

Soil and Groundwater Technical Forum

RFP 9 Soil Hydrophobicity

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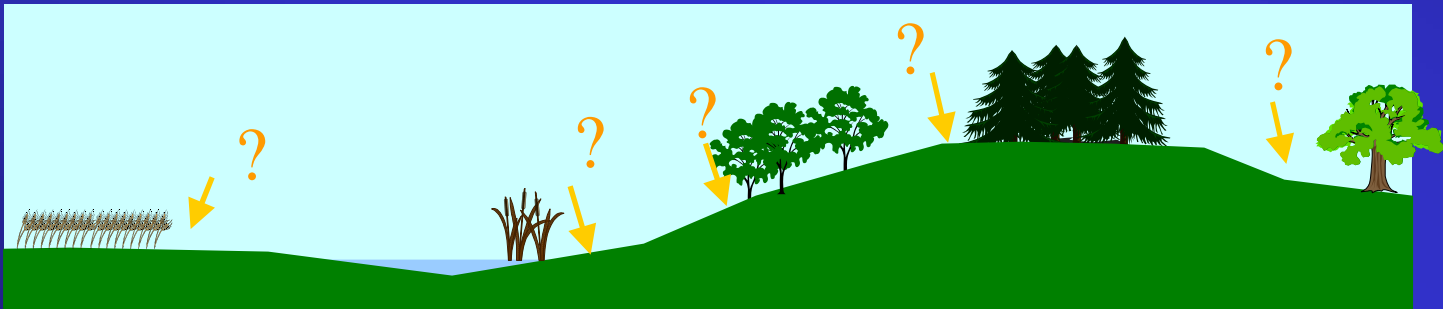
Problem





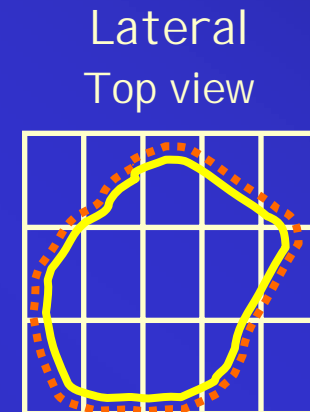
Objectives

- 1 Compare soil, topography, hydrology and vegetation at 26 water-repellent sites

