

Introduction

Soil quality is defined as the ability of a soil to perform the necessary functions for its intended use.

Soil quality is often perceived as an abstract characteristic of soils, that cannot be defined properly because it depends on external factors, such as land use, soil management practices, ecosystem interactions and socioeconomic and political priorities (Pankhurst et al., 1997). In addition, most often, soil functions, themselves, cannot be directly measured, but some selected physical, chemical and biological properties of the soil are used instead to quantify different soil quality functions. Those soil properties are called soil quality indicators.

Many inherent and dynamic soil properties have been suggested as potential soil quality indicators. The poster discusses the values and spatial distribution of four of these soil quality indicators (pH, EC, equivalent calcium carbonate content, Cation Exchange Capacity) gathered over several soil surveys carried out in Catalonia since 1984.

The study area

Catalonia is a region located north-east of the Iberian Peninsula. It has a total area of 32.107 km² and a population of seven million, mainly distributed along the coast.

From a physiographic point of view, Catalonia can be divided in three areas (Fig. 1a):

- the Pyrenees, a series of mountain chains ranging in parallel way, from west to east. They are characterized by high elevations (3.400 m to sea level) and wild landscapes.
- the mediterranean System, consists of two complex mountain chains, ranging, in a parallel way, from north-east to south-west. It shows a long and, in some way, width valley in between, thickly populated and very rich from an agricultural point of view.
- the central Depression, formed by flat, or almost flat, areas in between the Pyrenees and the mediterranean System.

