



FREEWAT

Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project



 **ict4water.eu**

Joining participatory approach and spatially-based modelling tools for groundwater resource management

Giovanna De Filippis, Iacopo Borsi, Laura Foglia, Massimiliano Cannata, Rotman Criollo, Enric Vázquez-Suné, Irena Kopač, Björn Panteleit Pio Positano, Marco Saulo Nannucci, Manuel Sapiano, Daria Svidzinska, Mykhailo Grodzynski, Rudy Rossetto

EIP Water Online Market Place

Matchmaking for water Innovation

MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)





Water resource management and planning



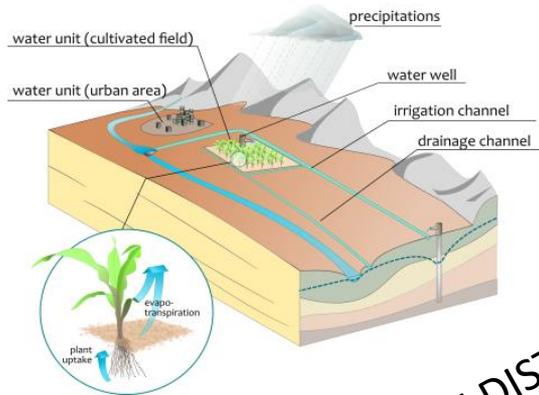
Although a lot of science is produced on Water Resource Management (WRM), especially in the ICT sector, **WRM is still today poorly addressed via scientific means**

REASONS

- underrated importance is given at political and decision-maker level
- low-capacity of the research environment to transfer the results to the real world
- missing capacities in using advanced digital tools at agencies and governing authorities

- ICT are complex tools, as high level of knowledge and computing skills are often required
- Often treated as “tricky games”
- Barriers to:
 - the uptake of existing and state-of—the-art technologies for water management
 - full data exploitation which at present often end up in...
 - ... data on paper or excel spreadsheet ...
 - ... so diminishing data values
- They have to be understood also by a non-technical audience
- Open ICT can then be a tool for shared WRM

What's FREEWAT



USGS
science for a changing world

MODFLOW and Related Programs (MT3DMS, SEWAT, UCODE, etc.)

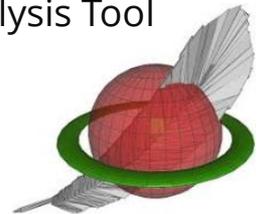
SPACE AND TIME DISTRIBUTED DATA

UPSCALING from cell results

WATER MANAGEMENT AND PLANNING MODULE



GIS AND SPATIAL DATABASE



Observation Analysis Tool

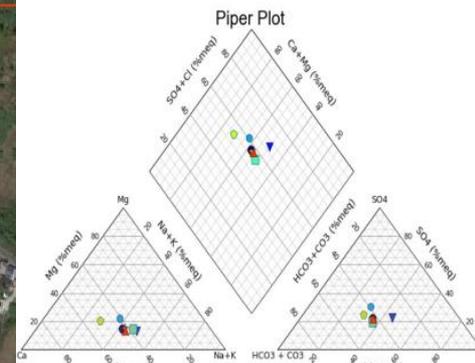
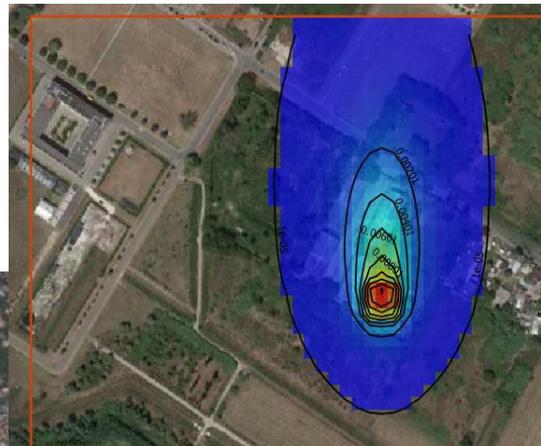
Surface and Groundwater Flow Simulation

