Procedure to identify representative areas for monitoring shallow groundwater at regional level

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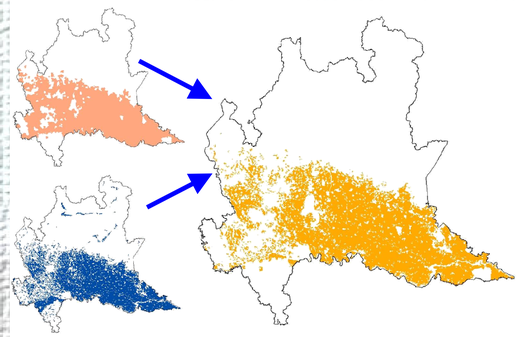
GENERAL PROCEDURE

Representative areas identification → Experimental field selection → Sampling & Analysis

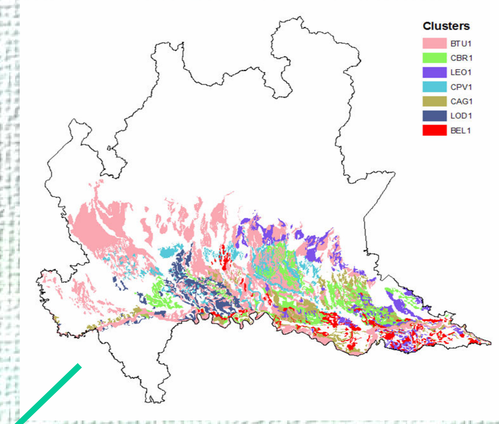
REPRESENTATIVE AREAS IDENTIFICATION

I. Maize diffusion in Lombardia



Using the data base coming from 5° agricultural census (ISTAT, 2000) in red and the map of land use CLC90 Corine Land Cover in blue

II. Soil types



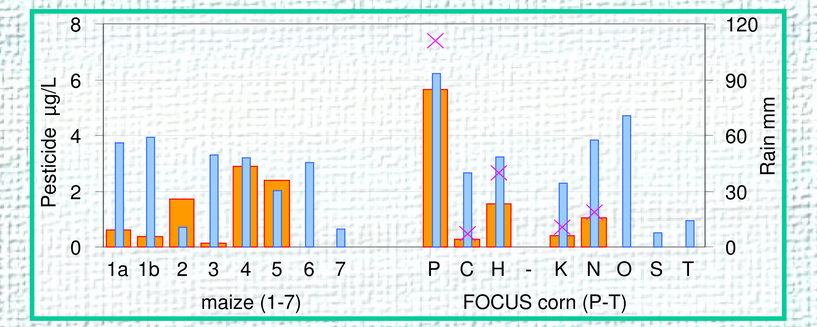
The soil map is digital in shape format and is linked with a database containing all the information regarding the landscape unit and the representative soil profiles. The soil map 1:50,000 is made by 785 different profiles that represent the soils along the Po valley area. These soils were grouped by cluster analysis.

III. Scenario definition

Scenario	Soil name	Maize Ha 364918
maize1	BTU1	28.2%
maize2	CBR1	10.0%
maize3	LEO1	7.1%
maize4	LOD1	7.1%
maize5	CAG1	6.1%
maize6	CPV1	4.7%
maize7	BEL1	4.2%
not represented		32.6%

Cluster analysis (SAS) was used to find groups of similar soils. The variables used in the cluster procedure are the soil properties affecting sorption, degradation & hydrology and therefore leaching process.
Only 7 clusters have been chosen because they represented the soils more widespread and cover the 44% of Lombardia flat area soils and the 64% of regional maize crop area.

