Suitability mapping as an effective tool for identifying potential locations for Managed Aquifer Recharge

A case study: Dunajec catchment, Poland

Sławomir Sitek[1], **Krzysztof Janik**[1], Agnieszka Piechota[1], Jakub Mukawa[2]

1. University of Silesia in Katowice, Faculty of Earth Sciences, Bankowa 12, 40-007 Katowice, krzysztof.janik@us.edu.pl

2. Tarnow Waterworks Ltd., Narutowicza 37, 33-100 Tarnów

DEEPWATER-CE

Developing an integrated implementation framework for Managed Aquifer Recharge solutions to facilitate the protection of Central European water resources endangered by climate change and user conflict

Project aim: to build a joint water resource management strategy and to facilitate the protection of Central European water resources endangered by the climate change.

Why is MAR important in Poland and Central Europe?

Groundwater is the primary source of drinking water in many countries of the CE region, including Poland. These resources are strongly affected by the climate change.

The solution(s) for storing water for dry periods from abundance periods is needed.

The project partners have taken a closer look at 6 MAR techniques with the greatest potential for development in CE and developed a Toolbox to select the most potentially suitable locations for them.

Methodology development

Developed methodology of selecting a suitable MAR location is based primarily on the geological and hydrogeological parameters analysis of the selected regions.

The creation of suitability maps took place on two levels of detail: **general and specific.**

Transnational decision support toolbox for designating potential MAR locations in Central Europe

https://www.researchgate.net/publication/346114901_TRANSNATIONAL_DECISION_SUPPORT_TOOLBOX_FOR_DESIGNATING_POTENTIAL_MAR_LOCATIONS_IN_CENTRAL_EUROPE

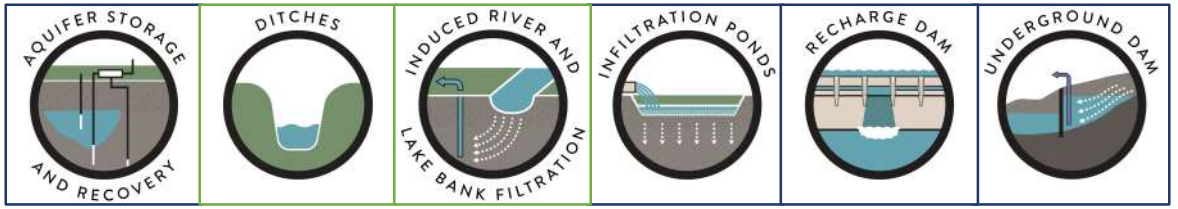
Video tutorial: Decision-support toolbox for identifying the suitability of managed aquifer recharge (MAR)
https://www.interreg-central.eu/Content.Node/DEEPWATER-CE.html

Methodology development

The following criteria were taken into consideration during the **general mapping:**

1. Distance from surface water source.
2. Lithology of the surface formations.
3. Slope angle.
4. Depth of the top of the aquifer.
5. Lithology of the aquifer.
6. Depth of the groundwater table.