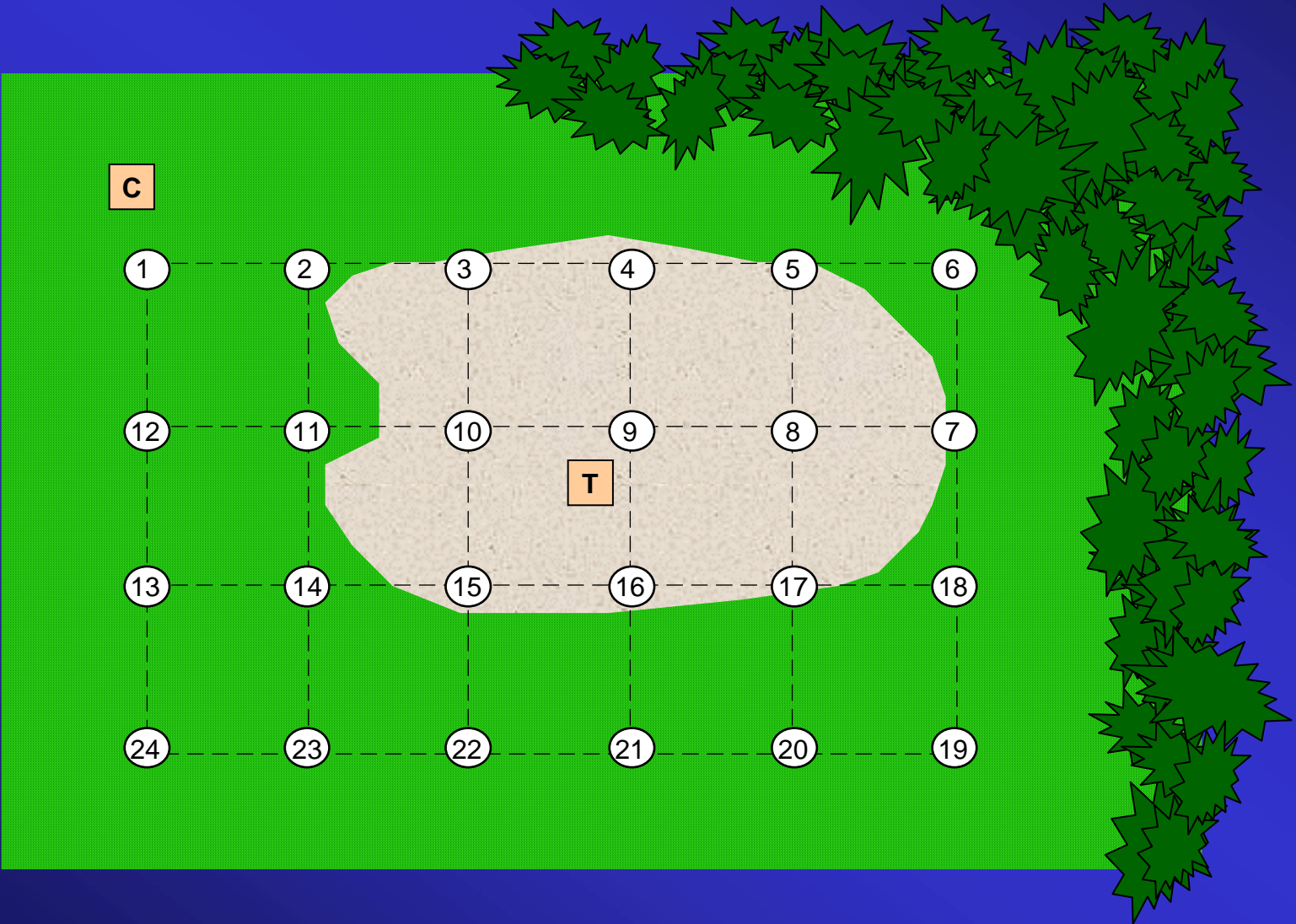


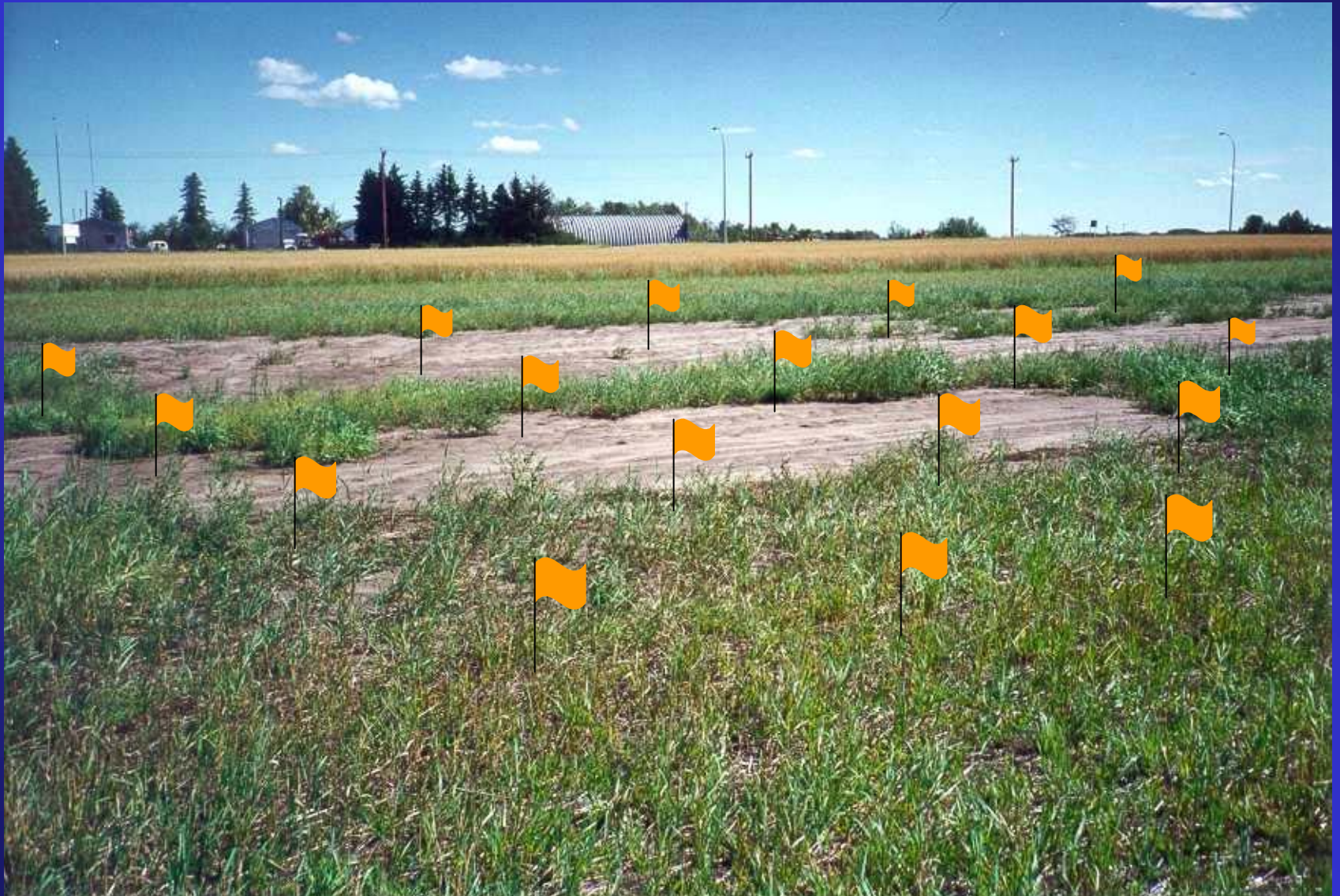
2 Compare the spatial distribution of soil water repellency and extractable petroleum residues at 12 water-repellent sites

- water-repellent
- contaminated



Sampling







Soil preparation and analysis

Air dried



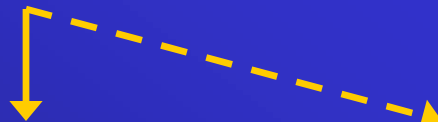
Ground and sieved
(< 1 mm)



