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Soil microbial diversity and related soil functioning in urban parks

S. Bourgerie ¹, M. Motelica-Heino ², I. Limam ², E. Yengué ³, D. Morabito ¹

¹ LBLGC, Université d'Orléans, France

² Institut des Sciences de la Terre d'Orléans (ISTO), UMR 7327 CNRS-Université d'Orléans, France

³ CITERES, UMR 7324 CNRS-Université de Tours, France

Introduction

The main thrust of this work was to improve the knowledge concerning soil biodiversity and related ecosystem services in soils from urban parks in several cities of the Région Centre, France. In this work, the pedological, geochemical and microbiological characteristics of surface soils were investigated in order to make an inventory of soil fertility in several urban parks of the major cities of the Région Centre, France. The effects of agricultural practices on biomass, community structure and activity of micro-organisms were investigated in these soils in parallel with the determination of various pedo-physical and chemical parameters.

Material and methods

The microbial biomass and community level physiological profiles were determined by using the MicroResp™ system in topsoils. Surface soil samples (0-20 cm) were also evaluated for physico-chemical characteristics such as the organic carbon and nitrogen concentrations, conductivity and pH together with their structure and texture and other soil physical parameters.



Pedological study

Sampling with an edleman auger
2 mm mesh sieving
LaMotte textural soil kit (code 1067)

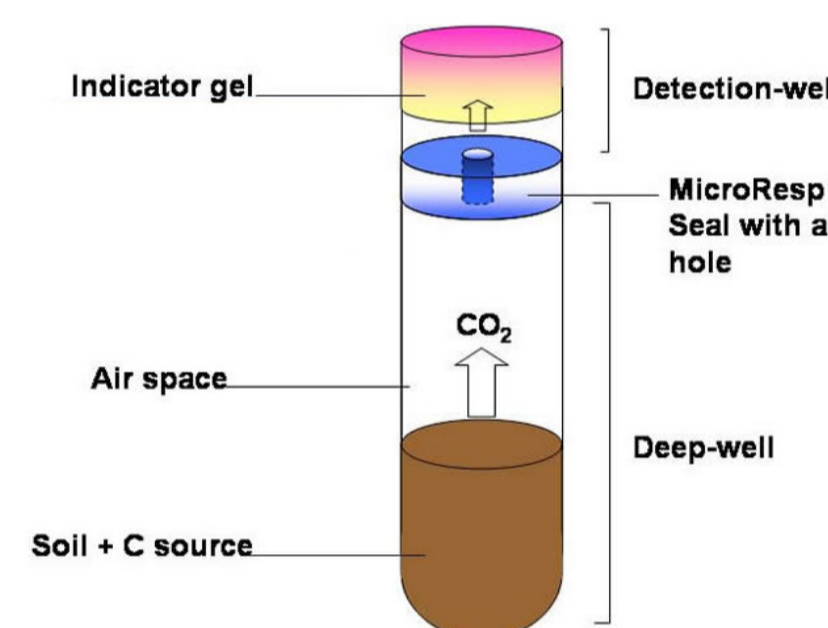
Physico-chemical study

pH: distilled water extracts (1:2.5 w/v) (NF ISO 10390)
Total organic carbon: Rock-Eval 6 (Vinci technologies)
Total nitrogen: Flash pyrolyser
Exchangeable cations: LaMotte universal extraction solution (S/L 1/10) and ionic chromatography (Dionex ICS-2000, Sunnyvale, CA =)

