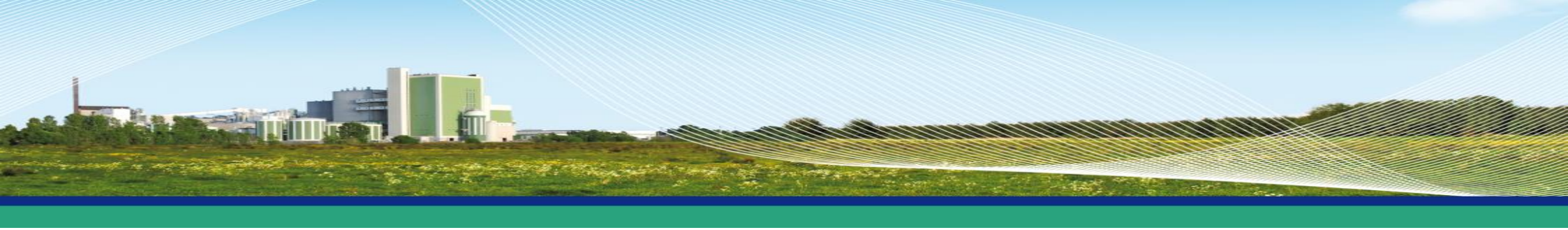

Prioritization of valorization scenarios for sediment deposits management – VALSE project

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"Sediment Challenges and Opportunities due to Climate Change and Sustainable Development"

SESSION : SEDIMENT ASSESSMENT AND MANAGEMENT – CONCEPTS AND POLICIES

Interreg France-Wallonie-Vlaanderen

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Outline

- Introduction
- Methodological approach
- Building of 2 indicators for the valorization scenarios prioritization
- Use of the 2 indicators in a GIS

Introduction

Nord-Pas-de-Calais region has been strongly marked by an industrial and mining past:

- => soil and sediment contamination in the waterways and river basin including 186 historic onshore sediments deposits managed by VNF

Prioritization of the valorization scenarios needs to take account of **social-economic context** and **sediment quality.**

The objectives are therefore to provide a **decision-making tool** constructed **from indicators** and dealing with **valorization scenarios** of these deposits.

This study is a part of the **Interreg V France-Wallonia-Flanders VALSE project** and this part focus on historic deposits valorization. The project VALSE aims to propose and validate valorization scenarios for sediments.

Methodological approach

The approach adopted for the prioritization for the valorization scenarios includes :

- the building of the **2 indicators**:
  - management **of VNF sediment characterization data;**
  - selection of 2 valorization scenarios with VNF;
  - assessment of **human populations exposure** for the **two major scenarios (green park, hunting aera);**
  - building of a global health risk indicator;
  - building of a **socio-economic** indicator.
- the use of the 2 indicators in a GIS.

Management of sediment characterization data

The working steps includes:

- creation of a **sediment characterization database** of a subset (119 sites) of the 186 sediment deposits sites with chemical characterization (8 heavy metals, 7 PCBs, 16 PAHs) and location (GPS data);
- selection of **2 valorization scenarios** : **green park** and **hunting area**;
- sélection of the data concerning the first 50 centimeters of sediment deposits;
- tests of spatial correlation of the characterization data at different scales.

Health risk asssessment: parameters used

Parameters used for scenario exposure routes/pathways:

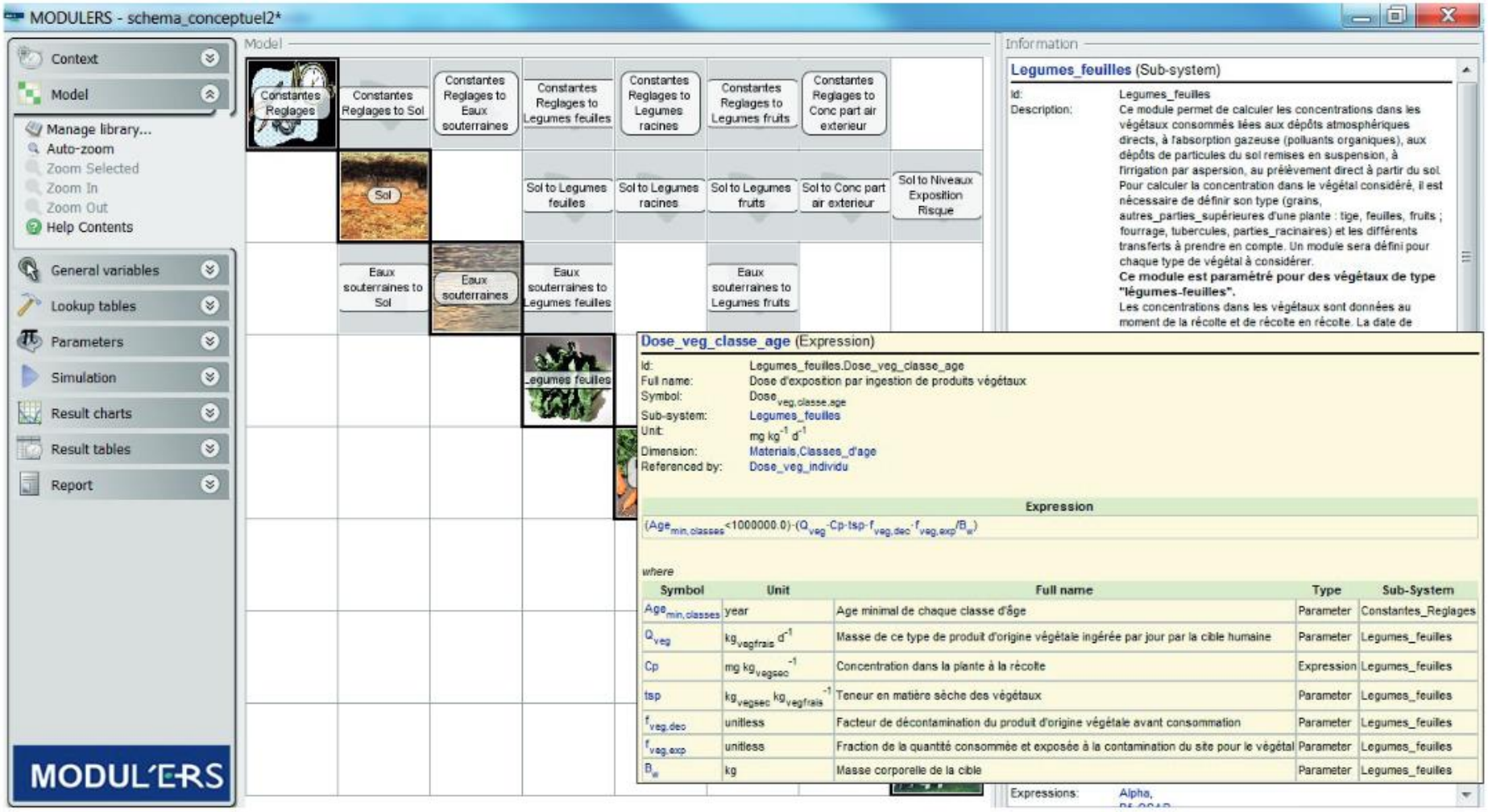
- « Green park » : inhalation of gaseous pollutants, ingestion of soils) ;
- « Hunting » : (inhalation of gaseous pollutants, ingestion of soils and consumption of rabbits);
- All analyzes of surface soils (8 metals, 7 PCBs, 16 PAHs).

A bioconcentration factor approach was used to account for the contamination of rabbits:

- from analysis data of caged rabbits on site transmitted by VNF;
- in the absence of measurements, by a QSAR model (dependent on the Kow of the substances).

Health risk asssessment: model used

The health risk assessment calculations were carried out using the MODUL'ERS software, which is a modeling and simulation platform.

