

Development of a version of GeoPEARL for the Walloon region of Belgium

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GeoPEARL - Future Developments of Spatially-Distributed Pesticide Leaching Models in the EU

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How shall we adapt GeoPEARL to the Walloon region of Belgium?



Context

- Implementation of environmental policies
- Availability of a large number of relevant and georeferenced databases
- Building for Walloon region a pesticides risk assessment system
- First use of MetaPEARL, but what about:
 - Thickness of the soil profile when < 1 m ?
 - Vertical variability of soil profiles ?
 - Taking into account only two seasons (Autumn and Spring)?
 - Spatial resolution (scale of assessment)?

Objectives and hypothesis

- To develop a GeoPEARL version for Wallonia
- To use the model with agro-climatic scenarios to determine vulnerable areas
- To use the model for different time step assessments
- To use the model to explain observed pollution
- **Conservative estimation of the pollution risk**

Development of GeoPEARL_WAL

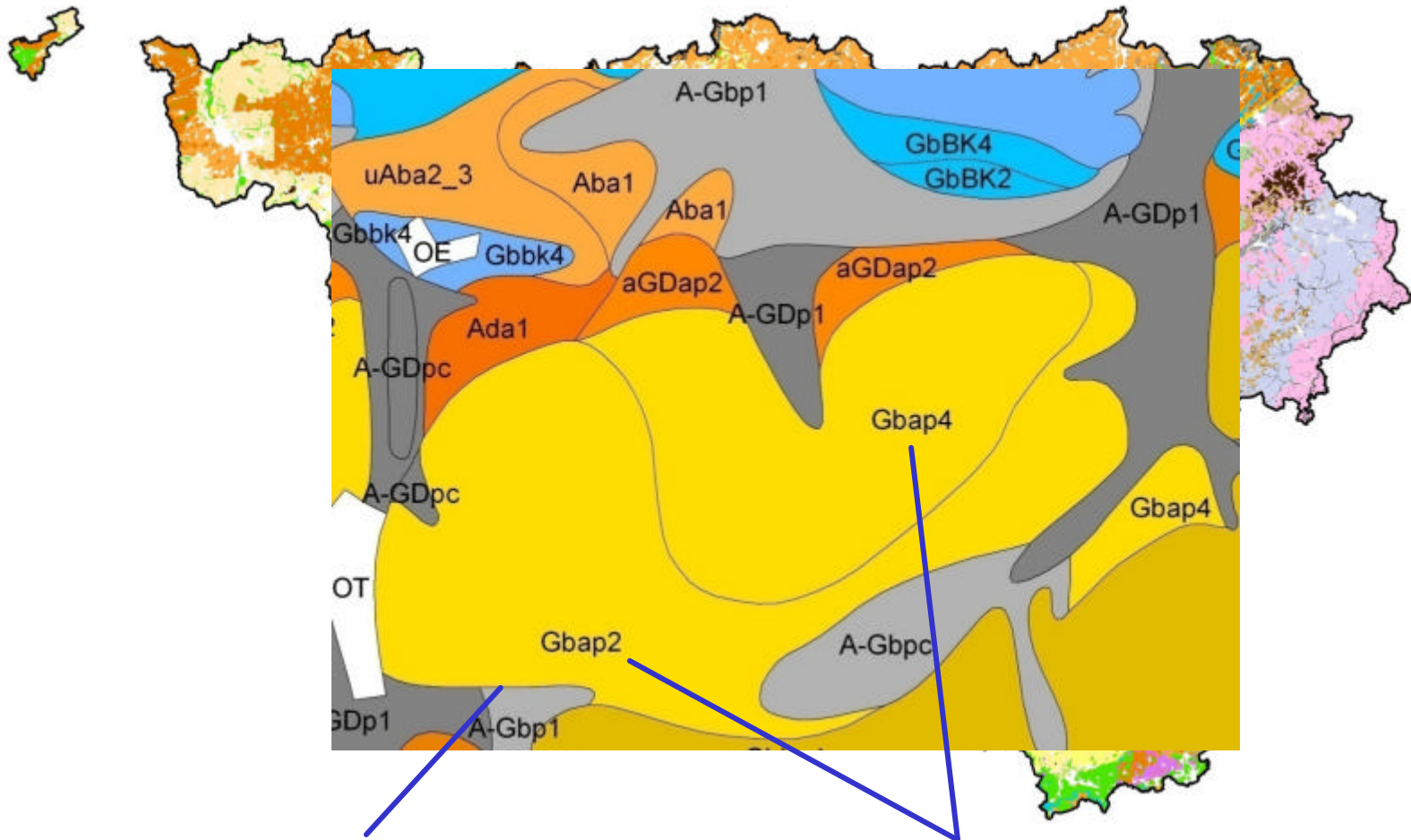
- Data available for GeoPEARL adaptation
- Spatial schematisation
- First activities of GeoPEARL adaptation



