte.hu	Szabolcs Fábian	Research Scientist	User		Remove
borkovits.balazs@pte.hu	Balázs Borkovits	Manager	User		Leave
gemesi@gemina.ttk.pte.hu	István Gemesi	Research Scientist	User		Remove
sarkadi@gemina.ttk.pte.hu	Nadri Sarkadi	Research Scientist	Administrator		Remove
ugwonchireon@gmail.com	Nelson Ugwonchireon	Graduate Student	User		Remove

Raingardens

research &
demonstration



Next steps

- ✓ Comparing the results of the surveys
- ✓ Collecting best practices to showcase spongecity interventions
- ✓ Defining the content of local action plans (risk analysis)
- ✓ Developing the toolbox
- ✓ Constructing 3 raingardens (CR, SI, RO)
- ✓ Starting to elaborate the training materials

**Thank you for
your attention!**



Contact: borkovits.balazs@pte.hu

Balázs Borkovits
senior projectmanager



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Chancellery, Directorate of Grants
International Project Office
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<https://projects.pte.hu/>

SpongeCity project analyses the hydroclimatic characteristics and water management practices of 12 pilot settlements, sets up a toolbox to support the planning of sponge city measures, tests and promotes the tools by participative elaboration of local action plans, feasibility studies and demonstration investments. Partners mainstream the results to national and EU level.