Solutions to tackle climate change via Managed Aquifer Recharge

DEEPWATER-CE project

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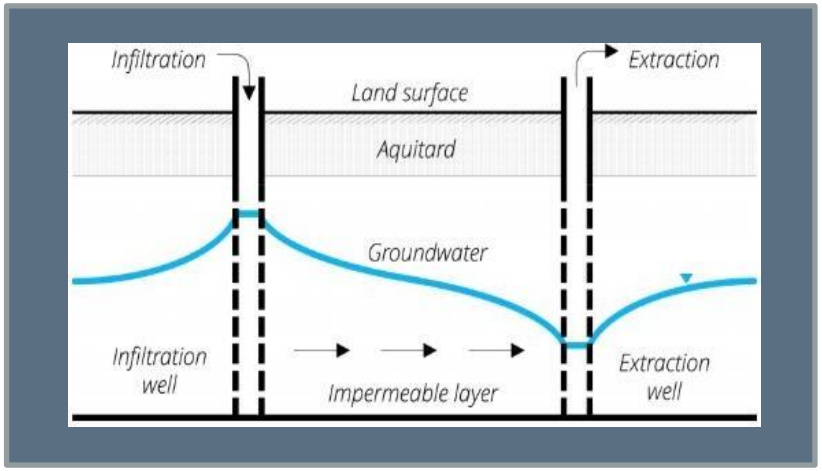
Adapting to Climate Change in relation to Water, 28/11/2023, Budapest

Managed Aquifer Recharge (MAR)

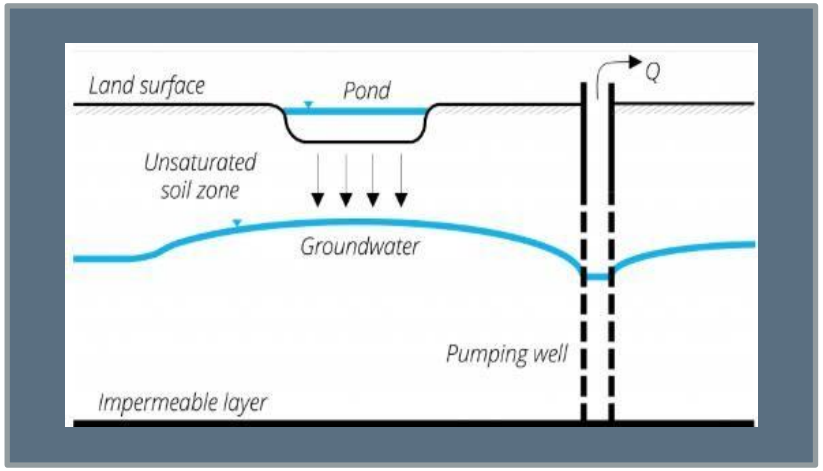
- **Endangered, decreased and unstable water sources due to climate change impacts**
- To prevent and address the arising user conflicts - necessity to innovate approaches and technologies in water management
- One of the solutions is **Managed Aquifer Recharge (MAR)**
- MAR is **an intentional process of directing/infiltrating excessive surface water into the ground** — either by spreading on the surface by using recharge wells, or by altering natural conditions **to increase infiltration in order to replenish an aquifer**.
- **To maintain, enhance and secure groundwater systems under stress**

MAR principle

Aquifer storage, transfer and recovery (ASTR)



Infiltration pond



Possible water sources - surface water, rain water, storm water, reclaimed water, groundwater

6 selected MAR types

DEEPWATER-CE: Decision-support toolbox for identifying the suitability of MAR (English version) – YouTube

DEEPWATER-CE Promotional video_English version – YouTube

MAR sites selection criteria

1. **GENERAL SCREENING** – applied on the state or region
2. **SPECIFIC SCREENING** – applied on the areas considered as suitable after general screening

Criteria to be considered for screening:

- ✓ **Climatological selection criteria** - to find out where MAR schemes are needed or will be needed in the future
- ✓ **Geological and hydrogeological selection criteria -** to identify areas where MAR schemes are possible to be located
- ✓ **Analyze the sensitivity of MAR systems to climate extreme events -** to evaluate how MAR schemes can be applied when extreme climatic situations occur (i.e. dry or wet periods) and to identify related potential risk