Microbial study



Assembled MicroResp™ system

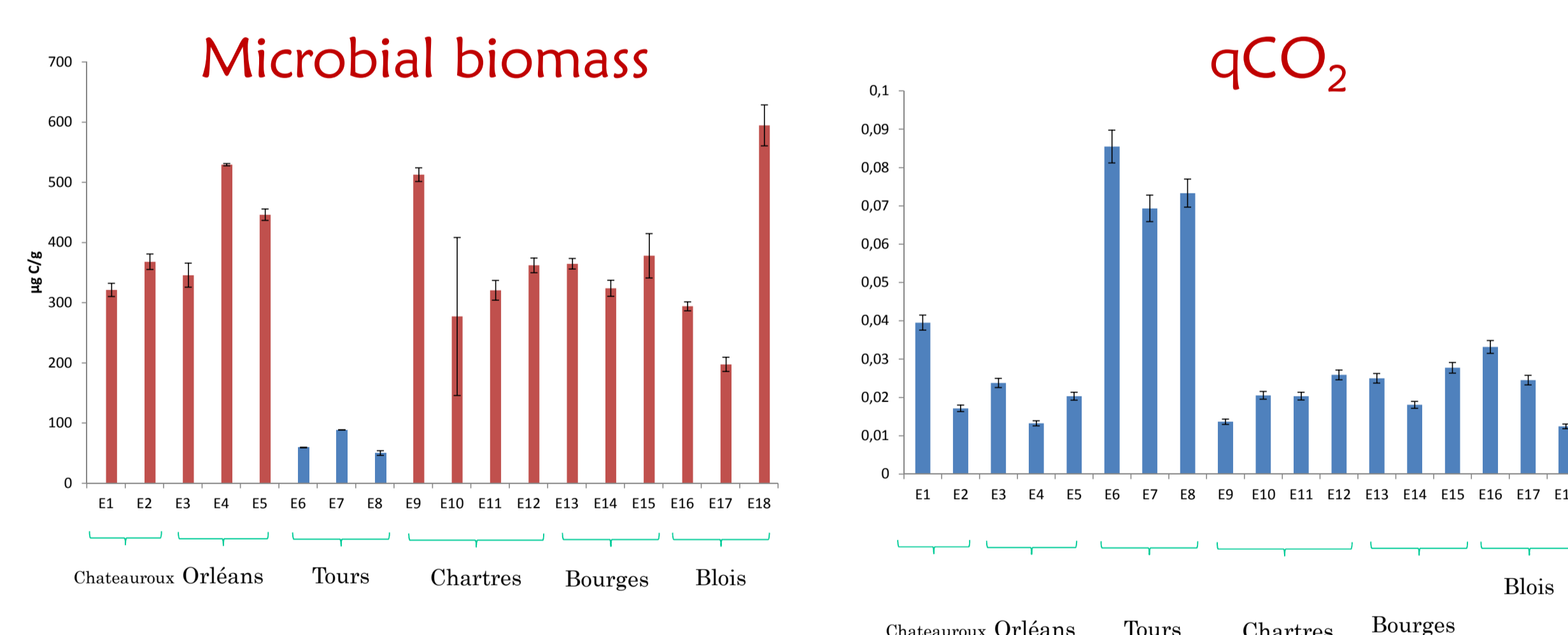


Schematic diagram of a deep well connected to a detection well

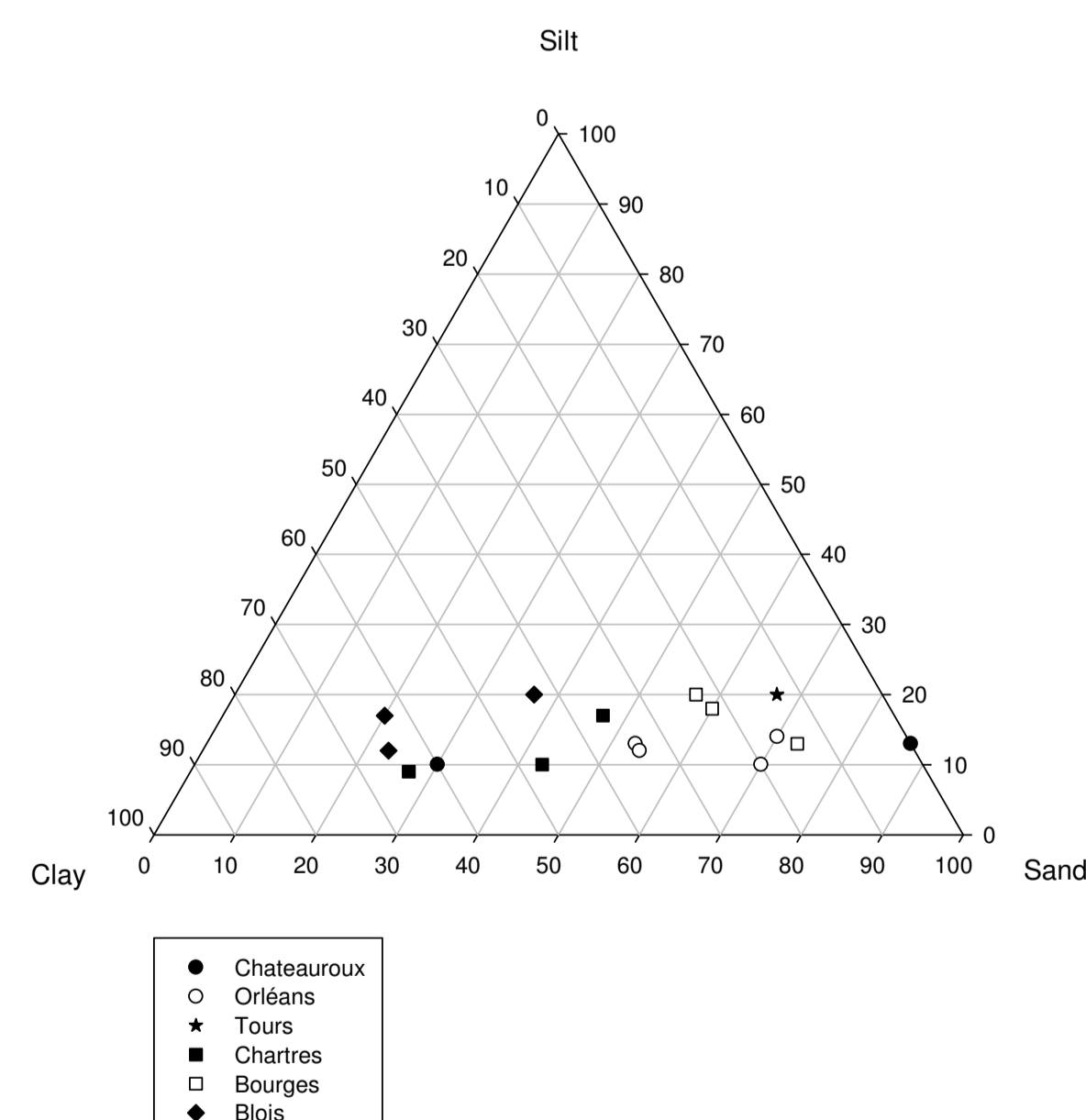
Results

- Large green area (type 1): **Lacustrine Limestone (Oligocene)**
Parc de l'Arrou, Blois
- Neighborhood green area (type 2): **Flint clay**
Parc Central, Chartres
- Historical park (type 3): **Sand and lacustrine limestone (Eocene)**
Parc Pasteur, Orléans
- Semi-natural area and woodland (type 4): **Jurassic Limestone and marls**
Prairie St-Gildas, Chateauroux
Jardin Lazenay, Bourges
- Family gardens (type 5): **Cretaceous sup. chalk and sands**
Jardins familiaux de la Bergeonnerie, Tours