simulation and analysis tools

Water quality issues

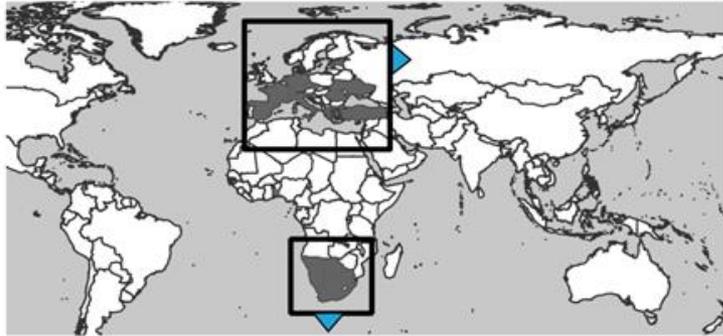
Rural water management module

Calibration Sensitivity Analysis
Parameter estimation

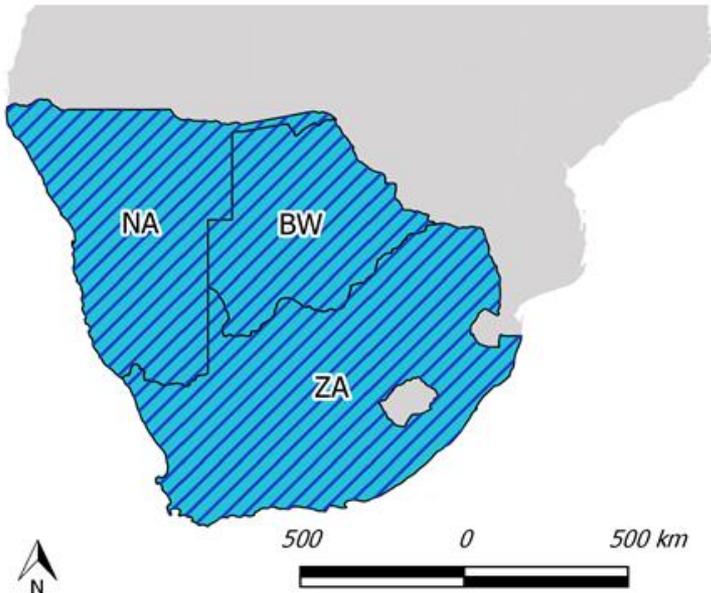
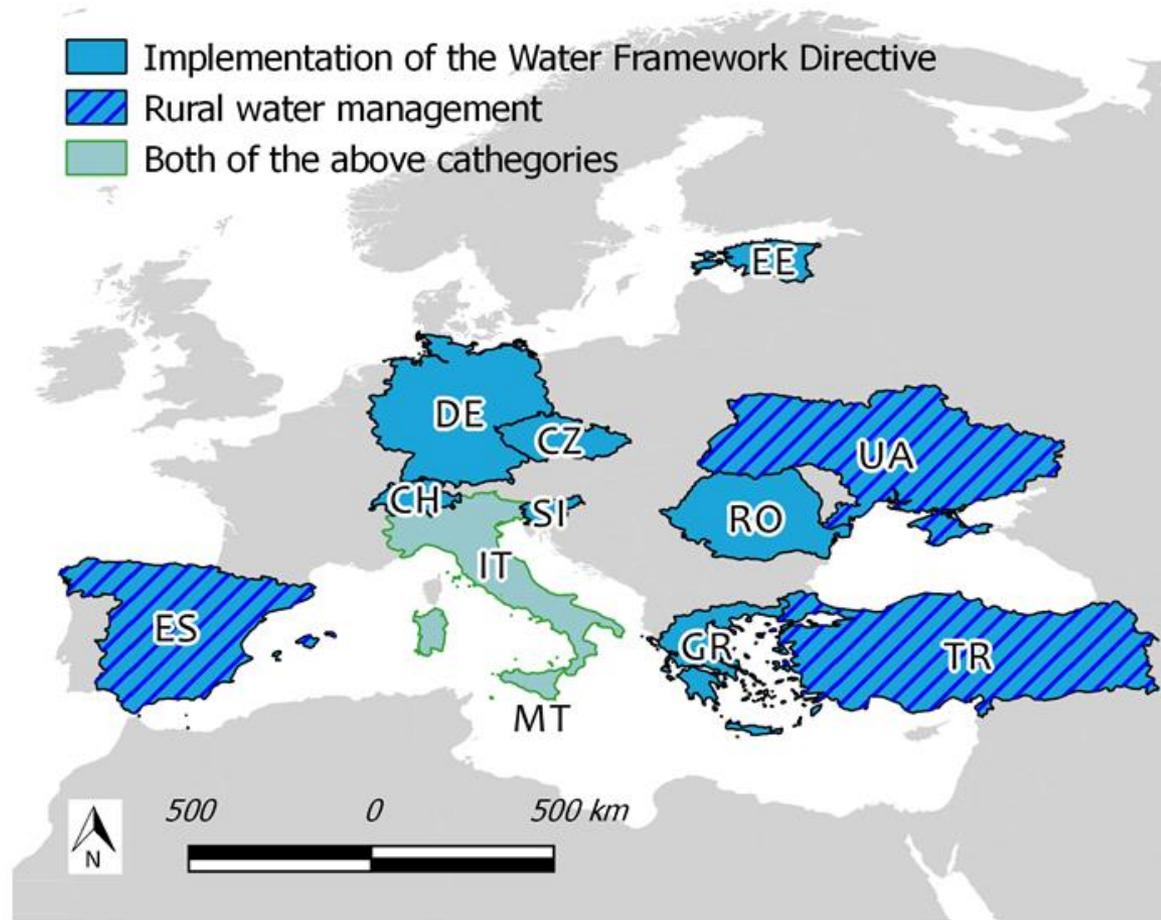