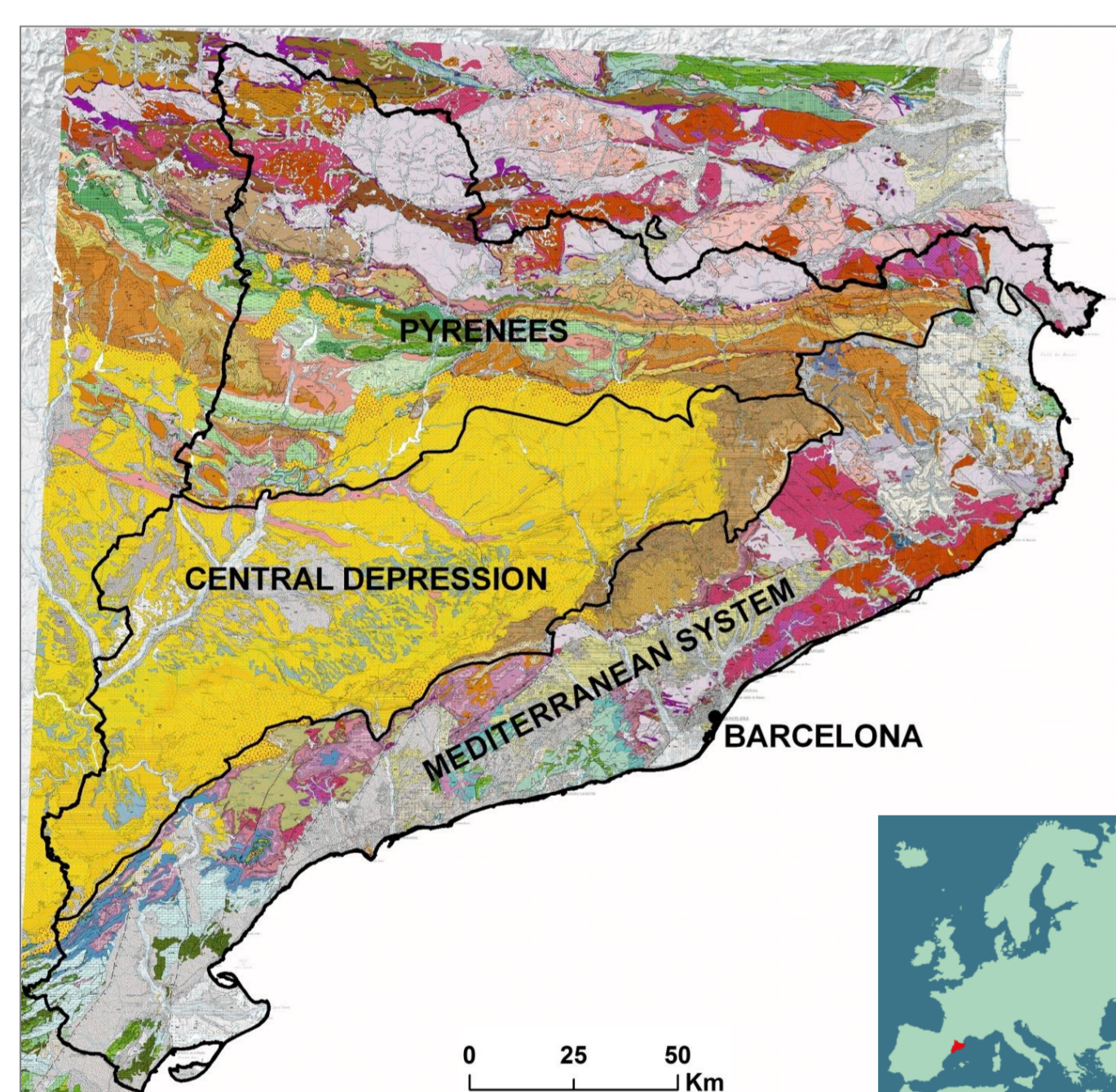


Fig. 1a. Physiographical areas of Catalonia drawn on the Geological map (1:250.000).

