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BOOK OF ABSTRACTS

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Variability of topsoil characteristics as indicator of soil material redistribution and soil quality within an agricultural catchment

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INTRODUCTION

The inventory of the horizontal changes and transport by agricultural practices or soil erosion is necessary to adopt strategies useful for the land improvement, making possible its conservation and prevent its degradation.

Lists of minimum data sets of soil quality indicators have been developed but, at spatial scale, variables reporting data on soil redistribution will be suitable on large cropped areas catchment.

Some soil parameters are evaluated in order to know the basic soil surface characterization as well as to establish the spatial distribution and relationships along the catchment area.

ABSTRACT

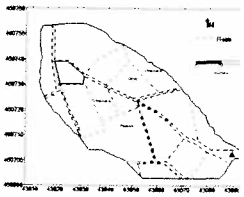
Spatial distribution of some soil parameters is evaluated as a tool to assess land quality in a small agricultural catchment. O.M, C/N ratio, $CaCO_3$, magnetic susceptibility, ^{137}Cs, ^{210}Pb and particle size are measured in 106 topsoil samples.

From the ^{137}Cs data, actual soil erosion processes are identified. Magnetic susceptibility and radioisotopes are useful indicators of soil redistribution. The other parameters are related to the soil use (O.M. and C/N) or to the parent material characteristics.

SITE CHARACTERISTICS AND MEASURES

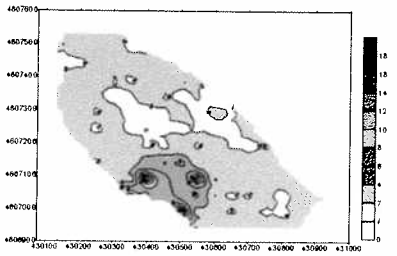
- Localization: Torre Marimon experimental farm (near Barcelona, NE Spain).
- Catchment characteristics:
  Range in elevation: 47 m (from 215 to 168 m a.s.l)
  Range in land slope: from 2% to 10%.
  Average slope of waterway: 5.4%
  Total area: 27ha (96% dry farming techniques mainly cereals; 3% forest and 1% other uses)
- Major soil type: Carbonated silt loam Calcixerollic Xerochrept (SSS 1992)
- 106 soil samples (0-20 cm depth) collected on a 50x50 m grid sample area.
- Soil indicators measured:
  - Basic soil characteristics: Organic matter content, N content, texture, cal carbonate content.
  - Soil redistribution was studied by means of indicators such as ^{137}Cs, ^{210}Pb magnetic susceptibility (Pennock 1997).

Plots distribution in the catchment



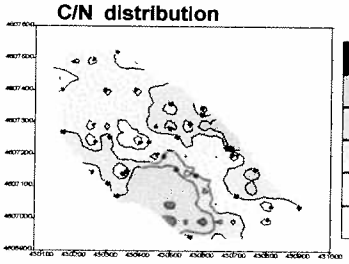
BASIC SOIL CHARACTERISTICS

Organic matter distribution

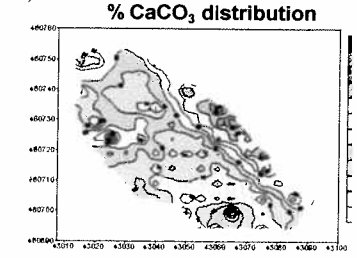


- **Amounts and quality of surface O.M and N are related to the land use. Forest plot has the greatest levels (> 4%O.M, C/N > 12) whereas 2-4% O.M is the more frequent concentration in soils under cultivation. Olive grove and vineyard plots have the lowest amounts, 1-2% O.M, due to differences on crop residue incorporation.**
- **No evidences of spatial redistribution are constated.**

C/N distribution



% $CaCO_3$ distribution

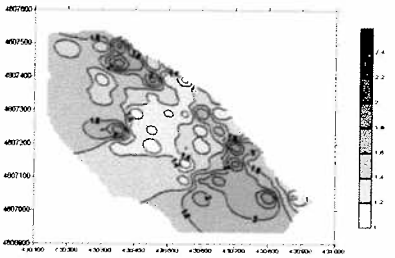


Topsoil %$CaCO_3$ high heterogeneity in the catchment is consequence of the parent material characteristics