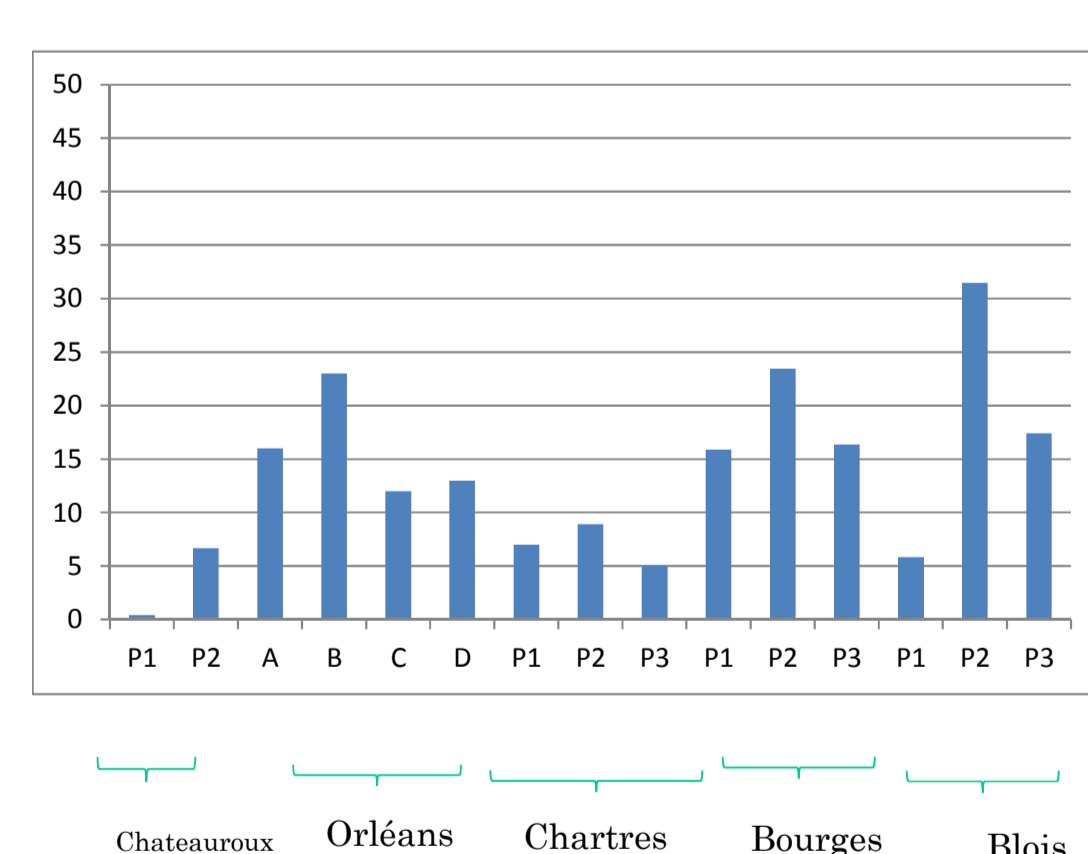
Microbial parameters



Surface soils texture



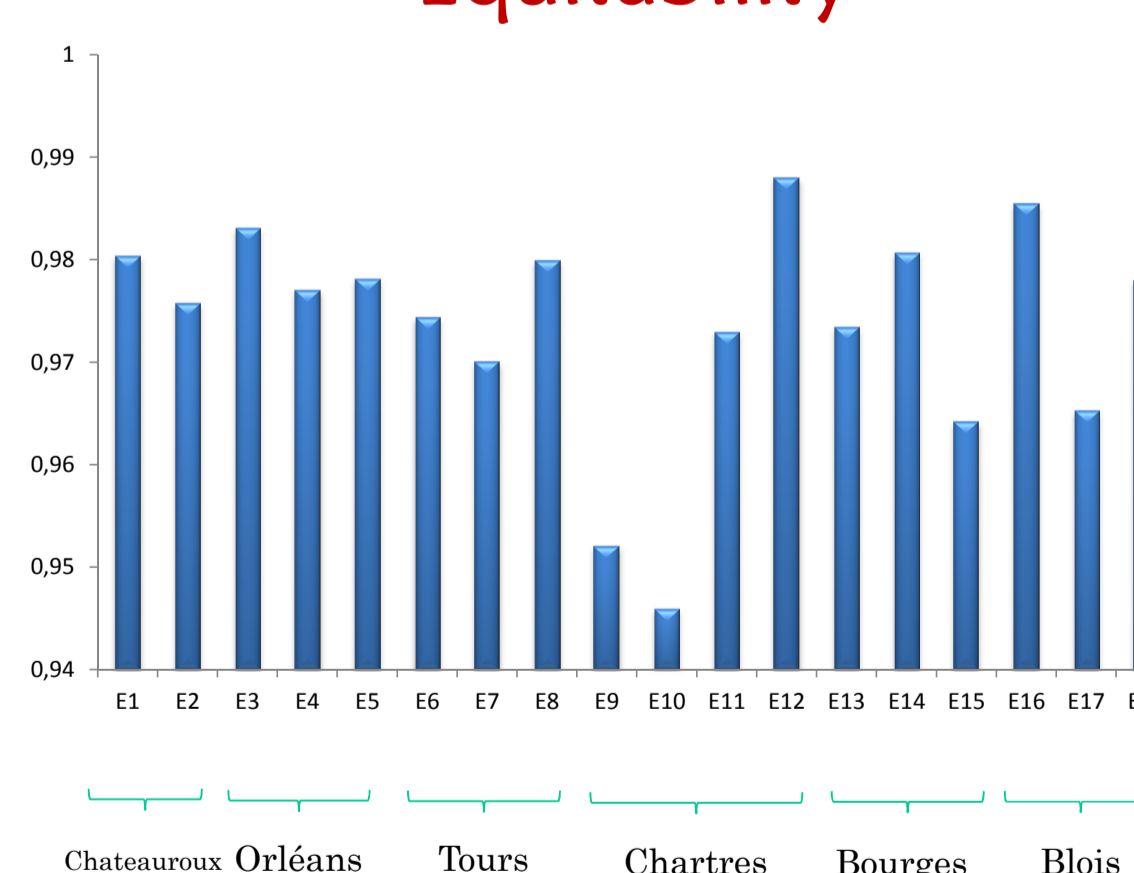
% of raw material of the surface soils



Physico-chemical characteristics of the surface soils

	Chateauroux	Orléans	Tours	Chartres	Bourges	Blois
pHeau	7,1	7,3	7,8	7,6	7,6	7,3
Corga g/kg sol	25,5	69,6	56,6	13,6	30,2	21,7
N g/kg sol	5,1	4,81	3,36	3,6	6,9	5,9
C/N	5,0	14,5	16,8	3,8	4,4	3,7
Mg++ ex. (cmol/kg)	16,97			8,13	8,25	8,48
K+ éch. (cmol/kg)	12,18			5,17	2,76	6,08
Ca++ ex. (cmol/kg)	153,9			91,03	2213	153,8

Equitability



Conclusion

Results from this study showed that except for one site the microbial biomass for all samples was high. Metabolic quotients (qCO₂) were in contrast variable for the different parks whether Shannon diversity indexes were quite similar for all the samples. The soil ecosystem has significantly influenced the functions of soil microbial community and hence probably its composition. More generally, catabolic diversity of soil microbial community is variable under the influence of various gardening practices and geological contexts.