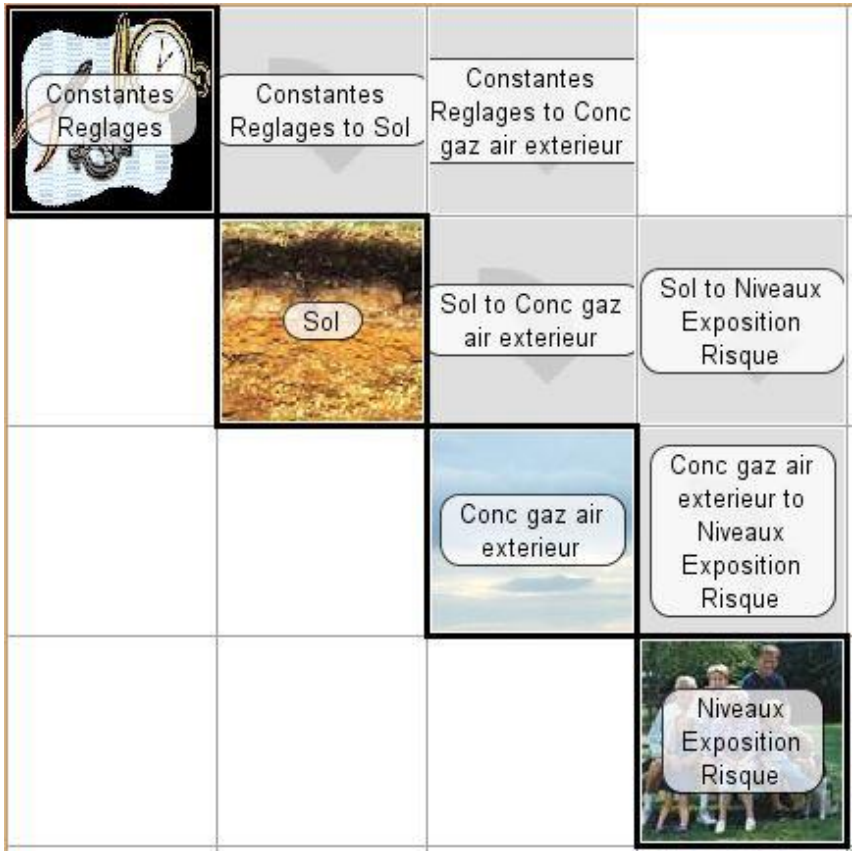


Health risk asssessment: exposure matrice

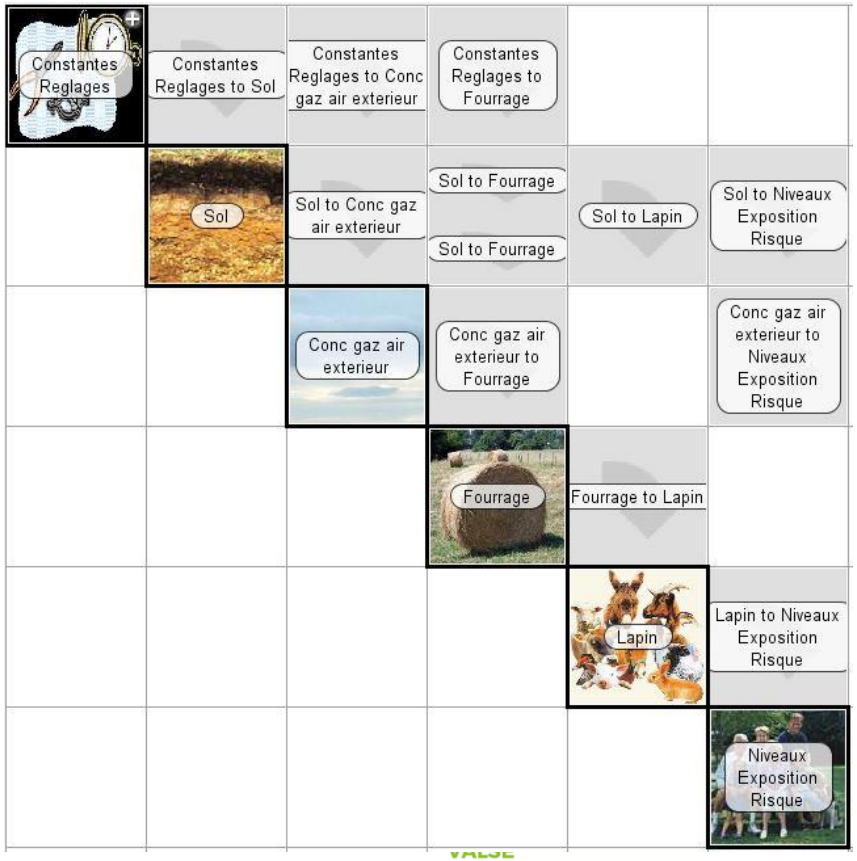
Exposure parameters were calculated for age groups 0 to 70 years old and include:

- time spent on site and soil ingestion for the 2 scenarios;
- consumption of rabbits for the hunter scenario.

Exposure matrice of the model MODUL'ERS



« Green park » exposure matrice



« Hunting area» exposure matrice

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Health risk asssessment: results and selection of scenario

Hazard Quotients (HQs) were calculated per target organ for the two routes totaling 13 organ systems for application per route and per substance.

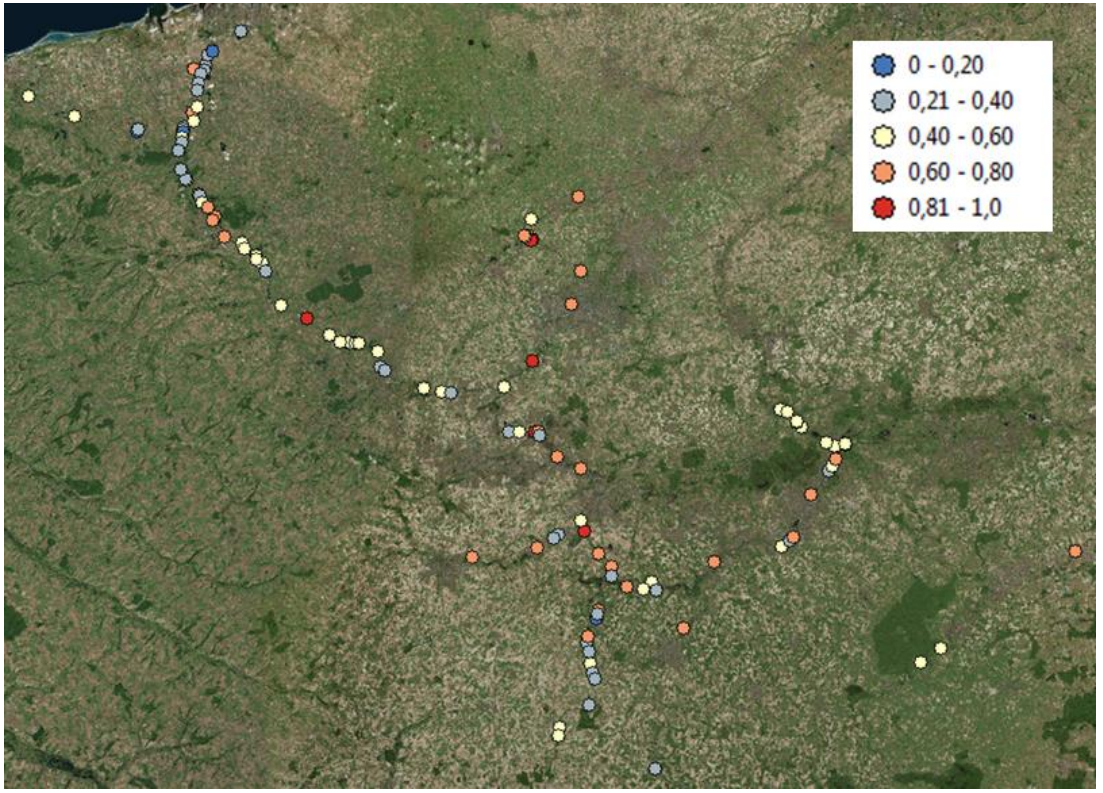
The simulations for the “Green park" scenario show exceedances of the risk threshold value for 7 sites out of 119. These exceedances are mainly linked to arsenic for the carcinogenic risk (CR) and lead for the non-carcinogenic risks (HQ). This scenario was confirmed as the reference scenario.