● P10_CUP0610 ● P3_CUP0610 ● P6_CUP_7309 ▲ P8_CUP0610
▼ P11_CAG0110-005 ■ P4_CPR1011 ★ P7_CUP0609

FREEWAT case studies within a participatory approach/1



-  Implementation of the Water Framework Directive
-  Rural water management
-  Both of the above categories



Running Focus Groups on ICT in water management

<i>Type of stakeholder</i>	<i>Name of stakeholder</i>
Local /governemnt	Regione Toscana
River Basin authority	Autorità di Bacino del Fiume Serchio
River Basin authority	Autorità di Bacino del Fiume Arno
Environmental Protection Agency	Agenzia Regionale di Protezione Ambientale Toscana
Land managers	Consorzio di Bonifica Toscana Nord
Municipality	Comune di Vecchiano
Water utility	ASA spa
Water utility	GAIA spa
	Ingegnerie Toscane
	Servizio idrologico Regionale
Natural area/protected area	Parco Naturale Regionale Migliarino S Rossore Massaciuccoli
Farmer association	Confagricoltura
Farmer association	CIA
Farmer association	Coldiretti
Industrial association/Commerce Chamber	Camera di Commercio di Pisa, Camera di Commercio di Lucca
Environmental protection association	WWF
Environmental protection association	LIPU
Environmental protection association	Legambiente
Research	University of Pisa

Piano di Gestione delle Acque - I Aggiornamento

Schede Indirizzi Vincolanti

Misure vincolanti per le quali è affidata agli enti competenti l'individuazione modalità attuative

N. 19

Monitoraggio dei fabbisogni e degli utilizzi irrigui nel bacino del lago di Massa

N. 20

Monitoraggio delle coltivazioni nel bacino del lago di Massaciuccoli

N. 25

Individuazione delle modalità operative volte ad incentivare un uso sostenibile risorsa idrica nel bacino del lago di Massaciuccoli.