MED test



DEO content

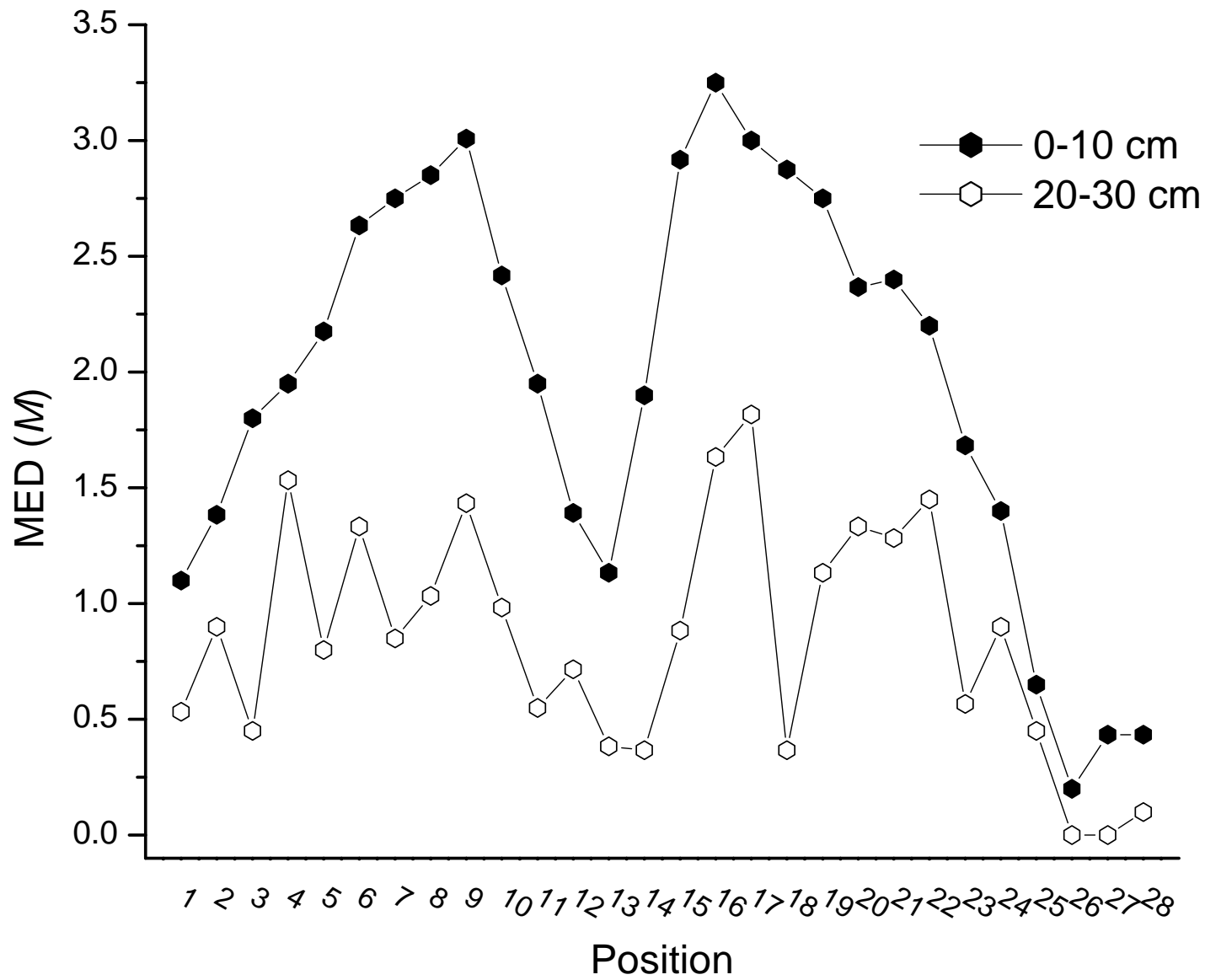


TOC content
(profile samples only)

Results

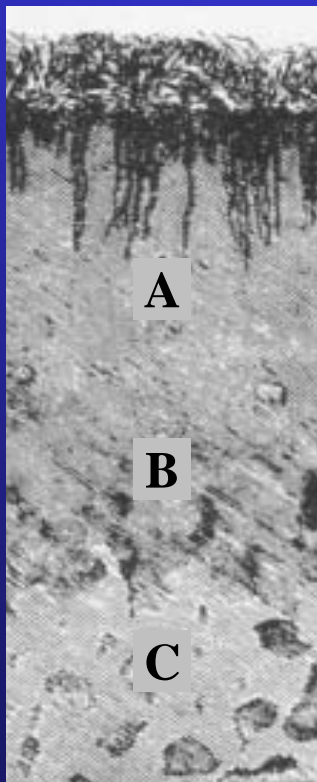
Of the 791 soil samples that were analyzed for MED:

	<u>MED > 0 M</u>
398 from A horizon (or 0-10 cm)	76.4 %
369 from B horizon (or 20-30 cm)	30.1 %
24 from C horizon	12.5 %



