Characterising Agricultural Areas in Europe

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Background - 1

> Sustainable use of pesticides within European agriculture is a stated goal.
> Requires a clear understanding of the routes by which pesticide residues can reach non-target areas.
> European agricultural conditions are diverse.
  - Clearly impractical to measure losses from every field.
> Need other methods – Numerical modelling

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Background - 2

> Numerical models are difficult to parameterise – 'data hungry'
> Most current European risk assessment procedures use a limited number of 'realistic worse-case scenarios'. (c.f. FOCUS tools)
> Recent suggested refinements include more probabilistic modelling with a broader range of soil and climate conditions (FOCUS L & M 2003).
> BUT, development has been hampered by the lack of harmonised data at the pan-European scale.
> FOOTPRINT has now addressed this issue.

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Objectives for creating Agro-Environmental Scenarios

> Develop and apply a methodology for defining generic scenarios for characterising the complete spectrum of European agricultural environments (integrate crop, weather and soil characteristics).
  - Scenarios must be capable of being applied anywhere in Europe at European/national/regional, catchment and farm/holding level.
  - Each scenario should have a default set of
    - long-term weather data
    - soil property data
    - agronomic data.

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Methodology

> Climate: Identify zones in which the critical weather variables are relatively similar.
  Define representative long term daily weather data for each zone.

> Crop: Identify and map the different types of agricultural land and the crops grown on them.
  Define crop growth characteristics for each crop.

> Soil: Identify the soil properties that are critical for pesticide transport and map their distribution.
  Define soil profile characteristics for each soil.
> Integrate all three data layers using GIS intersection to create the scenarios.

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Creating the agricultural land & crop data layer

> Use CORINE 2000 to identify and map agricultural land.
> Use corrected European cropping statistics from the FATE Land Cover map (JRC) to quantify range of annual crops grown.
> Use GIS to intersect CORINE agricultural areas with FATE Land Cover data.
Identification of FOOTPRINT Soil Types - Objectives

- To identify a limited number of soil types suitable for modelling environmental fate of pollutants across Europe.
- To represent the complete range of relevant pollutant transfer pathways from the soil surface to water resources.
- To represent the complete range of soil sorption potential relevant to ‘reactive’ pollutants.

The Hydrological Component

A combination of the Hydrology Of Soil Types system - HOST (Boorman et al 1994; Schneider et al 2007) and the CORPEN system (Groupe “diagnostic” du CORPEN, 1996)

HOST provides a quantitative link between soil types and stream response to rainfall.

CORPEN provides seasonal differentiation of pollutant transfer pathways. (Flow Pathway Categories, FPCs)


FOOTPRINT soil hydrological class

<table>
<thead>
<tr>
<th>Hydrological code</th>
<th>Description</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>Drained soils which have low permeability and are subject to limited water storage. They can only maintain limited evaporative demand or evapotranspiration. Example: Sands and gravels, fine sands.</td>
<td>1</td>
</tr>
<tr>
<td>V</td>
<td>Slightly impermeable soils, subject to limited water storage. They can only sustain limited evaporative demand or evapotranspiration, and are more sensitive to waterlogging. Example: Sandy-clay loams, clay loams.</td>
<td>2</td>
</tr>
<tr>
<td>T</td>
<td>Impermeable soils with high potential evapotranspiration. Example: Clayey soils with high clay content and low permeability.</td>
<td>3</td>
</tr>
<tr>
<td>S</td>
<td>Soil with high potential evapotranspiration, subject to limited water storage. Example: Sandy-clay loams, clay loams.</td>
<td>4</td>
</tr>
<tr>
<td>R</td>
<td>Impermeable soils with high potential evapotranspiration. Example: Heavy clay soils.</td>
<td>5</td>
</tr>
<tr>
<td>N</td>
<td>Drained soils with high potential evapotranspiration. Example: sandy-clay loam soils.</td>
<td>6</td>
</tr>
<tr>
<td>M</td>
<td>Impermeable soils with high potential evapotranspiration. Example: Clayey soils with high clay content and low permeability.</td>
<td>7</td>
</tr>
<tr>
<td>L</td>
<td>Drained soils with high potential evapotranspiration. Example: sandy-clay loam soils.</td>
<td>8</td>
</tr>
</tbody>
</table>


Creating the Soil Data Layer

> Assign a FOOTPRINT Soil Type (FST) to each Soil Typological Unit (STU) in SGDBE using stu.dbf attributes.
> All STU’s in the SGDBE represented by 373 FOOTPRINT soil types.
> 264 FST’s represent soils under arable or permanent crops.
> 287 FST’s represent soils under managed grassland.
> 33 FST’s represent soils only under non-agricultural uses.
> Use SPADE-1 and SPADE-2 databases (Approximately 2000 profiles) to derive profile parameters for each FOOTPRINT soil class under arable or permanent crops.

What is a FOOTPRINT Agro-environmental scenario?

> A unique combination of land use, cropping, climatic zone and soil map unit.
> Local soil is defined from a range of FSTs with a specific % probability of occurrence.
> For those scenarios that have a partly or wholly ‘arable’ land use, a specific range of annual crops with an estimated % probability of occurrence.

Data associated with scenarios

> 20 year daily weather data for each climate zone derived from the time series with driving variables closest to the ‘average’ for the zone.
> Probability fraction of crops occurring in ‘arable’ polygons.
> Crop growth templates for each crop.
> Probability fraction of FOOTPRINT soil types (FST’s) in each polygon.
> Soil horizon property data for each (arable) FST.
> Hydrological data for each FST.
Use of the Scenarios in the FOOT tools

> Option 1: No data:
  Use the spatial distribution of agro-environmental scenarios for areas where detailed data are not available (ArcGIS in FOOT-CRS and –NES).

> Option 2: More detailed local/regional data:
  Use the Data Management module in FOOT-CRS & FOOT-NES to create your own scenarios from your data. Correlate your local soils (from your own soil map) with FOOTPRINT soil types through a decision tree based on simple questions.

Conclusions

> The 25044 FOOTPRINT scenarios represent the spatial variation and heterogeneity of environmental conditions in the European agricultural landscape.
> The scenarios and their supporting information are used to:
  * Identify contamination pathways throughout Europe.
  * Underpin model parameterization.
> A significant contribution towards harmonization of risk assessment throughout Europe.
> Likely to be applicable to other agricultural contaminants such as nitrate or phosphorus.

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