



AWARE

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Water JPI
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MOTIVATION

- The use of pesticides in agricultural crops is a common practice in Europe
- In areas with water scarcity (e.g. Mediterranean countries), treated wastewater or wastewater-impacted river water is reuse for irrigation. This seems a viable alternative for the use of expensive drinking water.



Photo: E. Fløistad, NIBIO

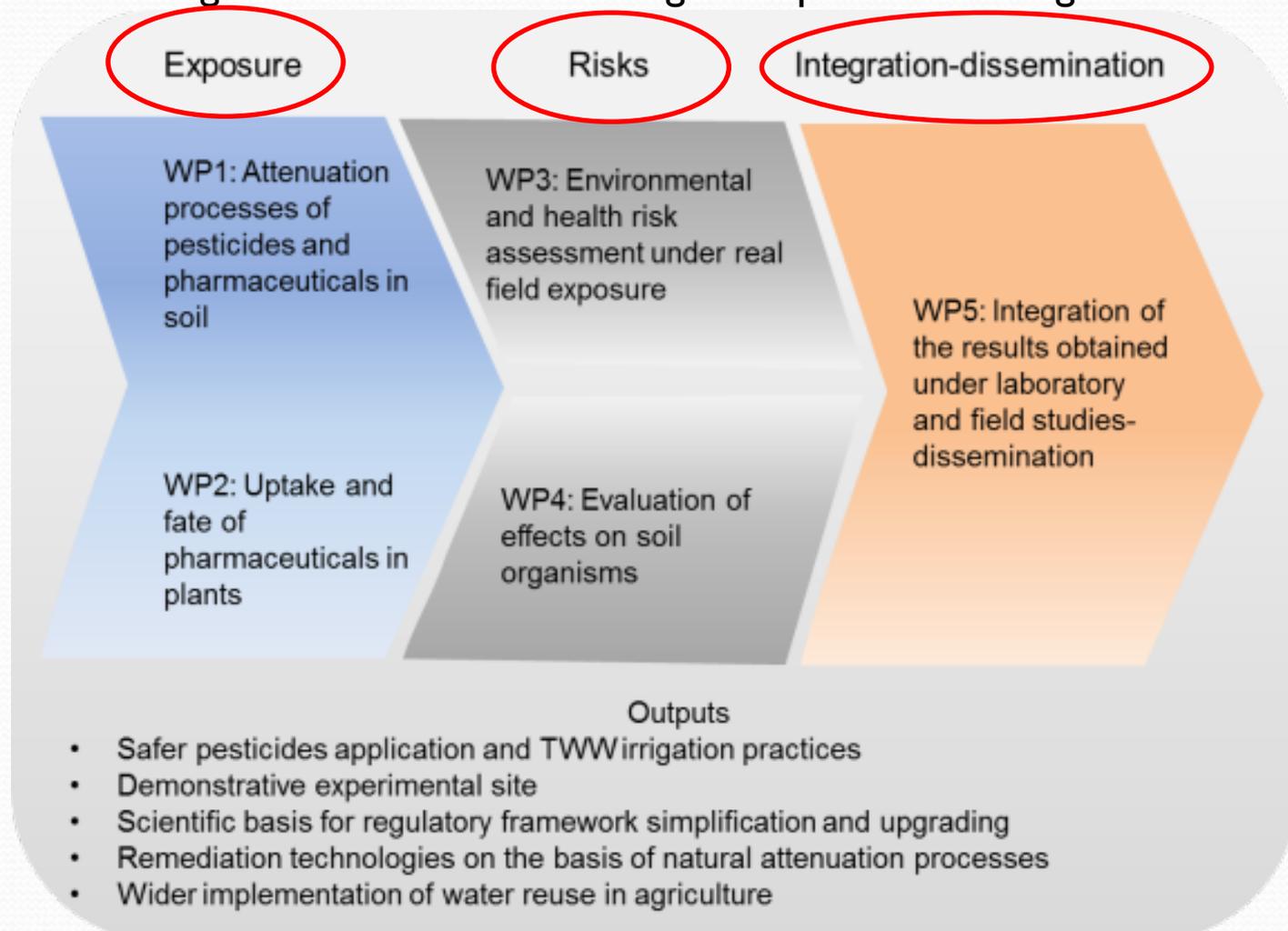


Photo: E. Fløistad, NIBIO

- Exposure of crops to wastewater contaminants following irrigation with contaminated wastewater and the application of pesticides directly to the crops needs to be assessed in order to guarantee food safety and consumer health.
- The risk level depends in the first place on the natural attenuation of these compounds in soil and the uptake and metabolism in crops.
- The effects of the contaminants in soil and plants need to be assessed.