In the case of the “Hunting area" scenario, almost systematic exceedances of risk threshold value are linked to exposure to lead through the consumption of rabbits. The presence of potentially pre-existing lead linked to hunting activity does not, however, allow a conclusion for this parameter. At a few sites, the CR for arsenic also exceeds the risk threshold value.

Building of a global health risk indicator

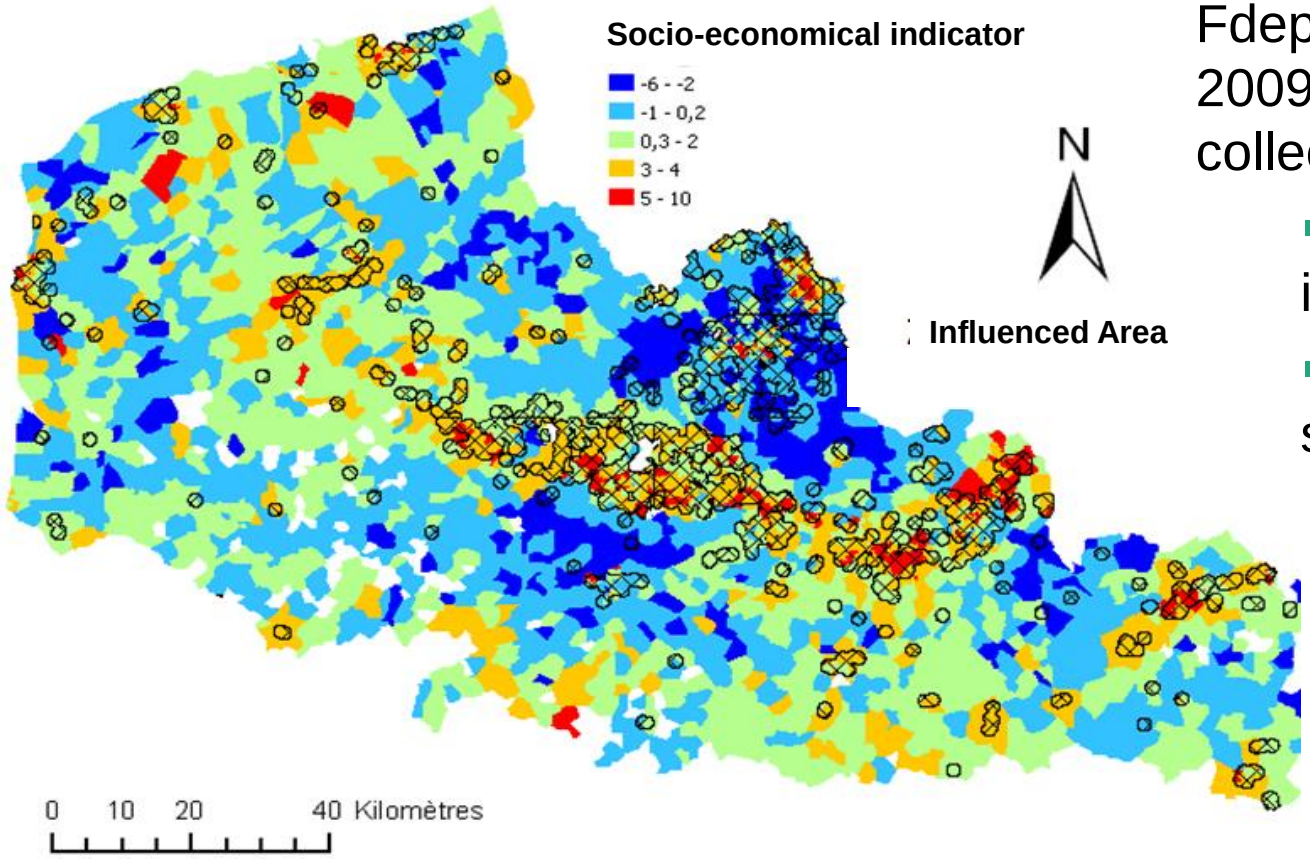
The raw values of HQs and CRs are normalized, reduced to [0 - 0.5] and summed to produce the global health indicator “ENV” at the 119 sites. This indicator must be only used for comparison purpose.