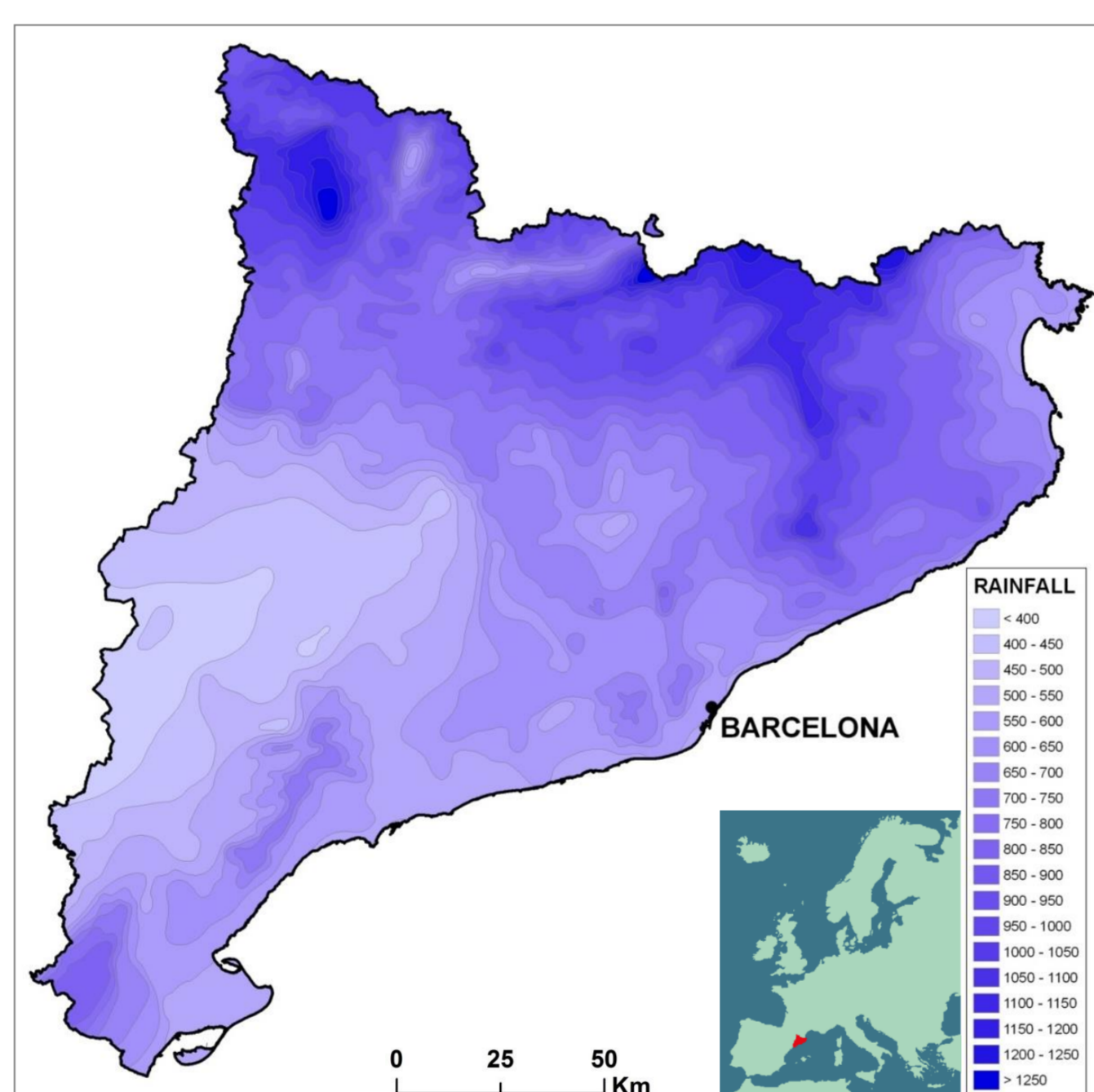


Fig. 1b. Mean annual rainfall (mm).

The Pyrenees and the mediterranean System show Paleozoic metamorphic rocks (slates, schists, granitic batholiths and Devonian limestones) as basement, covered with Mesozoic rocks (Cretaceous limestones and Triassic conglomerates, sandstones and gypsum). Along their intramontaneous basins, Miocen and Pliocen mudrocks, sandstones, conglomerates and gravels complete the parent material.

The central Depression presents mainly tertiary mudrocks, sandstones and conglomerates, where rivers have excavated big valleys and erosion basins. Limestones, marls and gypsum complement the lithology of the area.

The climate is dry Mediterranean, with mild winters and hot summers. The mean annual temperature fluctuates from 18°C in the south to 4°C in the Pyrenees. The mean annual rainfall varies from less than 400 mm in the arid areas of the south west to over 1200 mm in the top of the Pyrenees; in this case, mainly as snow (Fig. 1b).

Methodology

The soil map (1:25.000) of Catalonia started in 1983. At first, under the leadership of the Department of Agriculture of the regional Government and, since 2007, through the program of the ICGC. Throughout these years, over 12,000 soil profiles were described, mainly in agricultural areas, and more than 28,000 samples were collected and analyzed in order to characterize the soils (Fig. 2). The standard methods applied in the analysis of the soil were:

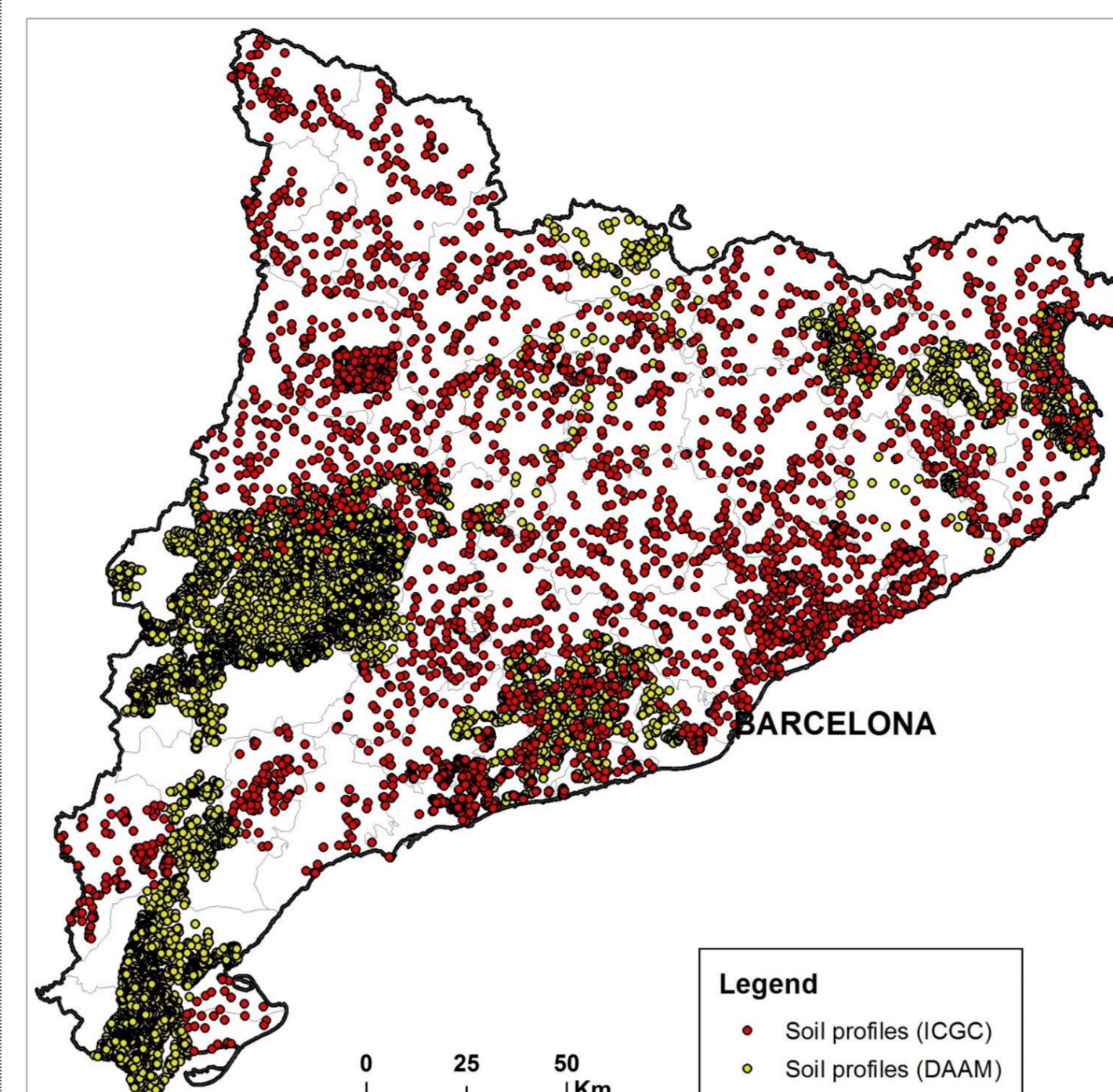


Fig. 2. Distribution of the Soil profiles

- **pH**; measured in a (1:2,5) soil-water solution.
- **EC (1:5)**; Electrical conductivity at 25°C, measured in a (1:5) soil-water solution, using a conductivity cell with automatic temperature adjustment.
- **Carbonates**; Bernard calcimeter method.
- **CEC**; Cation Exchange Capacity; extraction with ammonium acetate, after displacement of bases with sodium acetate (pH=8.2).

Results

Table 1. Some descriptive statistics of the soil quality indicators analyzed

	pH	Carbonates (%)	EC (1:5) (dS/m at 25°C)	CEC (meq/100 g soil)
Number of samples	28.477	27.467	27.806	8.249
Minimum	3,4	0	0,01	0,3
10 th percentile	7,9	3	0,11	5,3
25 th percentile	8,2	19	0,14	7,6
50 th percentile	8,4	31	0,18	10,5
75 th percentile	8,5	40	0,29	14,3
90 th percentile	8,7	50	0,79	20,0
Maximum	10,6	95	10,29	102,5
Mean	8,3	29,6	0,37	12,0
Standard deviation	0,57	16,6	0,58	7,5
Coefficient of variation	0,07	0,56	1,55	0,6

