CERIS : Civil Engineering Research and Innovation for Sustainability

SOL PRECAIRE – Soil Take Care

Summary

Soils play an essential role in our societies providing many different functions (economic, ecological, and cultural). However, in the SUDOE space many sites/ soils are affected by past or present contamination processes that degraded their quality irreversibly and limit their functions. Nowadays, the national environmental authorities of Portugal, Spain and France are facing two major challenges in terms of environmental management: 1) to establish precise inventories of contaminated sites; and 2) to define the best procedures for remediation.

These two challenges are the framework of SOIL TAKE CARE project which has three main objectives:

1. To bring experimental devices and innovative methodologies to achieve a quick, qualitative and quantitative diagnostics and inexpensive of the surface contamination in metals and hydrocarbons of soils and to assess the effectiveness of the remediation work.
2. To provide tools to identify and target the emitting areas of contaminants through an integrated approach (water-ground-air) of the environmental impact of contamination and thus reduce significantly the contaminated areas to survey.
3. To make a socio-economic study (public organization and population) to identify the strengths, the weaknesses and the levers in the "Organization of Societies" confronted to metal contamination.

The SOIL TAKE CARE project builds on research and development between academia and end-users and is closely connected with the public authorities in charge of the management of these sites. It involves French, Spanish and Portuguese partners who bring varied and complementary skills both on the level of research and political experiences of soil, surface and groundwater resources management.

The main deliverables include:

- To build and calibrate a flow and transport model for integrated analysis of the contamination in soil - surface and groundwater in selected contaminated sites of Portugal (Estarreja), Spain (Cartagena) and France (Viviez).
- To develop a Decision Support System in a GIS platform to integrate modelling results and other products such as vulnerability and risk maps.
- The development of easy to use tools for the diagnosis of contamination, the selection of remediation methodologies and recommendations (map of vulnerability, socio-economic analysis) for public authorities and stakeholders.
- Databases in 'open-access' to be used in water management, investigation and to integration with other water information systems.

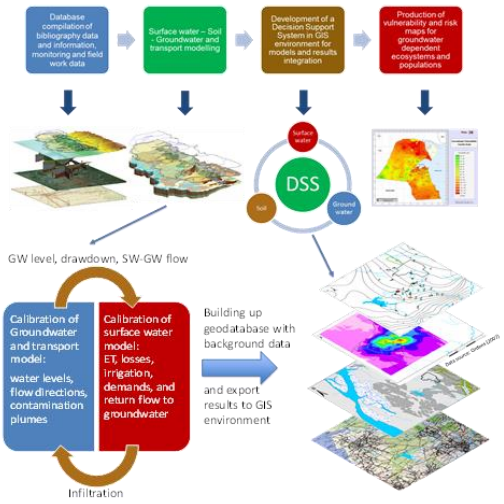

Figure 1. Methodology for the development of Decision Support System (DSS).

The SOIL TAKE CARE project is divided in 7 workpackages (WP):

- WP.1 Topographical and geotechnical measurements.
- WP.2 Diagnosis of soil pollution by metals and hydrocarbons.
- WP.3 The monitoring of the metal contamination transported by the atmosphere and evaluation of the bioaccessibility.
- WP.4 Contamination to the plants.
- WP.5 Transfer of contaminants to the sea.
- WP.6 Numerical modelling of contaminant transfers to soil, air and water.
- WP.7 Socio- economic impact of contaminated sites.

On the other hand, we will perform transverse actions via WP Management (WP.T1), communication (WP.T2) and project follow up (WP.T3).

Case-Study

Estarreja Chemical Complex Area (NW, Portugal).

Project Reference

SOE1/P4/F0023

Leading Institution

CNRS – French National Centre for Scientific Research (France)

Partners

IRSTEA – Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture (France), UNILIM – University of Limoges (France), IST – Instituto Superior Técnico (Portugal), UPCT– Polytechnic University of Cartagena (Spain), INP –Institut Polytechnique de Bordeaux (France), Fundació CTM Centre Tecnològic (Spain), University of Oviedo (Spain)

CERIS Principal Investigator

Teresa Condesso de Melo (teresa.melo@tecnico.ulisboa.pt)

CERIS Research Team

Nuno Barreiras, João Nascimento, Luís Ribeiro

Funding

EU Interreg Sudoe

Period

2016-2019

Total

1 950 591.23€

CERIS

134 150.00€

Project Website

soiltakecare.eu

Figure 2. Location of the Estarreja Chemical Complex.

Figure 3. Industrial landfill with potential hazardous wastes (over 320 000 m³) for surface and groundwater bodies.

The Estarreja Chemical Complex (ECC) is located in NW Portugal and started producing fertilizers in the 1940's, chloride and caustic soda (NaOH) in the 1950's, PVC in the 1960's and more recently, aniline and derivatives, chloralkalis, salt and aluminum salts among other substances and products.

The ECC has a long history of soil, surface and groundwater contamination related to the past practices which often included accumulation of residues at open pits and discharge of non-treated waters that caused serious environmental impacts.

The ECC area is on top of the Aveiro Quaternary Groundwater Body (AQGWB), a highly vulnerable multilayer aquifer to point and diffuse contamination. The groundwater body status is poor (NO_3, Cl, SO_4, As, Hg and other metals, organic contaminants) but the population historically relies on groundwater as a source of water supply for domestic and agricultural uses.

Figure 4. The Veiros lagoon, a groundwater-dependent ecosystem (GWDE) that reflects the poor chemical quality of the groundwater in the Aveiro Quaternary groundwater body.

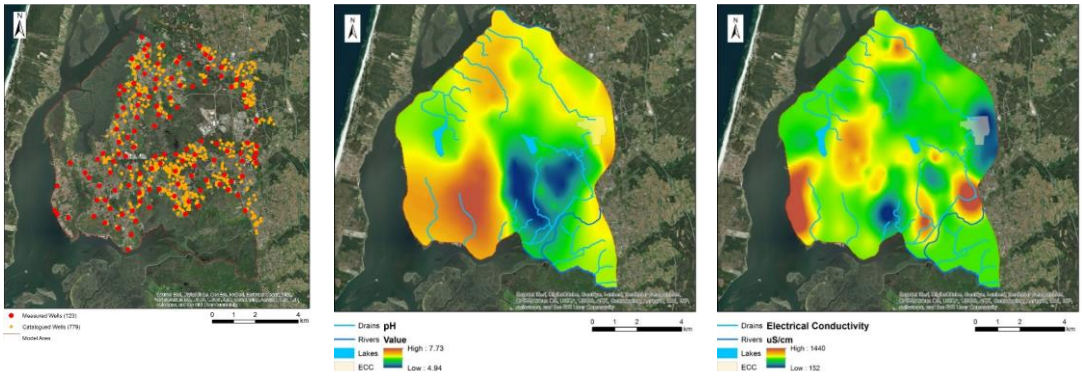

Figure 5. Low cost field campaign for measuring field parameters (Groundwater level, pH, T, EC, DO, ORP) in 155 pre-selected wells in a regular grid of 500m x 500m using Google Engine allowed for regional characterization of the aquifer in the studied area, permitted geostatistical analysis for the identification of anomalous values (e.g. acidic pH or high EC values) and guided groundwater sampling for chemical analysis.