River basin



ENV indicator

Building of a social economic factor: use of a social deprivation index



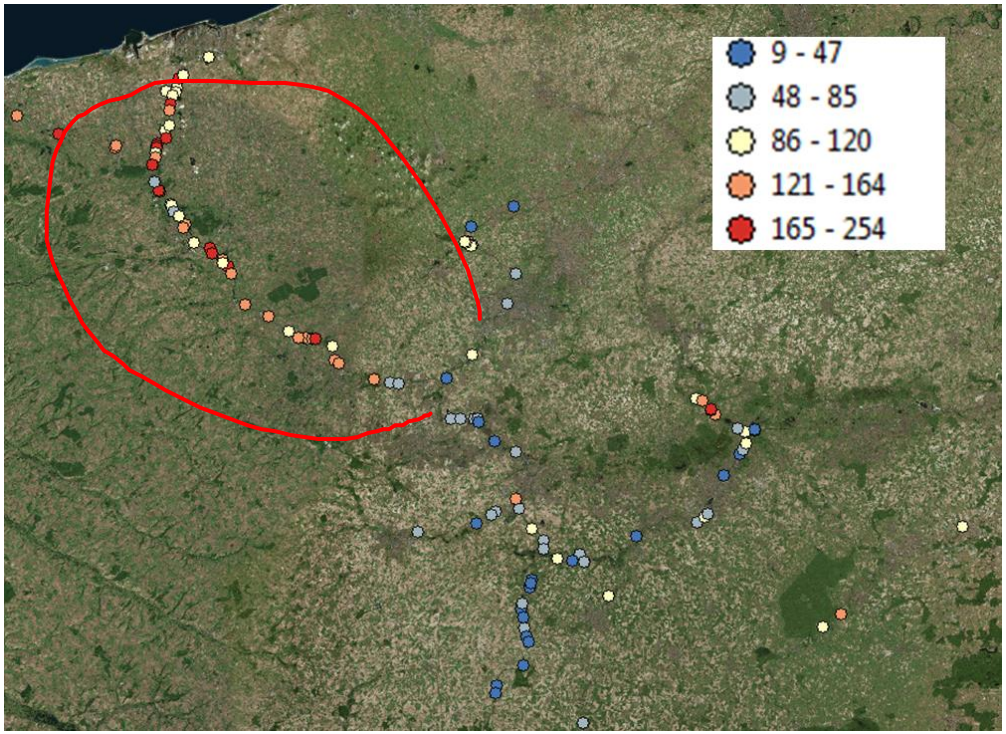
Fdep : social deprivation index (Rey et al., 2009) based on 4 socio-economic variables collected in the 2008 INSEE census:

- 4 variables (INSEE): unemployment, income, diploma, worker
- sum of the 4 reduced, weighted and stratified centered variables

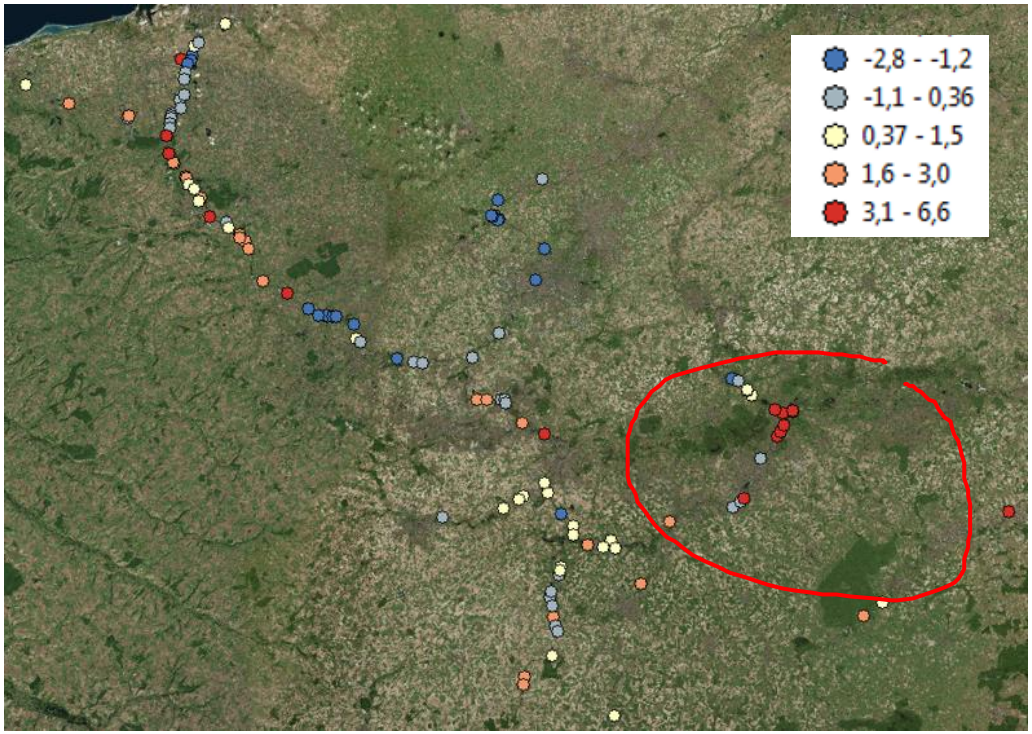
Methodological approach : building spatial composite indicators to analyze environmental health inequalities on a regional scale (Caudeville et Rican, 2016).

Building of a social economic factor: use of Nord Pas-de-Calais population and social deprivation index

Combination of the population living within a radius of one km (POP parameter) and the social deprivation index (FDEp).