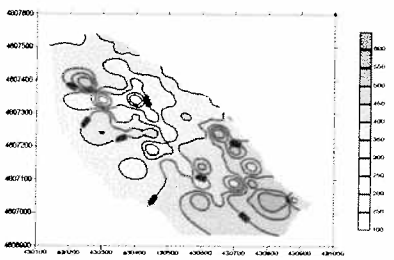
SPATIAL REDISTRIBUTION

Potential sediment transport (LSF attribute)

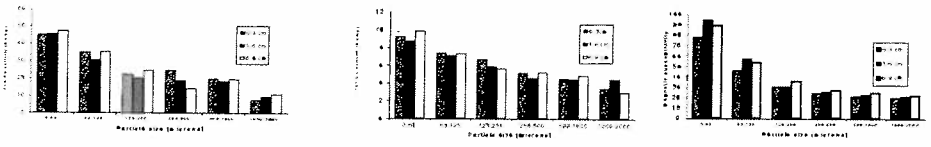
Particle size ratio distribution (Clay + Silt)/ Sand



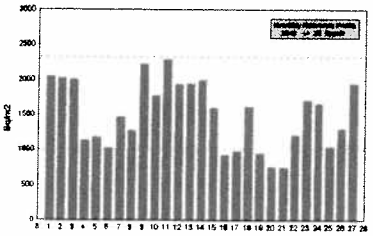
Magnetic susceptibility map



^{210}Pb, ^{137}Cs and magnetic susceptibility measurements of particle-size fractions



^{137}Cs levels in soil samples (0-30 cm depth)
Red dashed line indicates inventory data



- ^{137}Cs, ^{210}Pb and magnetic susceptibility acummulate in the finer particles.
- Magnetic susceptibility exhibit the same spatial distribution pattern than the particle size ratio (silt + clay / sand).
- ^{137}Cs levels within the catchment are lower than inventory reference profile indicating soil loss.

CONCLUSIONS

At Torre Marimon catchment, magnetic susceptibility data reveal the same particle-size distribution pattern than ^{137}Cs and ^{210}Pb. Spatial distribution of magnetic susceptibility is coincident with particle-size distribution maps, reinforcing their potential use for soil redistribution studies and complementing isotopic data.

In the catchment studied, variability of organic matter and nitrogen content is attributed to the land use. Spatial distribution of $CaCO_3$ is explained by parent rock characteristics.

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Variability of topsoil characteristics as indicator of soil material redistribution and soil quality within an agricultural catchment (Torre Marimón, NE Spain)

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The agricultural activity can generate important changes in some topsoil characteristics (like nutrients content, available water content, porosity, etc.) and redistribution of major components in a spatial scale. These changes in soil properties can imply a deterioration of the soil quality, limiting soil sustainability. Lists of minimum data sets of soil quality indicators have been developed (compiled by Carter et al., 1997) but, at spatial scale, variables reporting data on soil redistribution will be suitable on large cropped areas. The inventory of the horizontal changes and transport by agricultural practices or soil erosion is necessary to adopt strategies useful for the land improvement, making possible its conservation and prevent its degradation.

In an agricultural experimental farm near Barcelona (NE Spain), a long term investigation has been conducted to asses a catchment database. Most of the 27 ha are dedicated to different dry farming techniques (96% of the surface), forest (3%) and other uses (1%). An intensive topsoil sampling (106 samples, 0-20 cm depth) of the catchment has been carried out based on a 50 x 50 m grid sample area. Some soil parameters are evaluated in order to know the basic soil surface characterization as well as to establish the spatial distribution and relationships along the catchment area. Organic matter content, nitrogen content, particle-size, mineralogy, chemistry and soil texture are the main properties studied. Other indicators of soil redistribution such as the magnetic properties and the radioisotopes ^{137}Cs and ^{210}Pb concentration were determined. Results are discussed by means of statistical methods and spatial distribution maps.