Relevant databases are available

- Digital Soil Map of Wallonia (DSMW) from the Belgian soil map (BSM) edited at 1:20,000
- Soil profiles analytical database associated to the BSM
- Agricultural Land Parcel Information System (LPIS)
- Meteorological and Crop phenological informations from Belgian Crop Growth Monitoring System (B-CGMS)
- Water resources monitoring databases

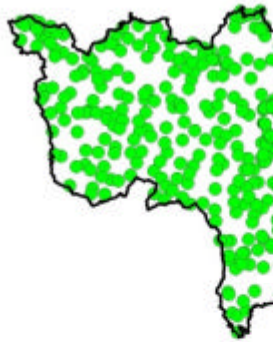
DSMW with about 700 Soil Map Units 6,000 Soil Typologic Units



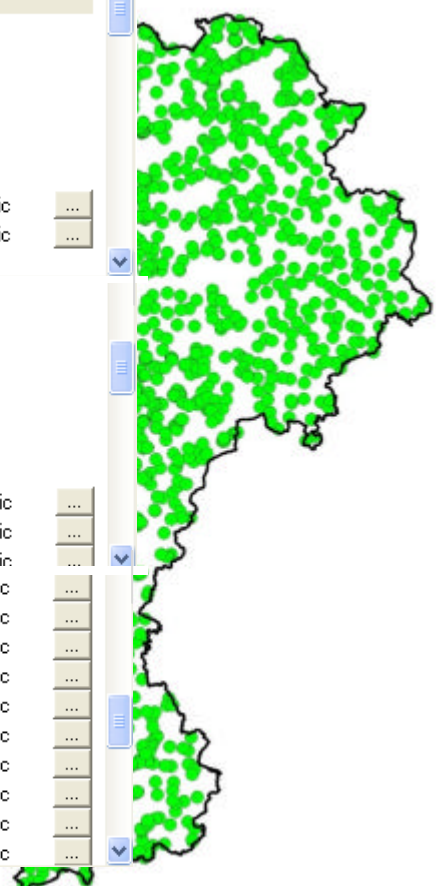
1 color = 1 SMU

2 STU

AARDEWERK Database with about 6,000 STU profiles analysis

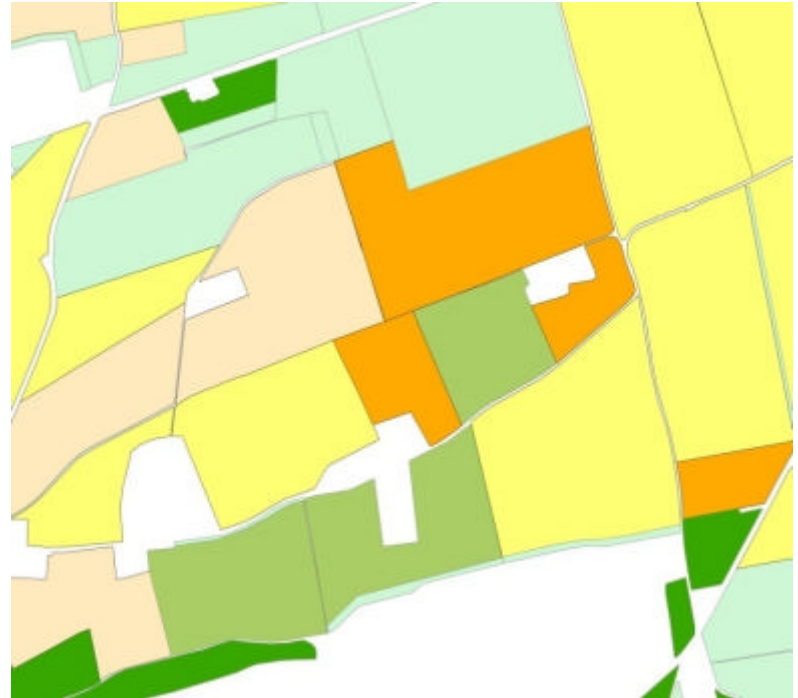