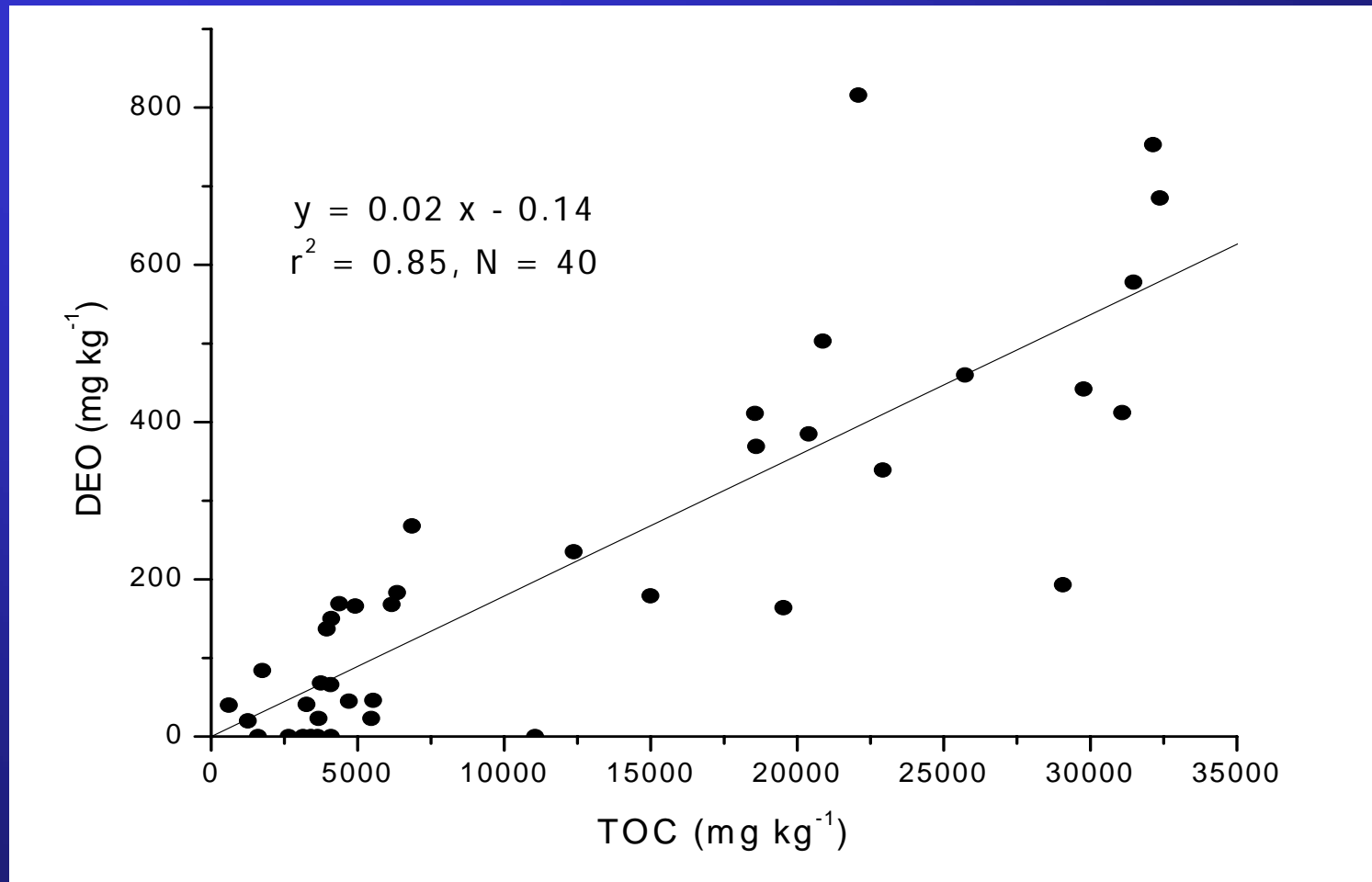
DEO in pristine soil (mg kg⁻¹)

DEO content in pristine grid and profile soil samples, defined as having MED = 0 *M* and DEO < 1000 mg kg⁻¹