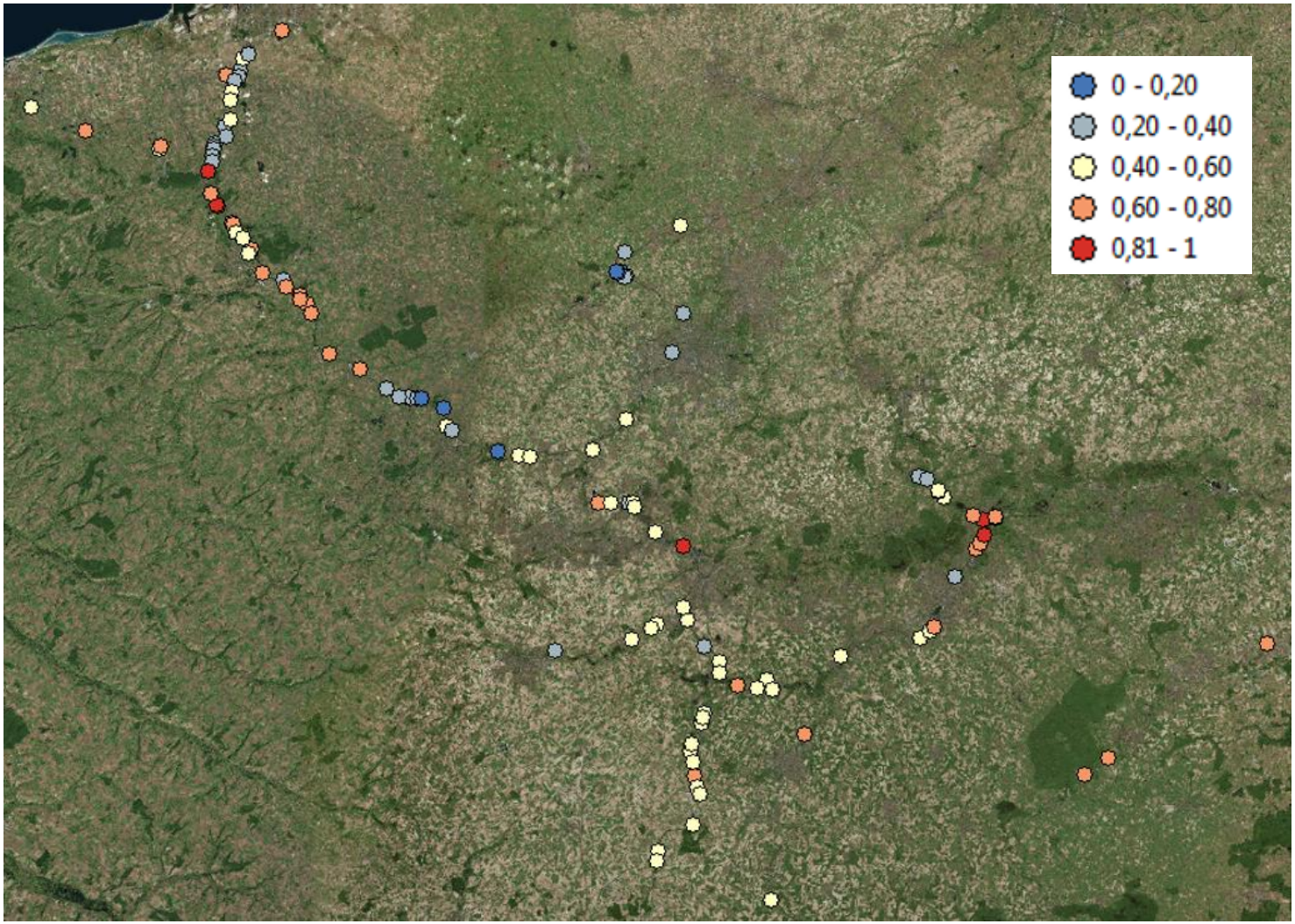


POP : Population for radius = 1km



FDep index

Building of a social economic factor: (POP Fdep) indicator



(POP FDep) indicator in the Nord-Pas-de-Calais river basin

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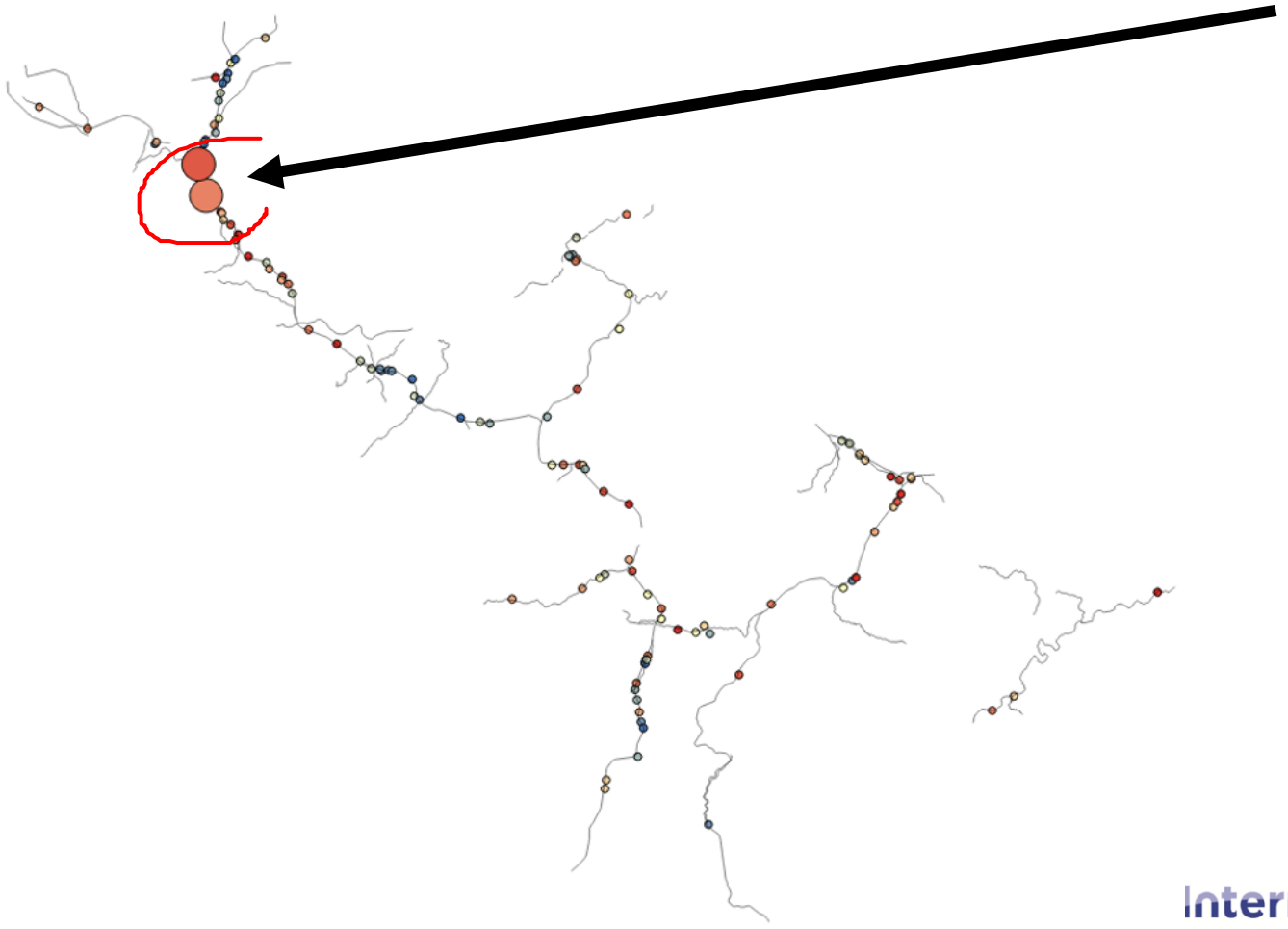