N. 36

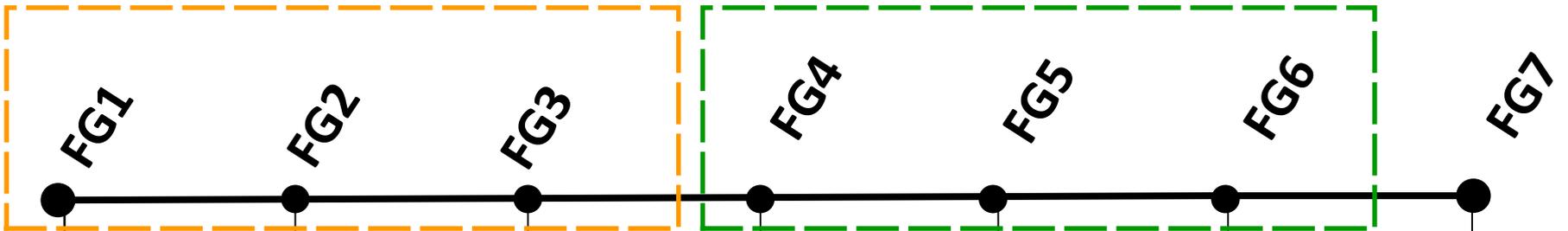
Approfondimenti del lago di Massaciuccoli



FREEWAT case studies within a participatory approach/2

identifying the case study objectives

targeting water management issues



Project introduction

conceptual model and data collection

from conceptual model to numerical model

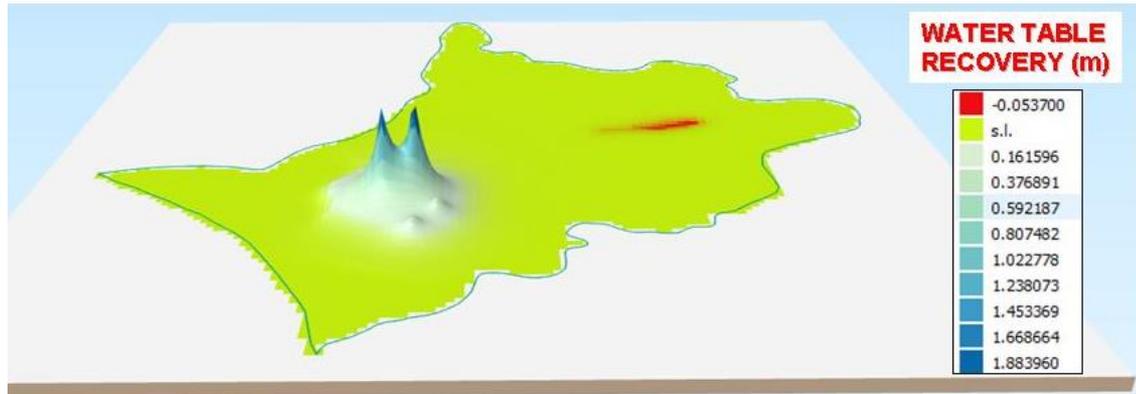
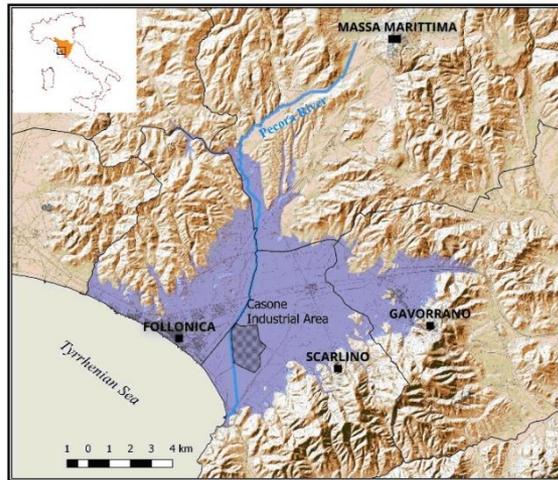
discussion on scenarios to be simulated

