Long Term Copper Contamination Effects on Soil Functions

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Introduction

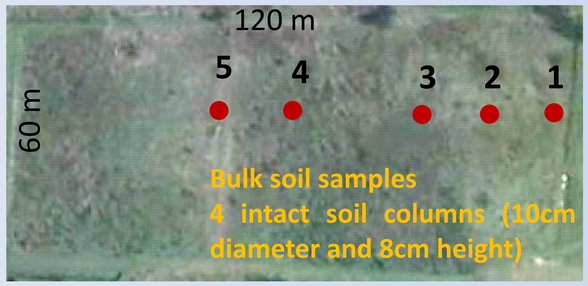
- Soil pollution at low levels is often within soil's capacity to treat and assimilate. Elevated levels of soil pollutants mainly heavy metals could be toxic to soil flora and fauna, causing detrimental effects on soil structure and related soil functions.

Objective

- Study biological and physical functions of soil contaminated by copper in a gradient to reveal when **"Soil goes functionally sleep"**.

Materials and Methods

Hygum, Denmark
N 55^0 46'
E 9^0 25'



Soil texture: Wet sieving and hydrometer method and organic carbon by FLASH 2000 organic elemental analyzer.

pH of soil: pH electrode.

Copper concentration: Atomic Absorption Spectrometry

Soil biological functions:

Plant species richness: Point intercept method, three replicates at each location.

Earthworm density (no. m^{-2}): Hand sorting of soil cores of size 0.25 x 0.25 x 0.25 m, three replicates at each point.

X-ray Computed Tomography:

Scanning: CT scanner (X-Tek HMX225), 200 micron

Image analysis: Image-J

Soil Physical functions:

Soil-water characteristics: Sand box/pressure plate method

Air permeability: Air permeameter (Darcy's law)

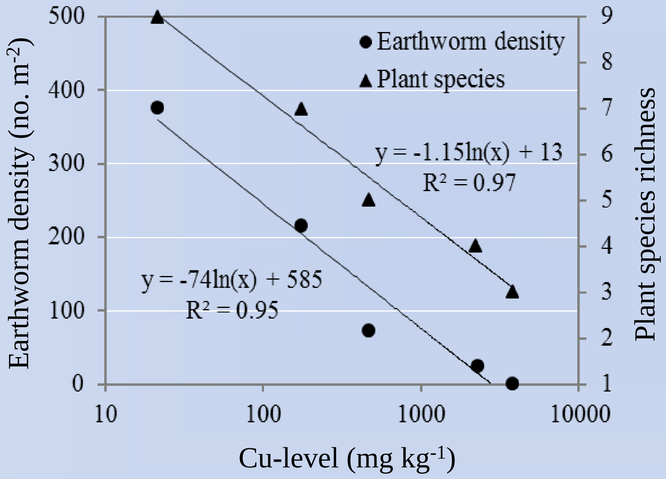
Gas diffusivity: Two gas/dual chamber device (Fick's law)

Results

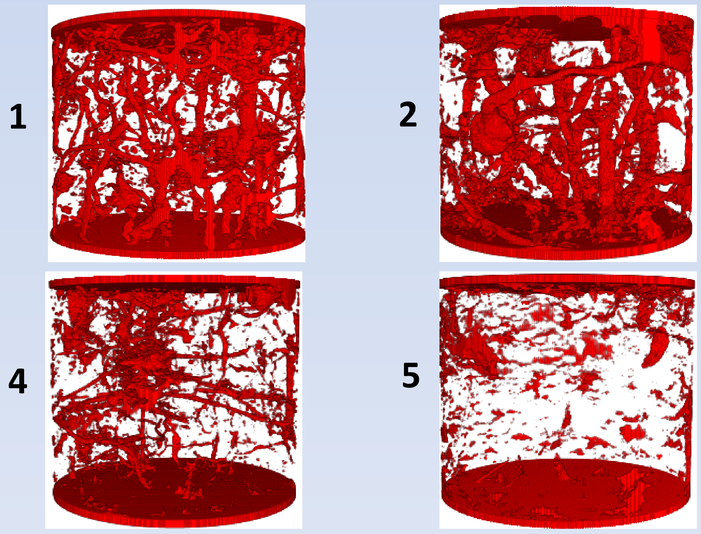
Location /Point	Cu-level (mg/kg)	Clay < 2µm (%)	Silt 2-50µm (%)	Sand 50-2000µm (%)	Carbon content (%)	Soil pH-H_2O	Soil Type (USDA)
1	21.5	11.1	21.7	63.8	1.96	6.1	Sandy loam
2	175	9.6	22.0	65.0	2.02	5.9	Sandy loam
3	466	10.7	27.3	58.2	2.20	6.2	Sandy loam
4	2228	10.7	35.8	48.4	2.98	6.3	Sandy loam
5	3837	12.4	28.4	56.6	1.56	6.6	Sandy loam

Soil Biological Functions

Earthworm density and plant species

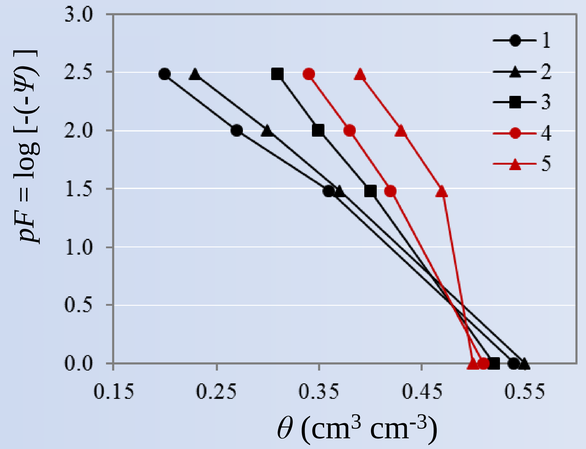


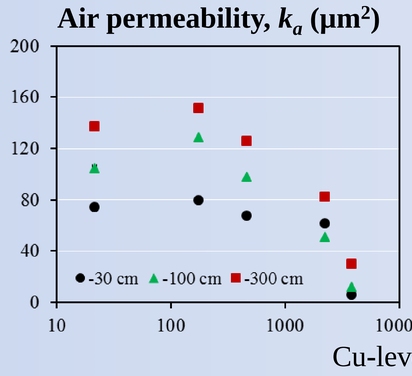
X-ray CT Visualizations

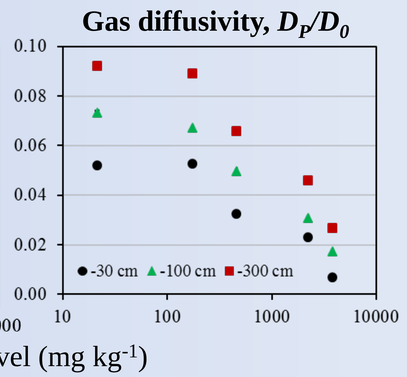


Soil Physical Functions

Soil-water retention







Cu-level (mg kg^{-1})

Conclusions

Elevated levels of soil copper concentrations had a more detrimental effect on soil biological functions (flora and fauna activity) as compared to its physical functions.

Soil goes to functionally sleep when soil copper concentration is higher than 500 mg kg^{-1}.

Acknowledgements

The work was funded by the Soil Infrastructure, Interfaces, and Translocation Processes in Inner Space (Soil-it-is) project from the Danish Research Council for Technology and Production Sciences.

References

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