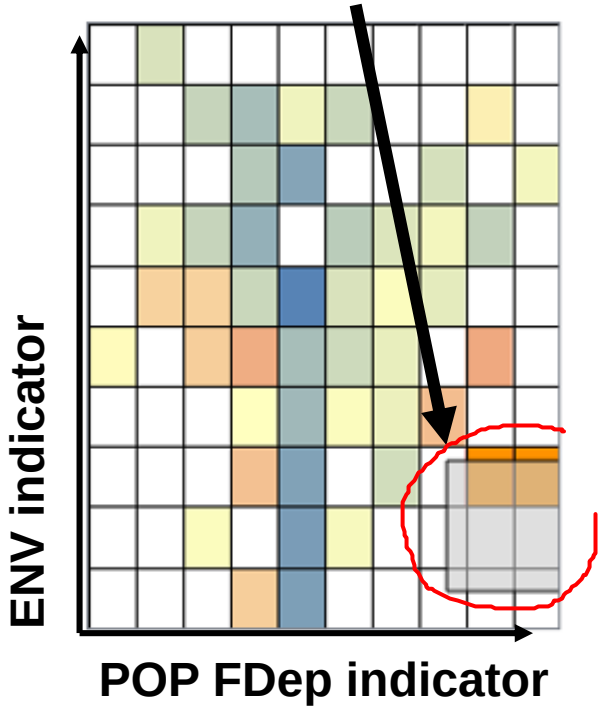
Prioritization for sediments deposits management: case 1

Use of indicators for decision support:

- case 1: choice of strong socio-economic issues and low environmental risks (willingness to reduce only socio-economic inequalities)