General screening area
with the hydrogeological maps
used as the background

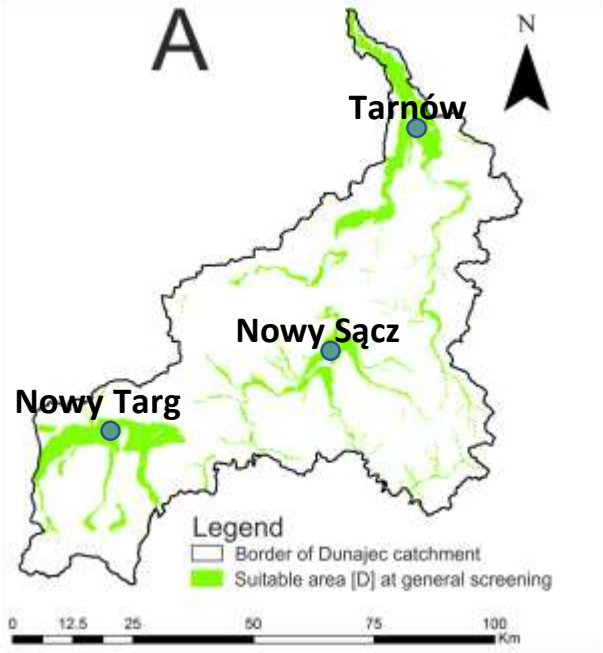


4,5,6 | 1,2,5,6 | 1,5 | 2,3,6 | 1,5,6 | 3,5,6

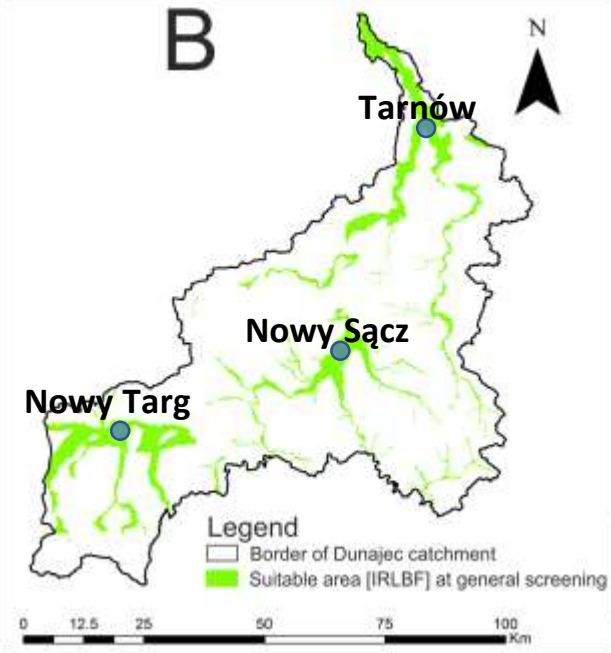
Example of selection criteria for general screening – MAR type: infiltration pond

Main parameter category	Name of parameter(s)	Suitability threshold	
		Not suitable	Suitable
Surface characteristics	Lithology of the surface formations	Unfractured or slightly fractured igneous and metamorphic rocks, fine-grained sediments and sedimentary rocks	coarse-grained sediments and sedimentary rocks, moderately to highly fractured and karstified rocks
	Slope	>10°	≤10°
Aquifer characteristics	Depth of the groundwater table	<5 m	≥5 m

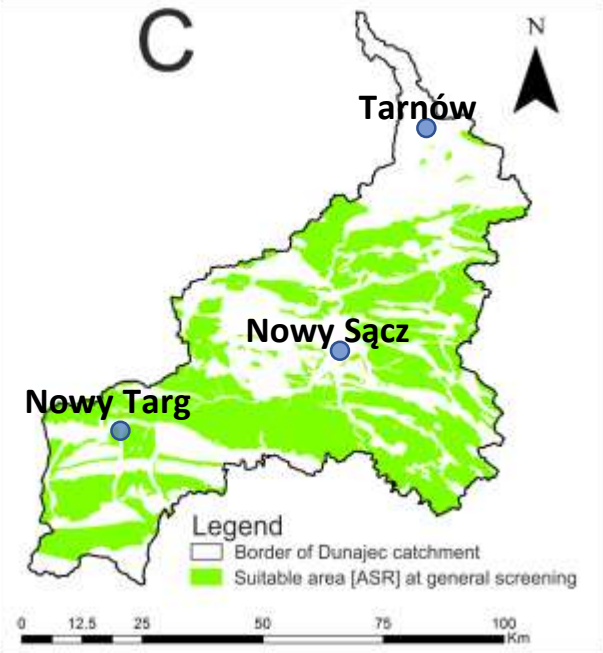
Mapping results and suitability percentage



13%



12.6%



49.9%

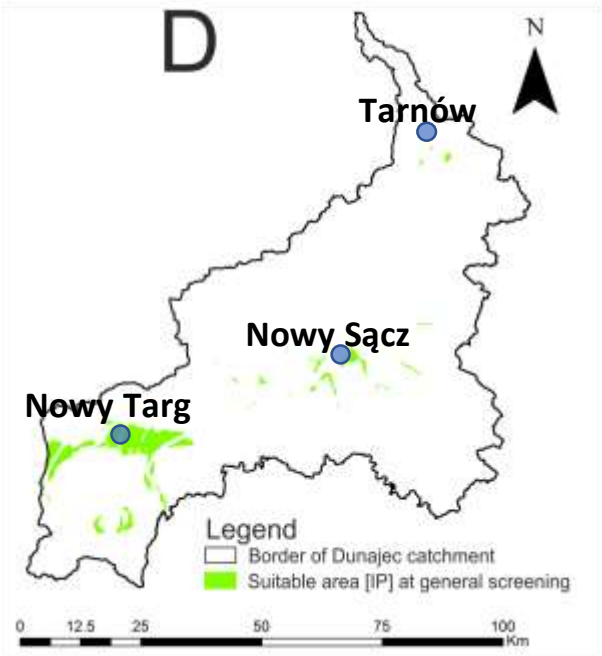
General level MAR suitability maps:

A: Ditches

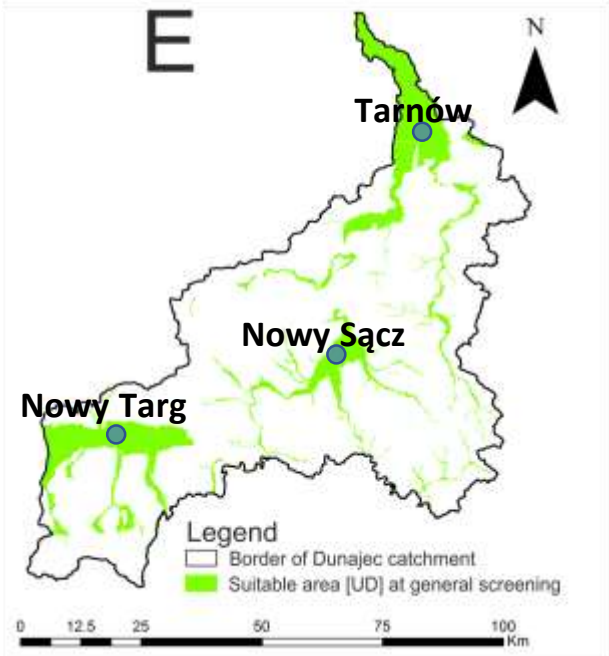
B: Induced River and Lake Bank Filtration

C: Aquifer Storage and Recovery

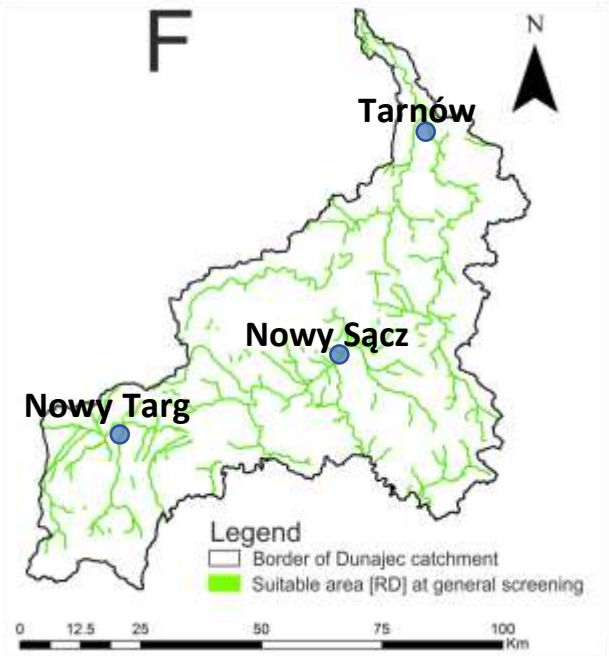
Mapping results and suitability percentage



2.91%



15.6%



62.1%

General level MAR suitability maps:

D: Infiltration Pond

E: Underground Dam

F: Recharge Dam

Conclusions

1. With the methodology used, it is possible to determine where there is potential for six types of MAR to be implemented and where more detailed research should be conducted (specific screening).

2. 3 methods seemed to be the most promising for the study area: Induced river and lake bank filtration [12.6%], Infiltration ditches [13%] and Underground dam [15.6%].

3. The authors have further identified 3 potential areas where the implementation of this type of MAR, enabling additional supply of the aquifer, could be the most beneficial. These were the urbanized and industrial areas near three cities: Tarnów, Nowy Sącz and Nowy Targ.

How would MAR make a difference?

Based on the maps created, the application of any of the proposed 6 MAR solutions in the study area can contribute in the future to:

- maintaining, enhancing, and securing the water balance of groundwater systems as well as increasing drinking water resources under stress as a consequence of the negative effects of climate change,

- in the research area MAR can be an efficient barrier to various contaminants and dilute them in the groundwater as a result of increased artificial recharge.

Thank you very much for your attention!

More information can be found at:
https://www.interreg-central.eu/Content.Node/DEEPWATER-CE.html
https://www.linkedin.com/company/deepwater-ce/
https://www.facebook.com/Deepwater-ce-101615247894649

The maps are published at IGRAC's Global Groundwater Information System:
https://ggis.un-igrac.org/maps/2171/embed