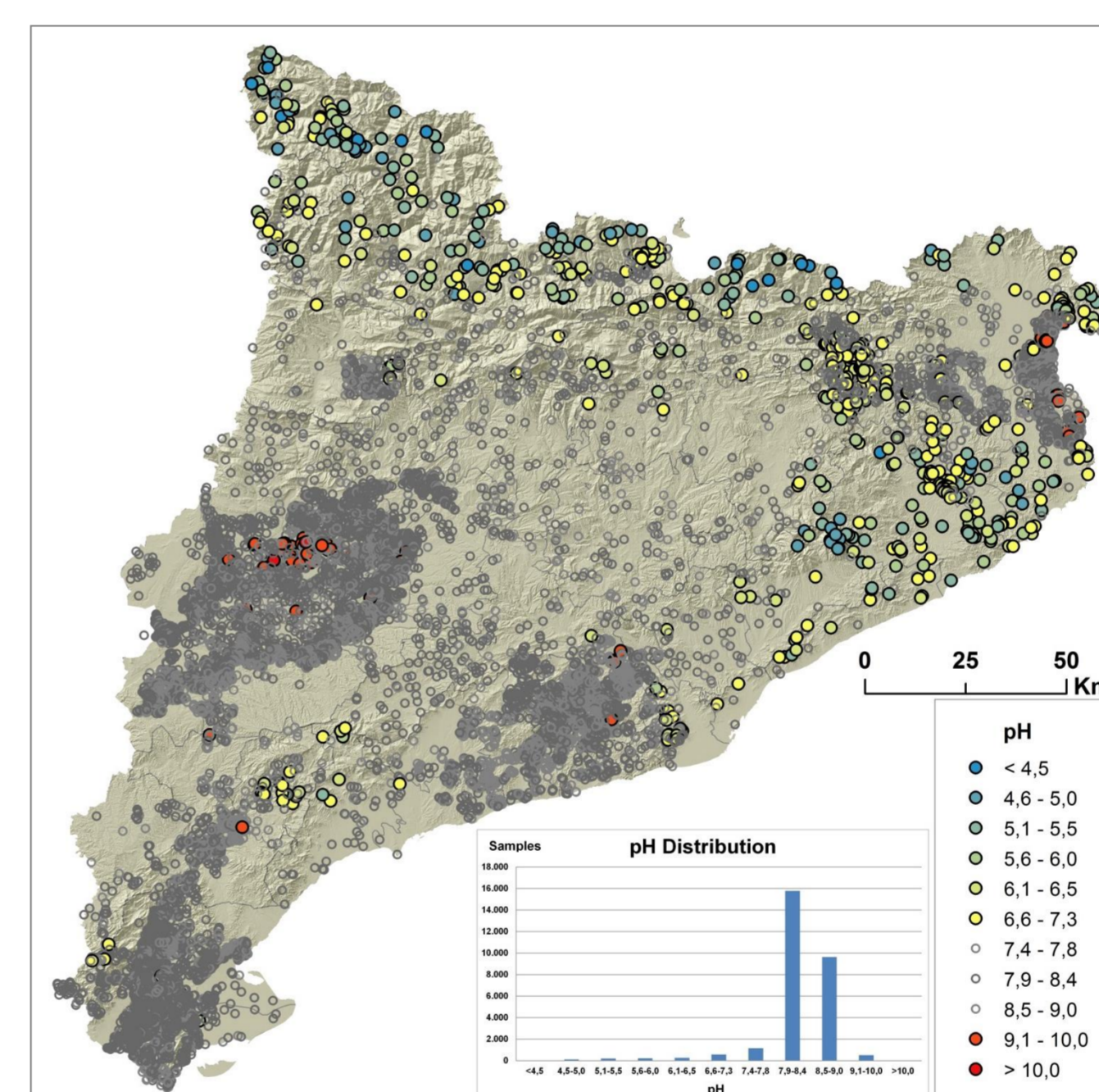


Fig. 3a. Distribution of pH in the soils of Catalonia

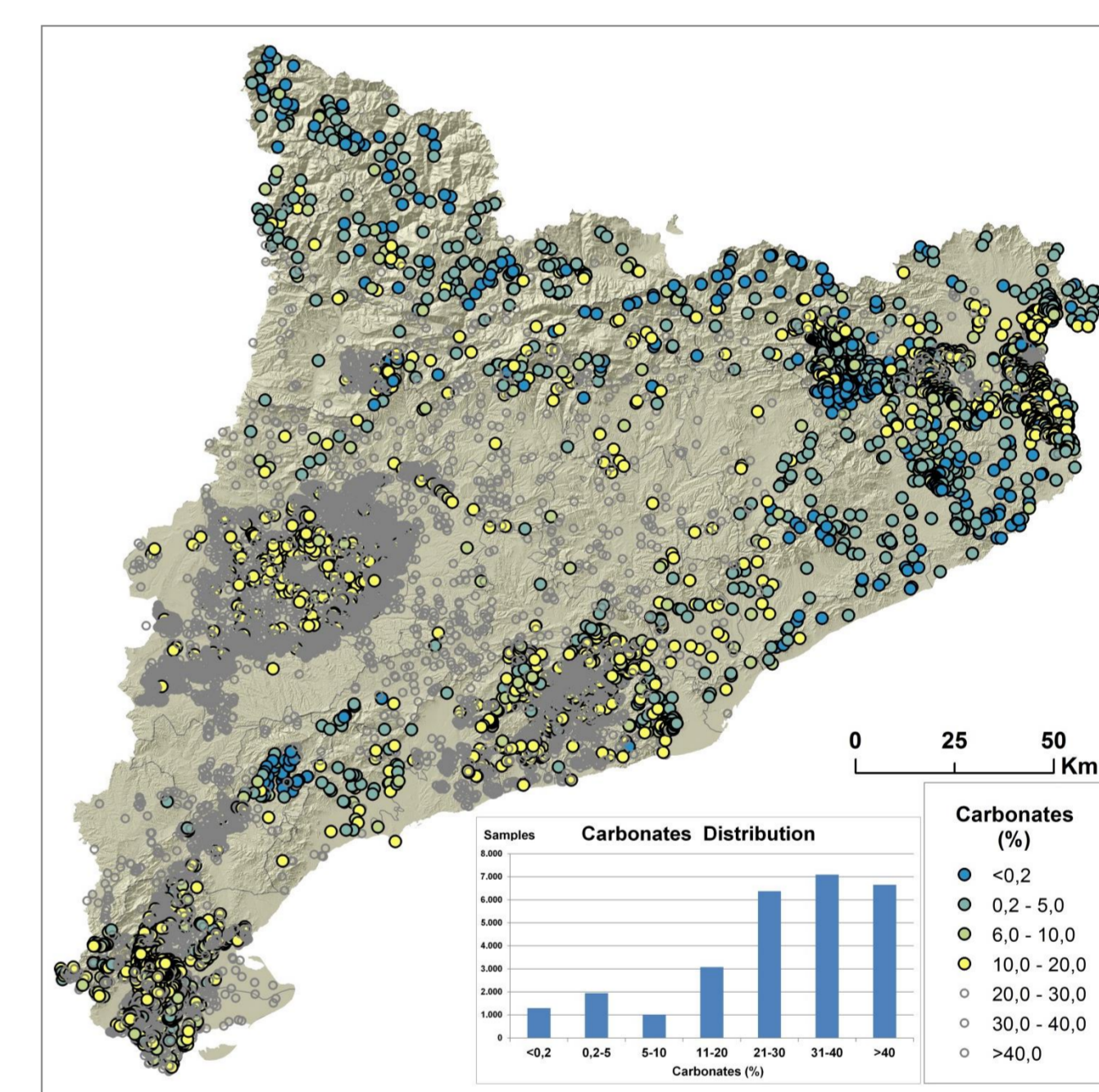


Fig. 3b. Distribution of CaCO₃ in the soils of Catalonia

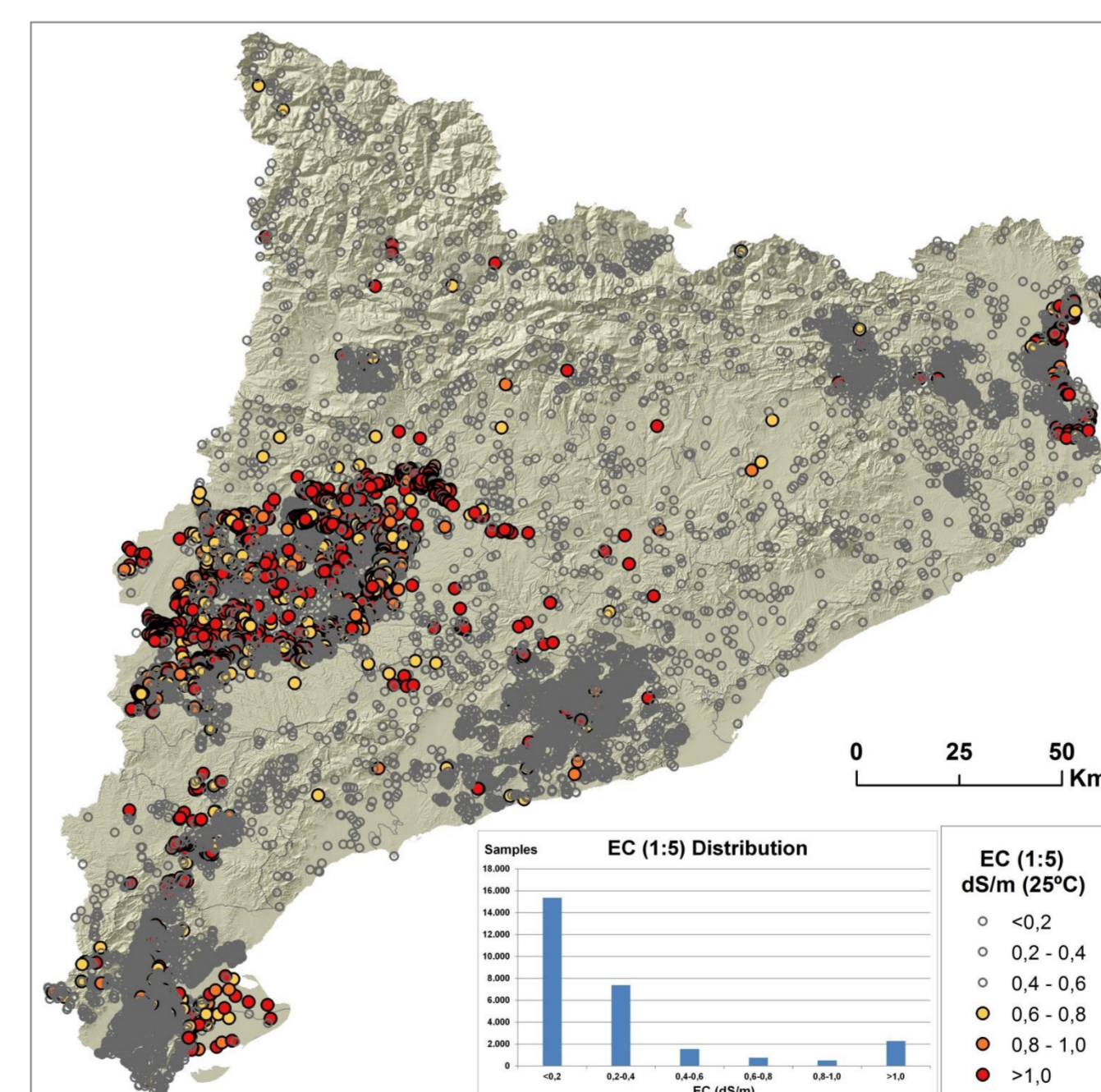