Socio-eco. (POP FDep) ++
Exposure (ENV) --



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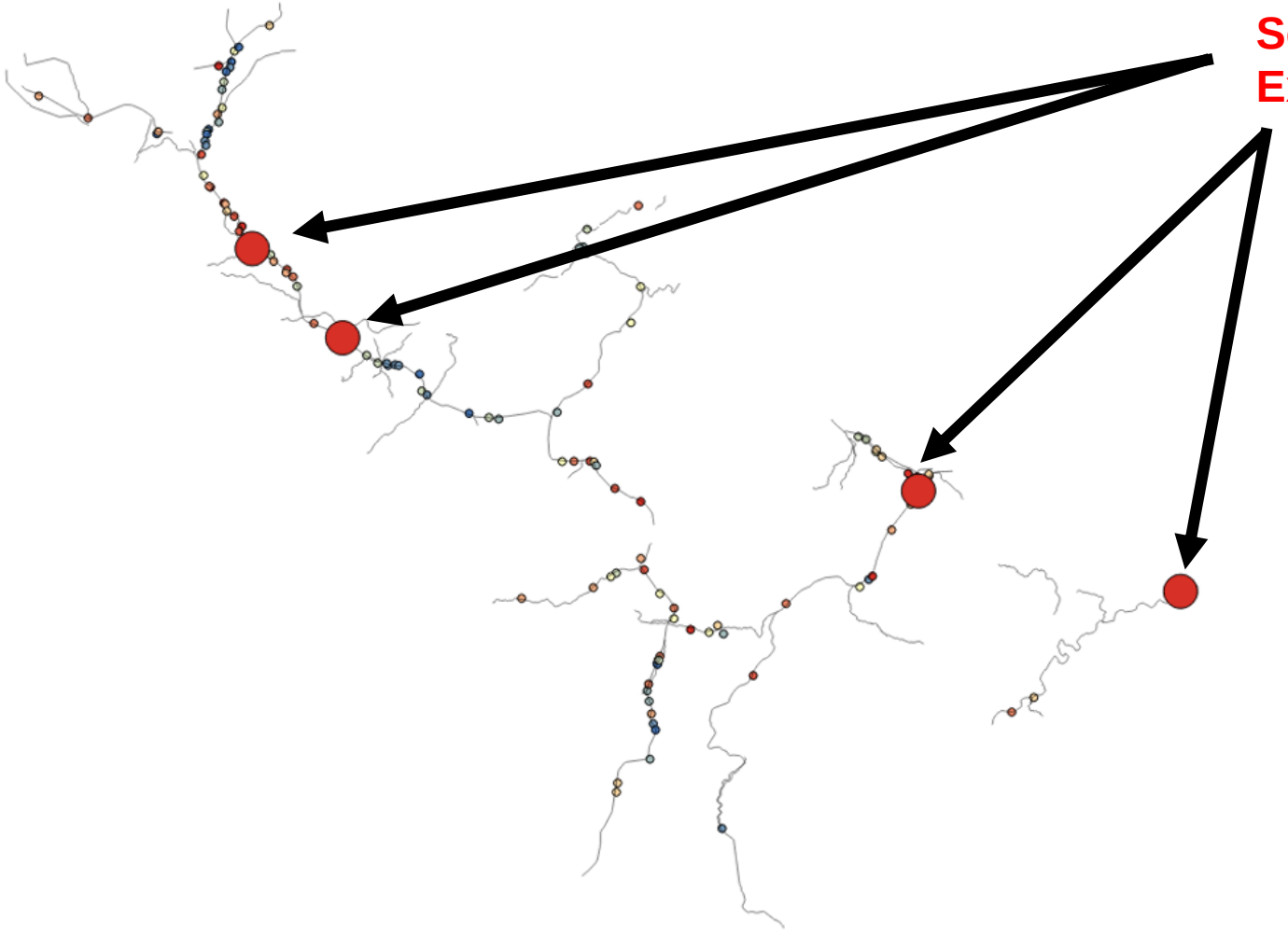
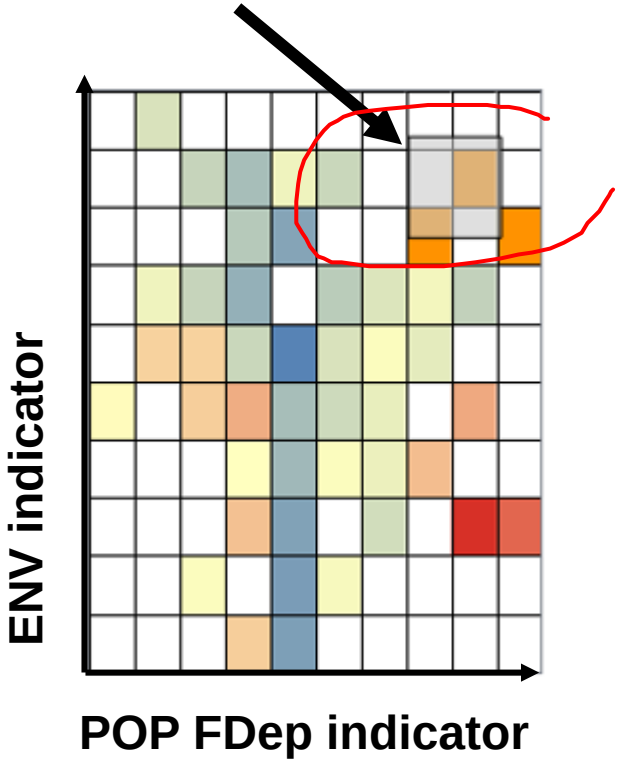
Prioritization for sediments deposits management: case 2

Use of indicators for decision support:

- case 2 : choice of strong socio-economical and health risk issues (willingness to reduce socio-economical and environmental inequalities)



Socio-eco.(POP Fdep) ++
Exposure (ENV) ++



Thanks for your attention !

More info on VALSE projet: https://valse.info/

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