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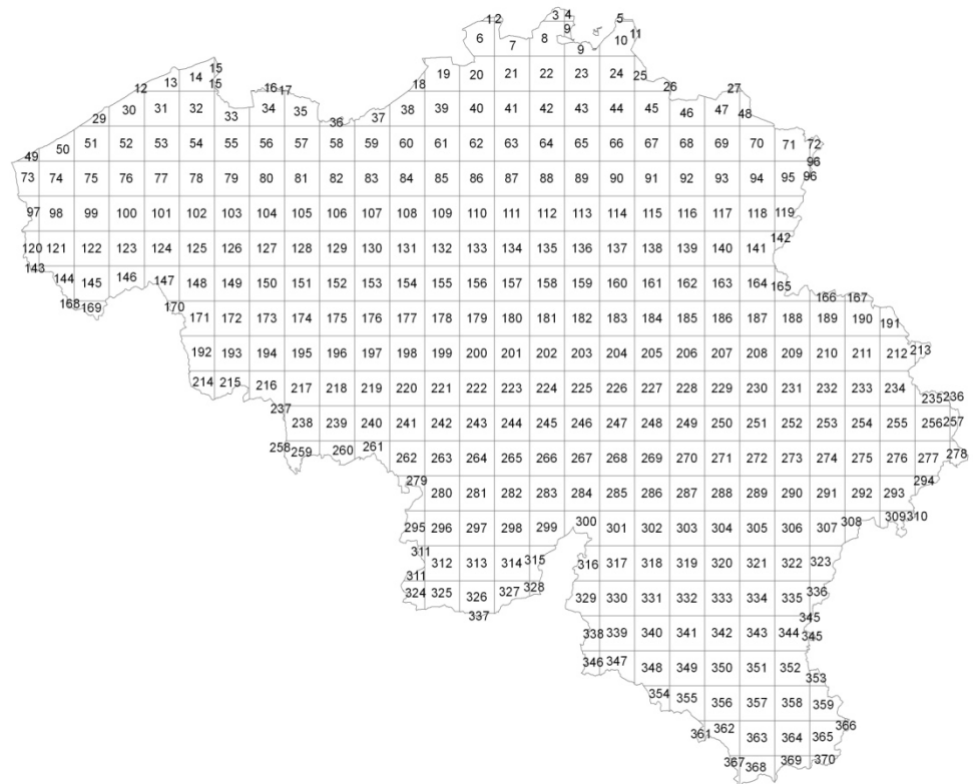
LPIS provides annual agricultural land use coverage at parcel level

- 762,000 ha for 2008
- 275,459 agricultural parcels for 2008
- 74 crop types for 2008



Meteorological information is provided by B-CGMS

- About 150 stations
- Raw data from Royal Meteorological Institute of Belgium
- Daily time step
- 3 Grids size
 - 10 X 10 km
 - 5 X 5 km
 - 1 X 1 km



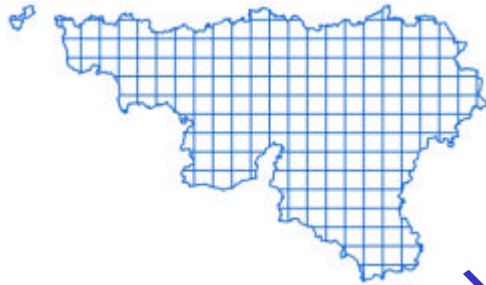
Development of GeoPEARL_WAL

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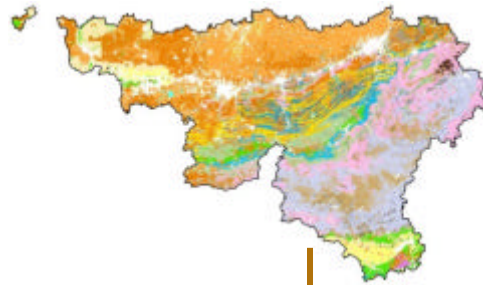