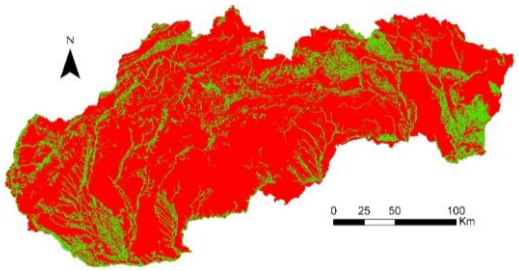
Decision-Support Toolbox comprising the checklists in order **to choose suitable locations for MAR**

Maps for 6 selected MAR types

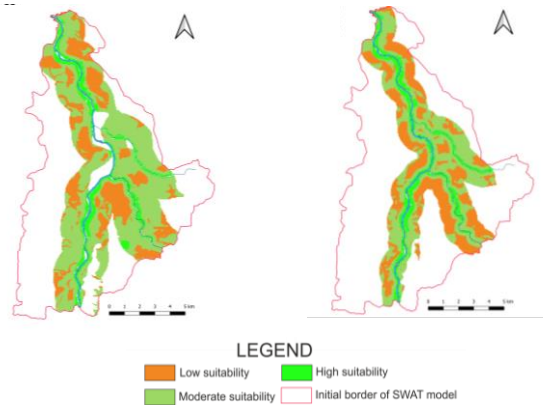
Maps for general and specific criteria applied in Hungary, Croatia, Poland and Slovakia:

https://ggis.un-igrac.org/maps/2171/embed

General mapping – Slovakia
Recharge dam



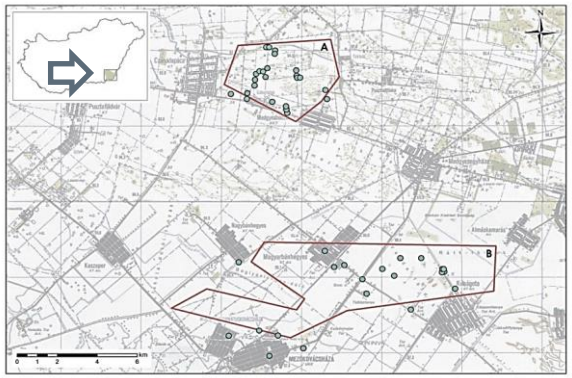
Specific mapping – Dunajec Catchment (Poland)
Ditches **Induced bank filtration**

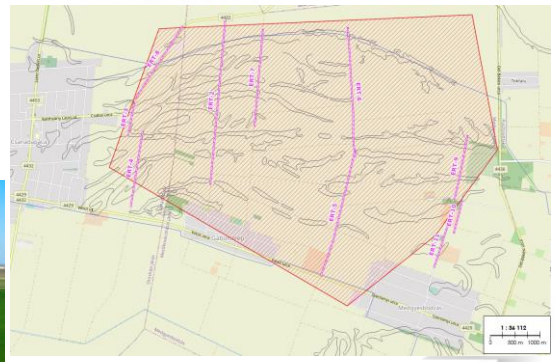


Pilot site

Hungary - Maros alluvial fan

- ✓ Alluvium - paleo-channels of the Maros River
  (SE part of Hungary between two rivers: Körös and Maros)
- ✓ **underground dam MAR scheme** (i.e. construct a subsurface wall to interrupt groundwater flow resulting in an accumulation of groundwater)
- ✓ Detailed investigation of the pilot site aquifer - **field measurements** (geophysical measurements, groundwater sampling, pumping tests), and consequently **conceptual and numerical groundwater flow models**
- ✓ **Agricultural purposes**

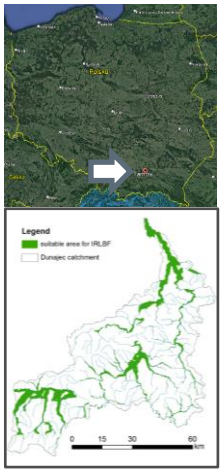




Pilot site

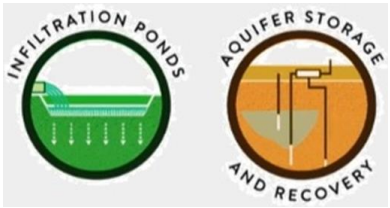
Poland - Tarnów Waterworks

- ✓ **Porous aquifers located near industrial sites** - serious threat for the quality of water in shallow aquifers
- ✓ **Tarnów Waterworks** - 200 000 inhabitants supplied by **drinking water**
- ✓ **Świerczków pilot site** - groundwater is extracted from the **unconfined Quaternary porous aquifer** *(average thickness of 4-6 m, average hydraulic conductivity is 3x10^{-4} m/s, static water level is approximately 3,5–5 m below surface, wells yield about 86,7 L/s)*
- ✓ Aim of MAR systems **– to improve groundwater quality by reducing the inflow of water from the industrial zone**
- ✓ Field works - geophysical, hydrological and hydrogeological measurements, water and soil sampling for laboratory tests.