implementation and results of scenarios

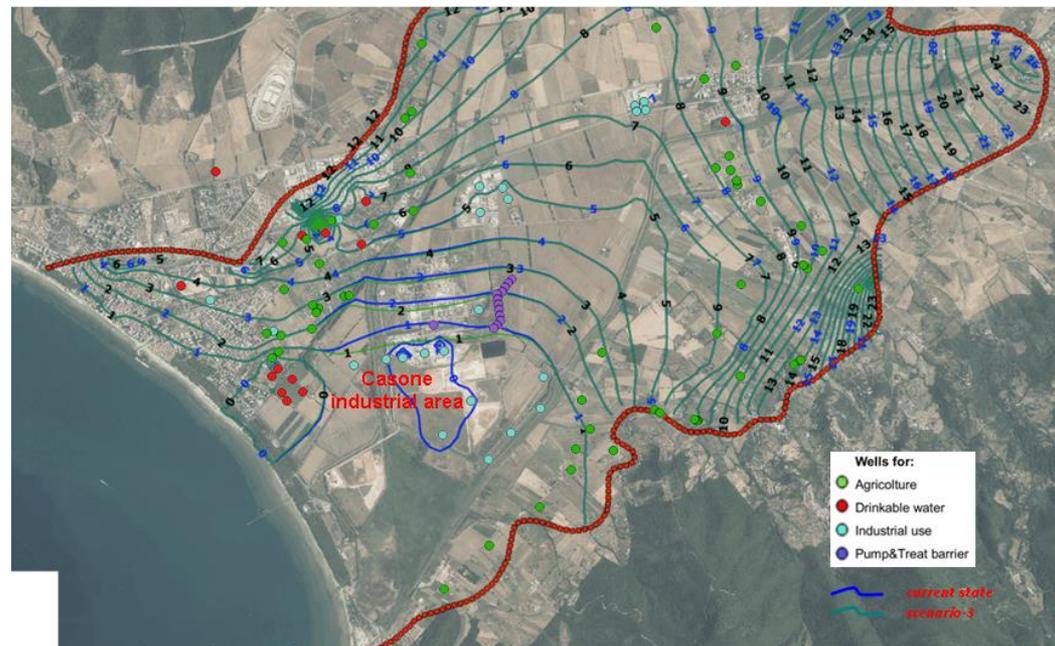
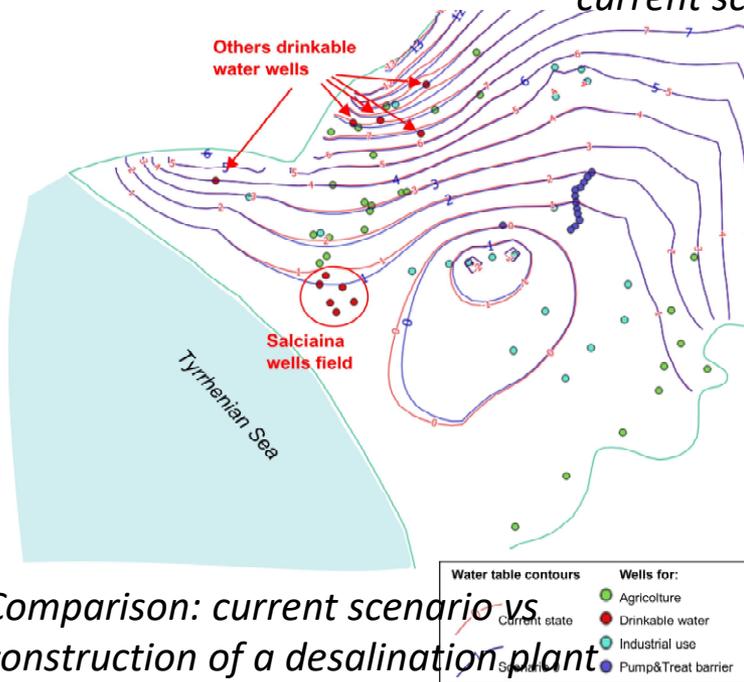
implementation and results of scenarios