Unique combinations are derived at first from three spatially distributed databases

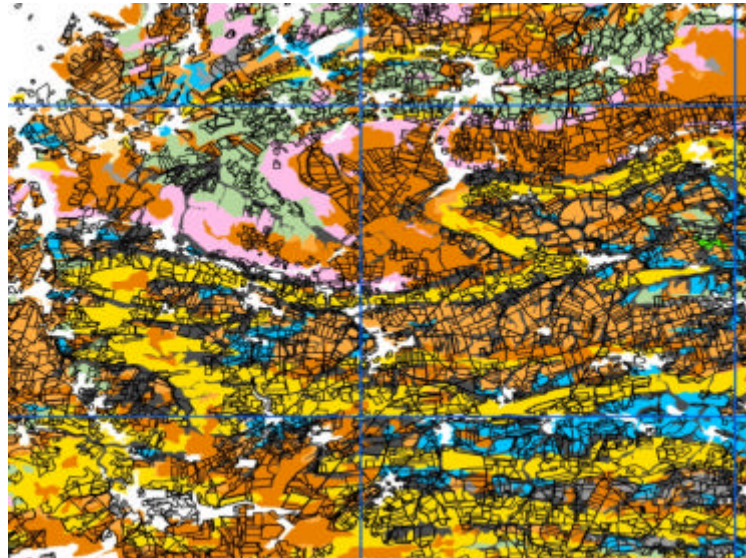
Meteo Grid 10 X 10



DSMW (STU)



LPIS



Spatial schematisation is in vector format

- Most of data sets are available in this format
- Allow keeping data sets own resolutions (no resolution loss)
- Less size of geodatabases

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Specific model parameters are determined for each plot of unique combinations

- Combining STU and AARDEWERK soil profiles analytical database
- Translation into model parameters using pedotransfer functions
- Extracting weather conditions and crop phenological parameters from B-CGMS
- Extracting pesticides properties from PROTECTEAUX pesticides database

Aardewerk soil profiles are associated to each unique combination

Local geo-matching

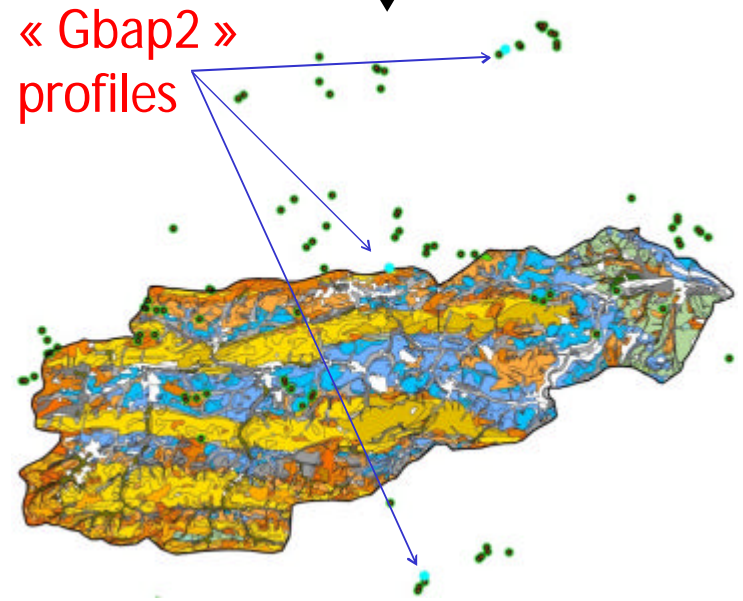
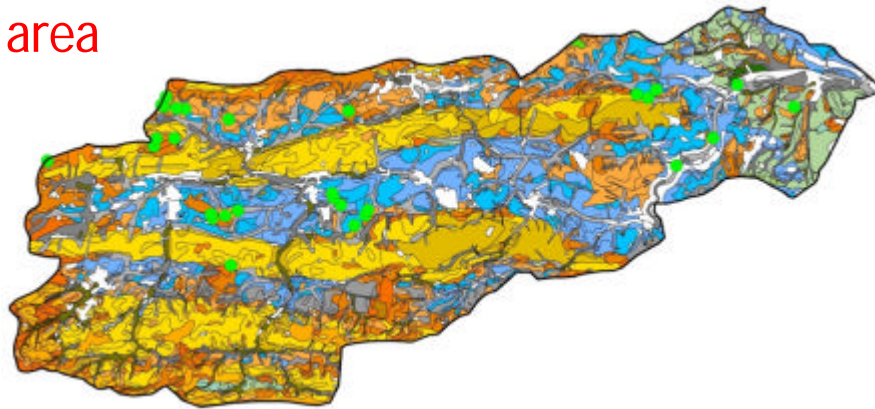
VS