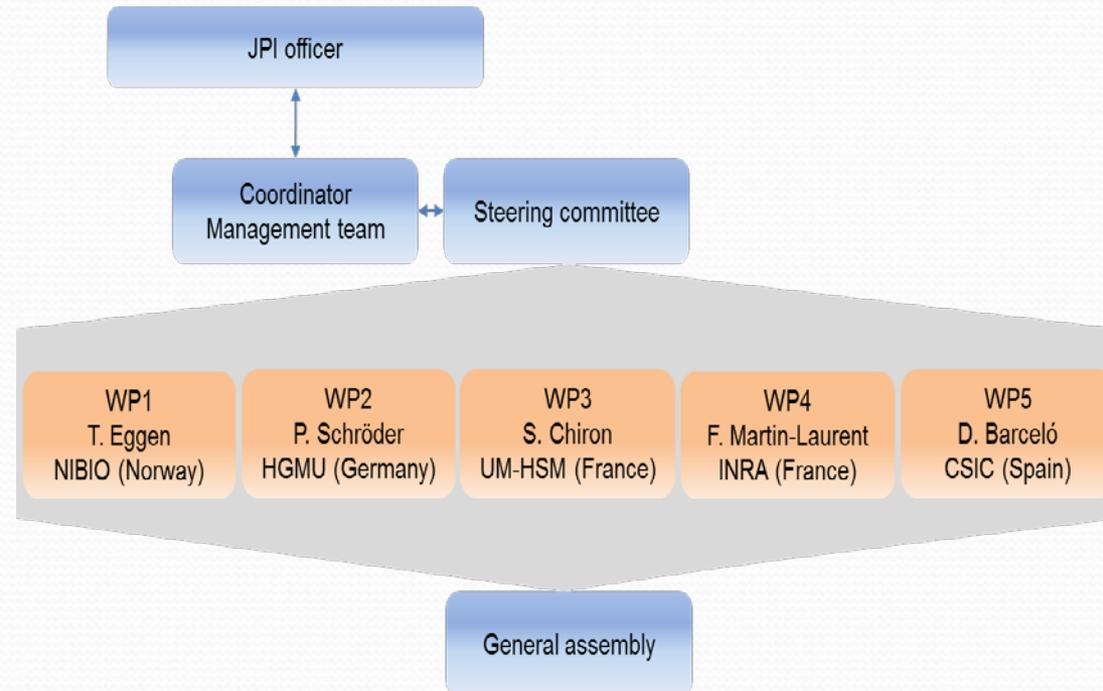
OBJECTIVES

AWARE is a **multidisciplinary** project that aims to evaluate the processes taking place after pesticide application and irrigation of fields with wastewater with regard to xenobiotic degradation and ecotoxicological impact on soil organisms.



CONSORTIUM DESCRIPTION

- 5 European partners – 4 countries: agriculture sector (INRA, NIBIO, HMGU) and the water sector (CSIC and UM-HSM) and UFZ as subcontractor.
- The consortium consists of partners that are experienced in the field of PPCP and pesticide analysis, field studies, and lab experiments. Interdisciplinary is well established, and transdisciplinary approaches needed to achieve the goals are implemented.



WP I

Environmental fate processes of selected pesticides and pharmaceuticals in soil

WP leader: NIBIO, Norway; responsible scientist: Trine Eggen

WP partnership/subcontractor: NIBIO, University Montpellier, Helmholtz Zentrum Leipzig

- Role and main responsibilities in the project

- Investigate pesticides and pharmaceuticals attenuation processes and fate in soil and soil/filter systems

- Key research facilities, infrastructure, equipment

- Field site, Mini-wetlands for controlled experiments, Fixed Bed Reactors
- LC-HRMS, Exactive-Orbitrap MS instrument



WP I: Tasks

- Task 1: Fate of pesticides in controlled mini-wetland system
- Task 2: Quantify turnover & formation of None-Extractable Residues (NER)
- Task 3: The ability of *Trichoderma* species to degrade pharmaceutical residues in rhizospheres
- Task 4: Enantiomeric fractionation tools to discriminate between sorption and biodegradation processes

WP II

Uptake, distribution & fate of pharmaceuticals in plants. Batch reactor

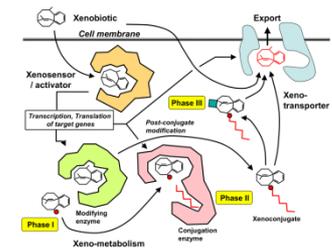
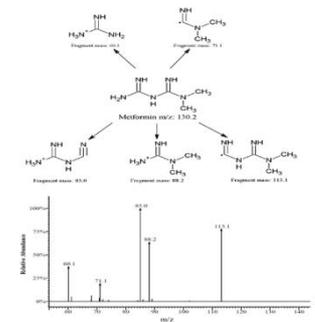
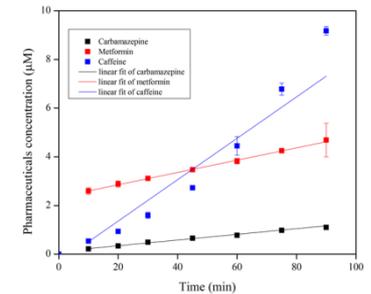
WP leader: Helmholtz Zentrum München, Germany; responsible scientist: Peter Schröder
WP partnership: HMGU & CSIC

- Role and main responsibilities in the project
 - Analysis and identification of PPCPs and their metabolites in plants
 - Quantification of plant stress
- Key research facilities, infrastructure, equipment
 - LC-MS/MS, HPLC-UV/VIS, molecular microbiology, plant stress response, protein biochemistry, greenhouse- and microcosm studies