results and conclusions

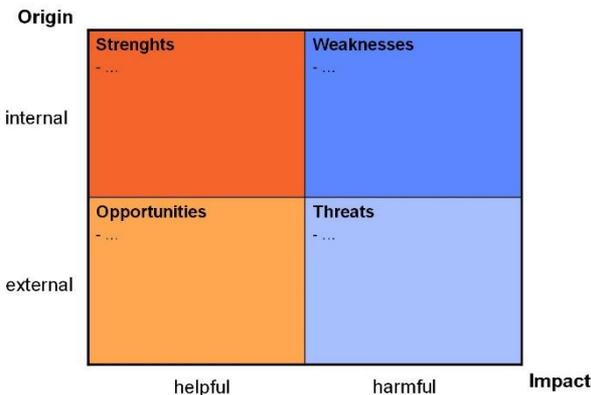
Over-exploitation of the Follonica-Scarlino aquifer (Italy)



Top – Water table recovery for the second scenario; Bottom - Comparison: current scenario vs re-use of Gavorrano mine drainage water

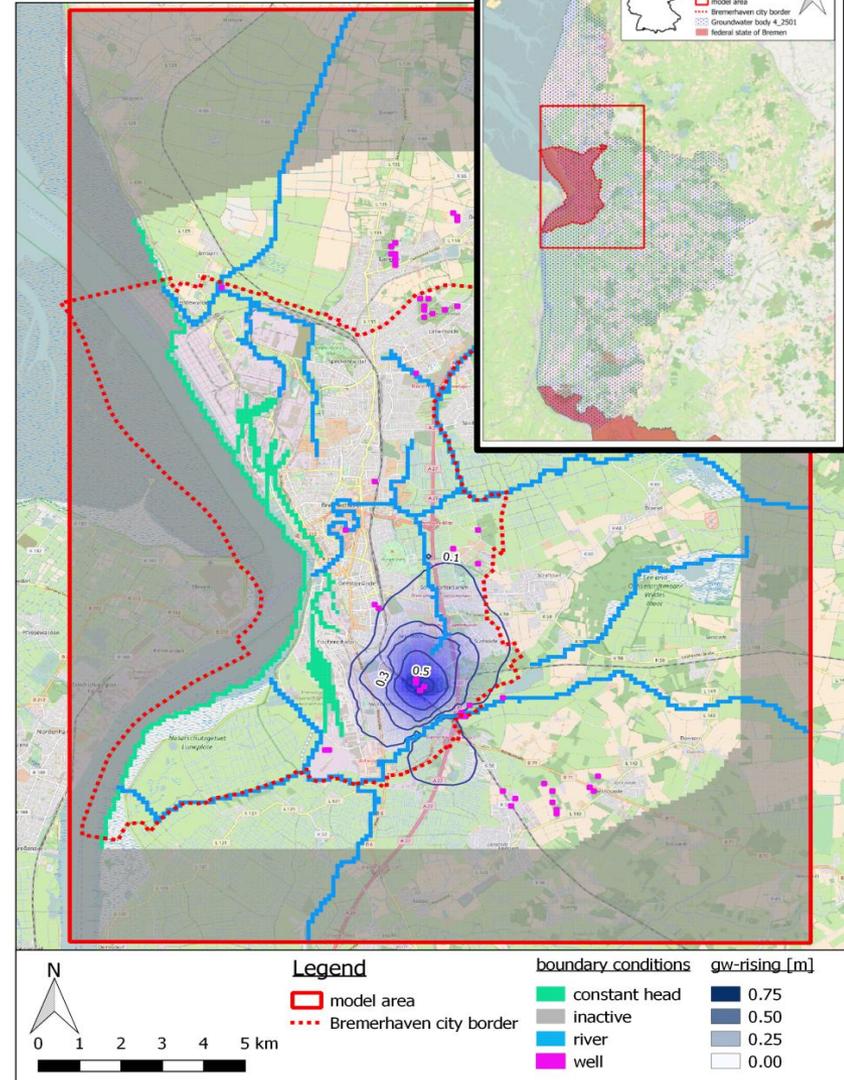
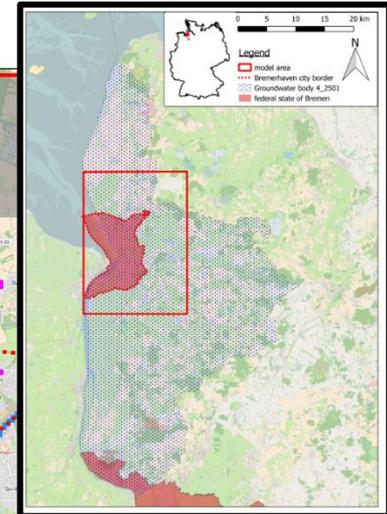
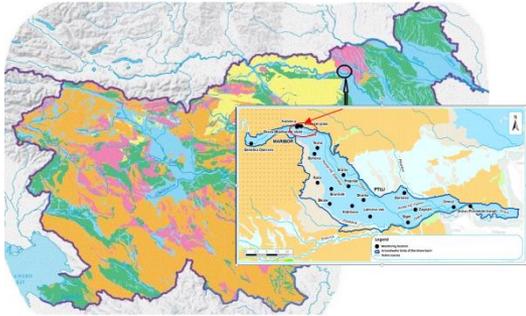