Regional class-matching



Considering only profiles that encountered in the concerned area

« Gbap2 »
profiles



Profile matching is possible only for some STU

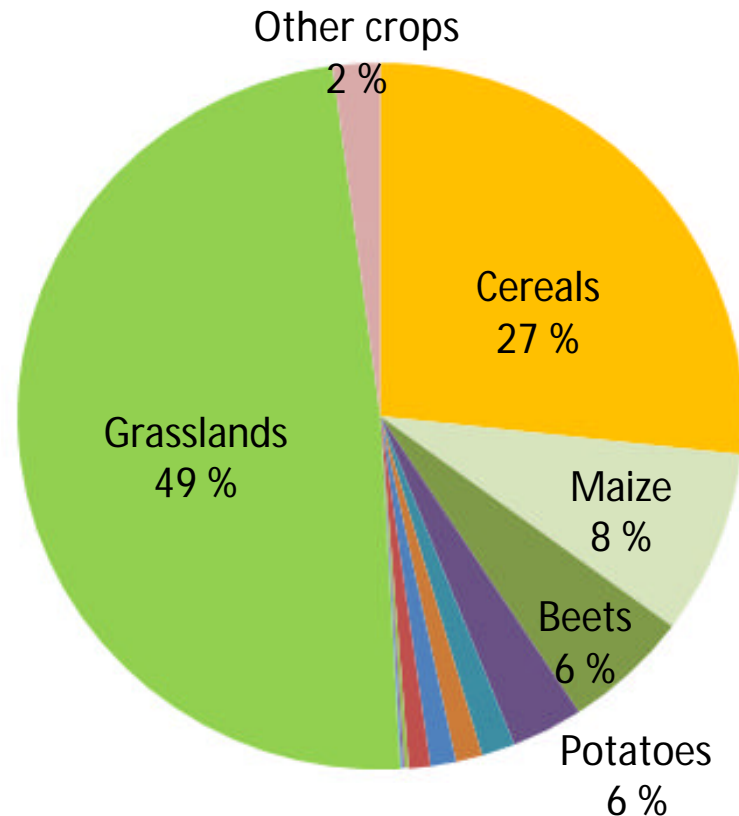
Median profile can be defined for each STU

Specific soil profiles parameters are derived using pedotransfer functions

- Hydraulic parameters [$\theta(h)$, $K(h)$, S_e] are estimated by the Mualem-van Genuchten model with revisited Vereecken PTFs (Weynants et al. 2009)
- Bulk density is calculated from texture and organic matter data, using Rawls (1983) pedotransfer function calibrated for Belgian soils by Boon (1984)

12 crop classes are defined for GeoPEARL from 74 crops types of the LPIS

4 crop classes cover about 50 % of whole agricultural lands, and 95 % of cultivated lands



Meteorological parameters values are obtained from B-CGMS

- Rainfall
- Minimum and maximum temperature
- Reference evapotranspiration

- Daily time step

- Crops drought stress index at regional scale

Crop phenological data is also provided by B-CGMS

- Sowing date
- Harvest date
- Crops LAI evolution
- Crops rooting depth evolution
- K_c cultural factor evolution for ETp calculation

Pesticides properties and application modalities are obtained from PROTECTEAUX database

- Sorption (K_{oc}/K_{om})
- Degradation (DT50)
- Solubility in water (S_w)

- Application date, type and dosage

Conclusions and perspectives

- Availability of relevant and georeferenced databases
- Number of spatial schematisation plots will finally depend on spatial resolution required (scale of model application)
- First adaptation will be carried on a representative catchment (Molignée catchment)
- Sensitivity and uncertainty analysis will be also carried out
- GeoPEARL will be validated on basis of previous works (Leterme, 2007, Vanclooster and Bah, 2009)