Fig. 3c. Distribution of EC(1:5) in the soils of Catalonia

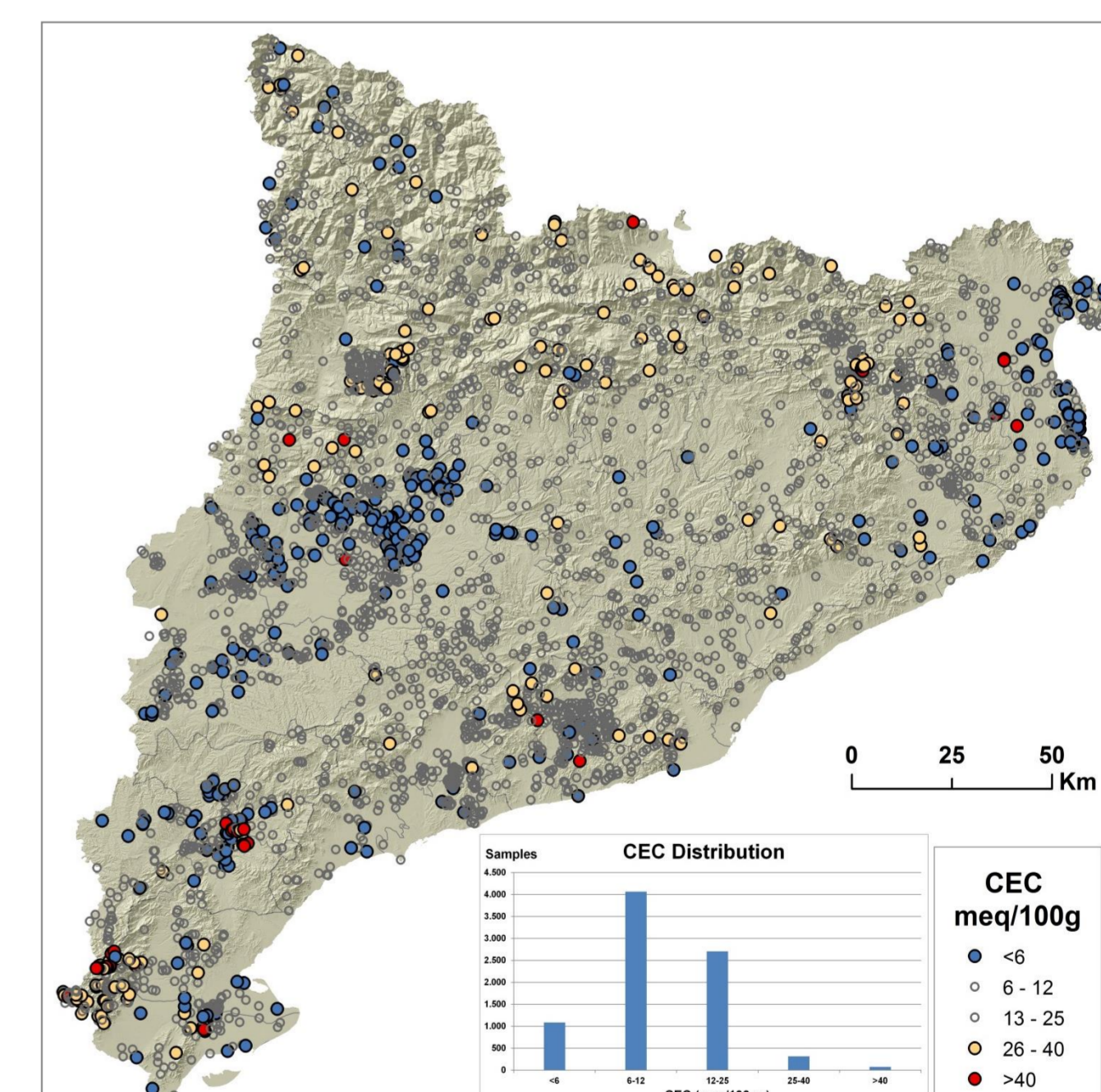


Fig. 3d. Distribution of CEC in the soils of Catalonia

Conclusions

- Parent material and climate seem to be the most influencing of the traditional soil forming factors for the distribution of pH and carbonates.
- In addition, high values of pH mainly appear on irrigated areas, often related to soil management.
- Salinity is clearly concentrated on the soils of the big irrigation schemes of Catalonia. Soil and water management are clue issues for the sustainability of these areas.
- Low and moderate values of CEC dominate the soils of Catalonia; in this case, natural vegetation and land use has also revealed some influence.