Comparison: current scenario vs construction of a desalination plant



- The 2nd scenario is a starting point to increase opportunities for productive activities in a very responsible manner for the society and the environment
- FREEWAT is a useful tool to improve the knowledge of a study area or a problem and to organize and share data
- The participatory approach was useful to grow up the importance of water resource management and planning

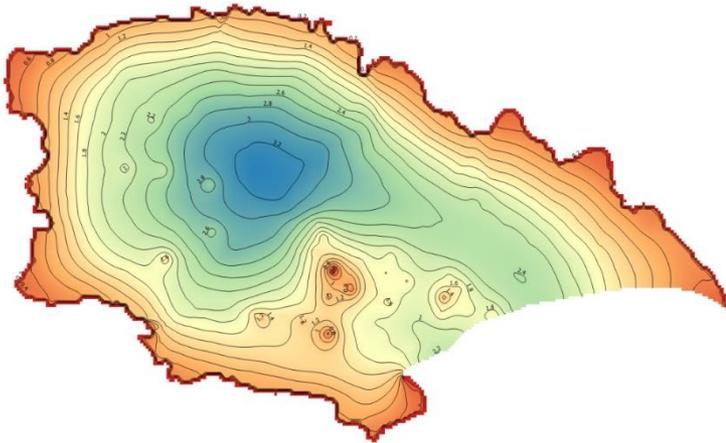
Management of a MAR plant at Vrbansky plato (Slovenia) and impacts of climate change at Bremerhaven (Germany)