WP II: Tasks

- Task 1 (HMGU). Evaluation of plant metabolism capacities to better estimate pharmaceutical plant uptake.
- Task 2 (CSIC). Identification of plant metabolites for targeted compounds. Distinguish between soluble (bioavailable) and bound metabolites by vacuole and cell wall preparations of treated plants.
- Task 3 (HMGU). Identification of relevant enzymes responsible for transport and conjugation of pharmaceuticals

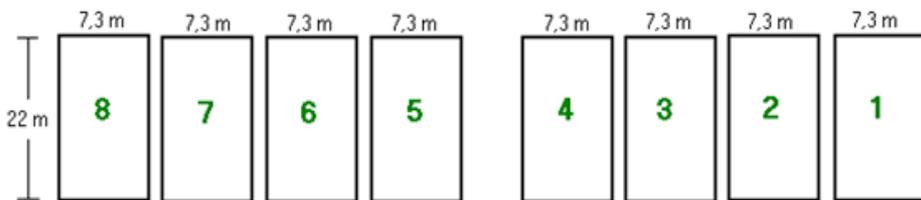


WP III

Risk assessment in field studies/real conditions

WP leader: University Montpellier; responsible scientist: Serge Chiron
WP partnership: ALL

- Experimental platform of treated wastewater reuse located at University Montpellier for studying pharmaceutical residues plant uptake
- Crop cultivation (radish, lettuce and zucchini) under controlled conditions (greenhouse, lysimeter and subsurface drip irrigation).
- Analysis of pharmaceuticals in water/soil, root and plant tissues for risk assessment.
- Field experiment for studying pesticide retention processes in advanced riparian strip zone
 - Test plots with and without advanced filter system



WP IV

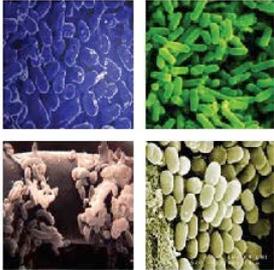
Effects in soil and plants

WP leader: INRA Dijon; responsible scientist: Fabric Martin-Laurent

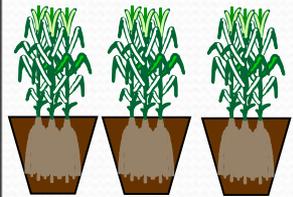
WP partnership: CSIC, UM-HSM



- **Task 1 (CSIC)** estimation of the role of *Lumbricus terrestris* on biodegradation and toxicity of pharmaceuticals.



- **Task 2 (INRA)** evaluation of ecotoxicological impact of drugs on the diversity and activity of soil microorganisms (biodegradation of chemicals and N cycle),



- **Task 3 (UM-HSM)** measurement of the alteration of plant hormone concentration in response to pharmaceuticals,

Management, integration of results and dissemination

WP leader: CSIC, Spain; responsible scientist: Damia Barceló

WP partnership/subcontractor: All

- To ensure a **smooth running** of the project and timely completion of the tasks, integration of the results and their dissemination through scientific channels
- **To integrate the results** to understand uptake translocations and metabolism of drugs in plants for a proper environmental risk assessment for a safe treated wastewater reuse in agriculture
- **To create interest and to raise awareness among the relevant stakeholders and policy makers on the outcomes of the project**
- **To establish regular channels of communication with the key EU and national policy makers and relevant stakeholders responsible for aquatic system management**

Participants: All

Expected Impact of the Project

- To have sufficient knowledge at both lab and real scale on presence, fate, degradation in crops and soil of representative pesticides applied in agricultural crops and also pharmaceuticals present in wastewater for irrigation
- Of special originality is also the search for similarities between the metabolism and the fate of emerging pollutants and agrochemicals with the combination of LC-HRMS and MALDI-MSI
- To reduce the levels of pharmaceuticals with fungi (*Trichoderma* species) or with soil microorganism adapted to pharmaceutical biodegradation, and to reduce runoff of pesticides from agriculture with more advanced filter systems
- **This project will contribute to set scientific basis of future regulations in particular by identifying key indicator contaminants of agro-systems**
- **It will enhance the knowledge of the risks of spreading chemical contaminants to soil through irrigation and will be of interest to water authorities and legislative bodies whose concerns are to identify economically and ecologically viable solutions to water shortage**

How will your project target to following aims of the call:

- To promote multi-disciplinary work .The multidisciplinary consortium of AWARE is formed by a team of highly qualified experts with excellent research records in complementary fields related to analytical chemistry, environmental monitoring, agricultural production, plant physiology, and soil remediation.
- To encourage proposals with fundamental and/or applied approaches
- To stimulate mobility of researchers within the Consortium
- To enhance collaborative research and innovation during the project life and beyond
Given the common research interests and complementary expertise of the partners, AWARE will create a platform for a continued knowledge sharing after the end of the project. The sustainability of the project will be promoted by the submission of a new proposal to continue the investigation on risk assessment of TWW reuse in agriculture in the framework of the EU PRIMA initiative.