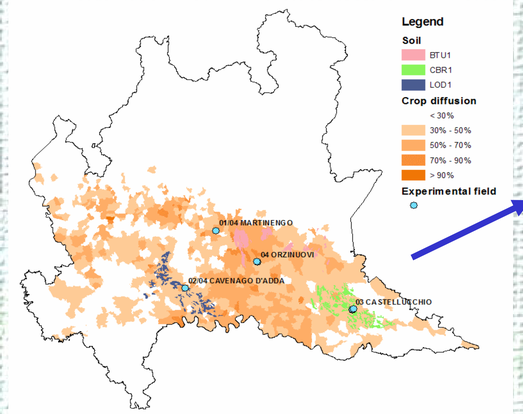
IV. Model application



The model PELMO was used to identify the different vulnerability of the seven scenarios. The model was set as suggested by FOCUS protocol (1 kg of a.i. applied every years per 26 year) In the graph 80%percentile of annual average pesticide leached concentration (orange bars) and water drained (blue bars) are reported.
Scenarios 4 & 5 result with high vulnerability, scenario 2 is intermediate and 1,6 & 7 are with low vulnerability. In the right half the FOCUS scenario used as comparison.

EXPERIMENTAL FIELD SELECTION

V. Farms selection



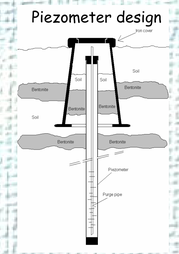
Farm	Soil texture	Topsoil organic C (%)	Table water depth (m)	Av. annual rainfall (mm)	Accum. T May-Oct (°C)
Orzinuovi	Sandy loam	1.6	0.95-1.75	993	104
Cavenago	Sandy loam over sandy	1.1	3.35-6.85	747	120
Martinengo	Sandy clay over loam	3.7	3.50-5.35	946	116
Castellucchio	Clay over clay loam	1.5	0.70-2.75	548	103

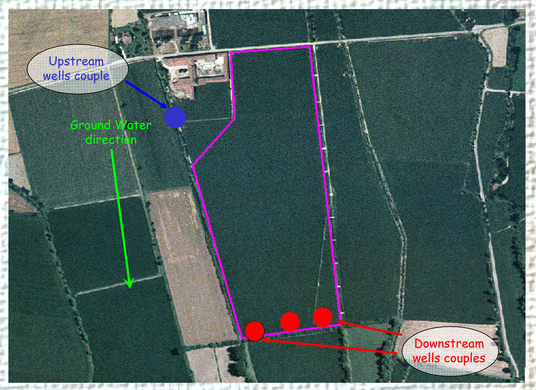
Several farm were identified inside the area covered by scenario 1, 2, 4 & 5. After evaluation of shallow groundwater direction, field and farmer collaboration, 4 different farm located in the four scenario areas were chosen.

VI. Experimental field

8 wells (4 couples) were installed in each selected field and groundwater was sampled every two months after pesticide treatment.

Piezometer design





SAMPLING & ANALYSIS

Soil	Scenario	Well	Pesticide concentration in GW (µg/L) Apr/2005	Jun/2005	Ago/2005	Oct/2005	Dec/2005
BTU	1	1	n.d.	0.04	n.d.	0.04	0.06
			n.d.	n.d.	n.d.	n.d.	n.d.
			n.d.	n.d.	n.d.	n.d.	n.d.
			n.d.	0.08	0.13	0.06	0.09
CBR	2	2	n.d.	0.17	n.d.	n.d.	n.d.
			n.d.	n.d.	n.d.	0.02	n.d.
			n.d.	n.d.	n.d.	n.d.	n.d.
			n.d.	n.d.	n.d.	n.d.	n.d.
LOD	4	4	0.04	n.d.	n.d.	n.d.	n.d.
			0.04	n.d.	0.07	0,06	0.02
			0.27	0.04	0,11	0.08	0.04
			n.a.	0.25	0.78	0.18	0.01
CAG	5	5	0.16	n.d.	n.a.	0.21	0.26
			0.12	0.07	0,82	0.33	0.33
			0.18	0,12	1,08	0.17	0.19
			0.11	0,91	0,60	0.12	0.13

n.d.= below 0.01 µg/L; n.a. = sample not analysed.

CONCLUSION

- This study shows a possible way to create regional scenarios with a procedure repeatable and transparent which take into account crop, soil & climate.
- The identified scenarios are representative of the regional agriculture and among their both vulnerable and protective to pesticides are present.
- The step by step procedure allows to identify scenarios which could be representative of very large area (i.e. Po valley, Italy, Europe)
- The monitoring data confirms the results obtained with the model simulations.

Pesticide, Behaviour in Soils, Water and Air , Warwick, UK, March 27-29, 2006