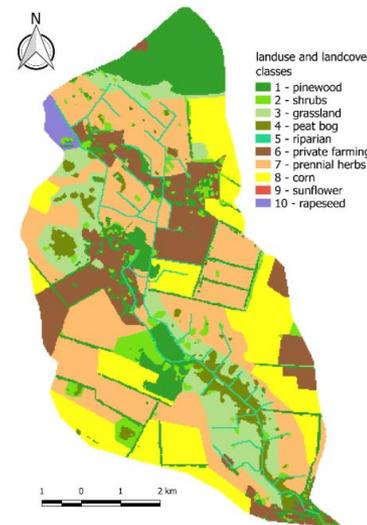
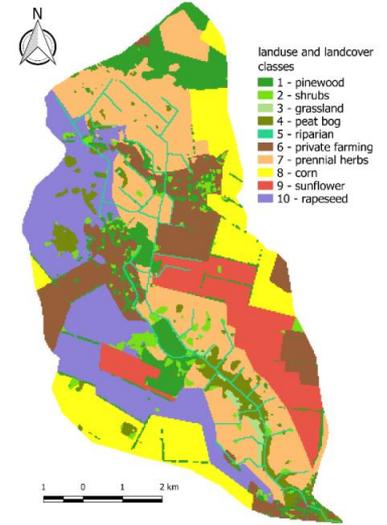
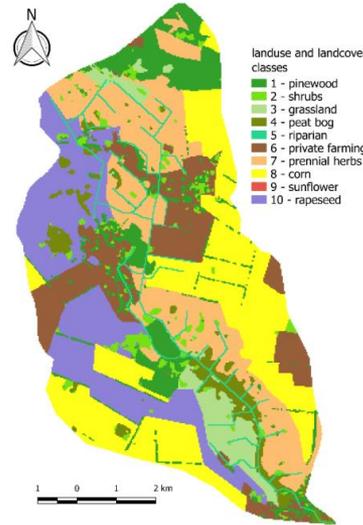
Induced Riverbank Filtration plant at Vrbansky plato

Water level increase after shifting the waterworks of "Bremerhaven Wulsdorf" →

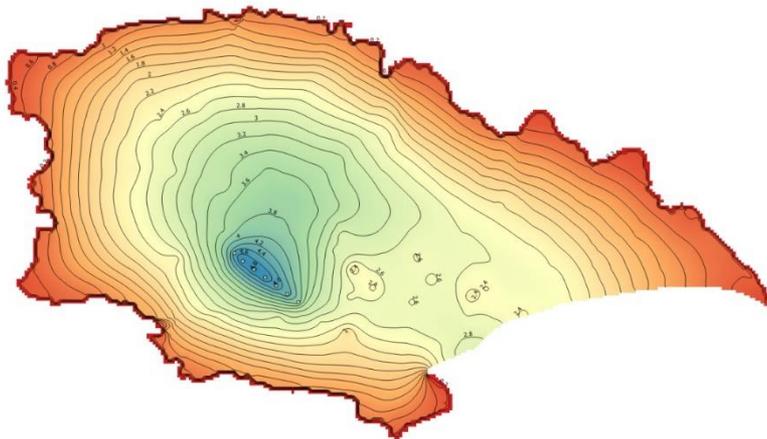
Management of the mean sea level aquifer of the Gozo island (Malta) and optimizing water use at the Bakumivka river basin (Ukraine)



Simulated hydraulic head at the Gozo island under current conditions



Landcover configurations for three scenarios simulated within the Bakumivka area



Simulated hydraulic head at the Gozo island after setting in place a MAR plant

Conclusions/1

- Combining technical work and stakeholder involvement in River Basin Management Plan is fundamental for WRM
- OPEN and FREE ICT tools may offer relevant opportunities in running this combined activities (i.e., from the point of view that models can be easily shared)
- Public authorities have the chance to build high informative and dynamically growing SHARED representation of hydrologic systems where performing planning analysis



Conclusions/2

- Demonstration of FREEWAT capabilities to a range of water-related problems to address requirements of EU Directives and National regulations for water resource management
- Positive and successful methodology based on the participatory approach
- Increased understanding in water management issues, creating a common space to generate a shared knowledge on the value of water





FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project



 **ict4water.eu**

Thanks!



EIP Water Online Market Place
Matchmaking for water Innovation

**MAR Solutions - Managed Aquifer
Recharge Strategies and Actions
(AG128)**