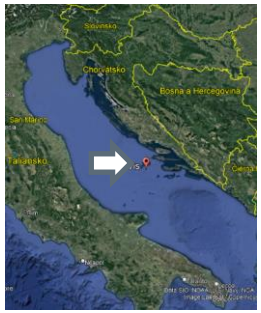


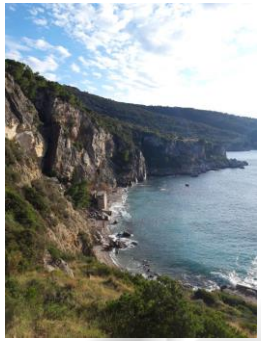
Pilot site

Croatia – Vis Island



- ✓ **Karst semiarid hydrogeological conditions** of Dinaric karst region
- ✓ **Public water supply** - drilled wells in location Korita (40 L/s) and coastal spring Pizdica (3.3 L/s)
- ✓ **Main problem - high possibility of seawater intrusion** *(karst poljes serve as a barrier to seawater intrusion from southern direction and volcanic-sedimentary-evaporite rocks form western barrier)*
- ✓ **MAR - well/basin infiltration into karst aquifer**
- ✓ **Further research of aquifer** - geophysical research, structural measurements, determination of hydraulic parameters of the karst aquifer, hydrochemistry, monitoring of salinity and water levels
- ✓ **3D conceptual model**

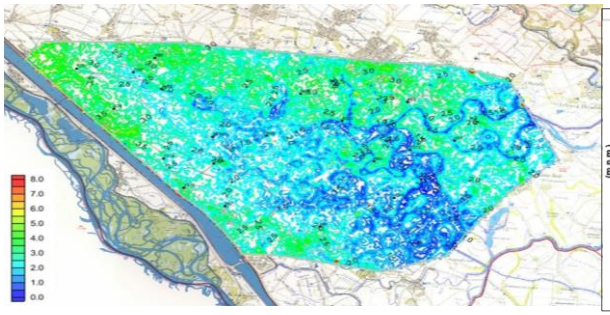


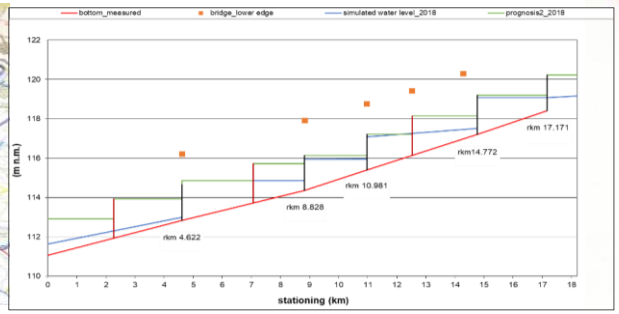


Pilot site

Slovakia – Žitný ostrov

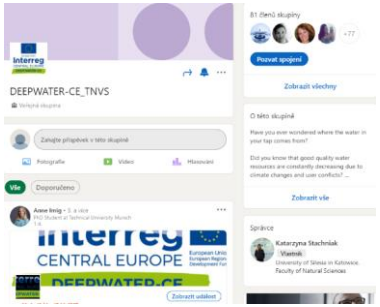
- ✓ Podunajska Lowland - **fluvial Quaternary sediments** (prevailing sandy gravels)
- ✓ **Gabčíkovo Water Structure** (HPP) –**Hrušov Reservoir** with left-hand seepage channel (supplies the channel network of Žitný Ostrov)
- ✓ pilot site area - **3 channels** Gabčíkovo-Topoľníky (S7), Vojka-Kračany (A7) and Šuľany-Jurová (B7) – **MAR scheme - recharge dam**
- ✓ Field/laboratory measurements - input data to **HYDRUS 2D and MODFLOW** models
- ✓ **Agricultural use**





- ✓ **Feasibility assessment** of establishing MAR schemes in CE
- ✓ **Development of policy recommendations** and **national action plans** for adopting MAR solutions in national water resource management schemes
- ✓ **Dissemination of project outputs** – trainings for target groups, web, Transnational/National Virtual Squares, social media

Supporting activities



https://www.interreg-central.eu/Content.Node/DEEPWATER-CE.html

Thank you for your kind attention

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