Mean	Median	Range	N
394a	383	0-970	51
253b	215	0-551	106
62c	44	0-175	19

DEO vs. TOC in pristine soil



DEO amounts to $\approx 2\%$ of pristine soil TOC

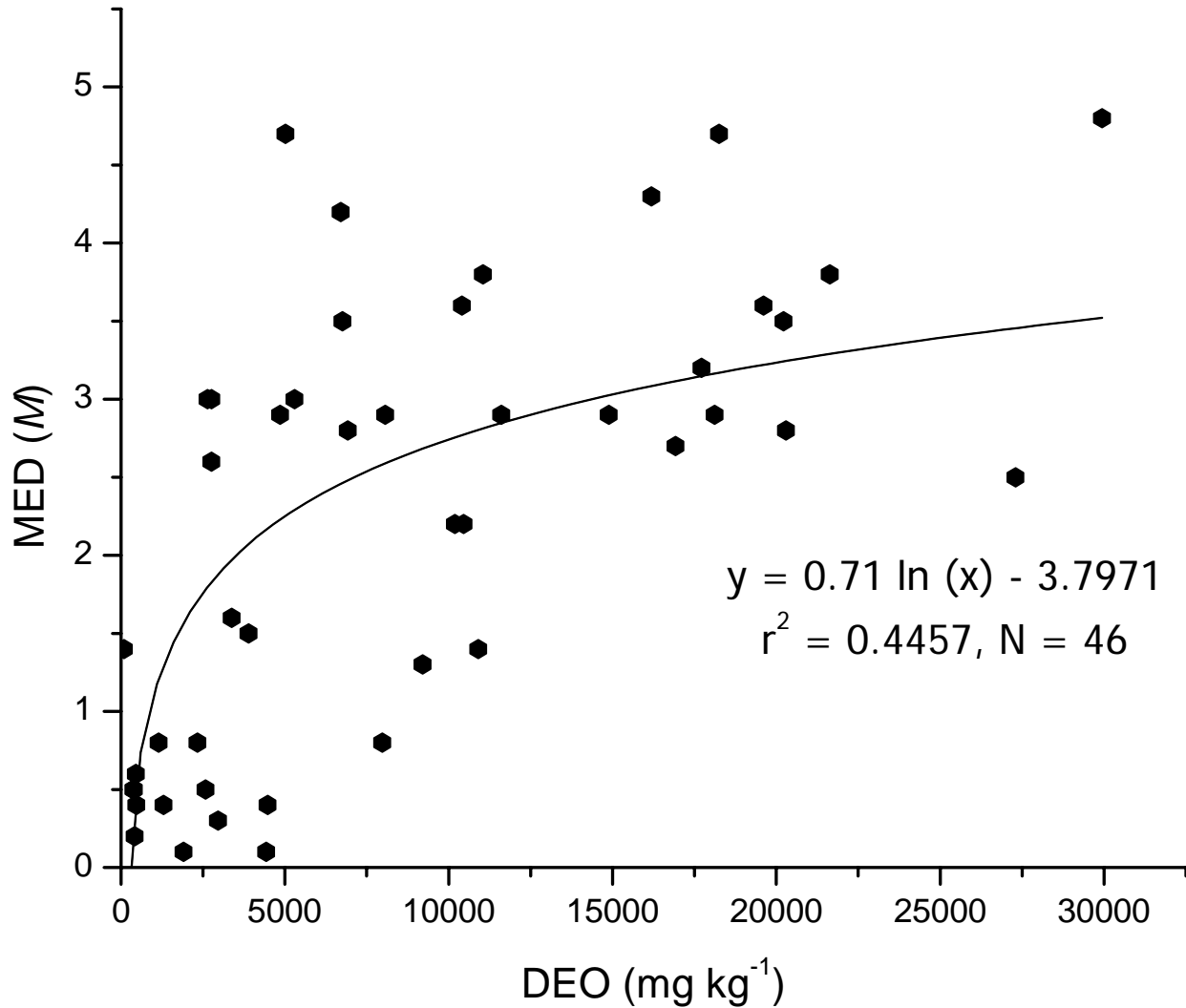
DEO vs. MED in hydrophobic soil

One of the original objectives of this study was to study the relationship between DEO and MED at multiple water-repellent sites

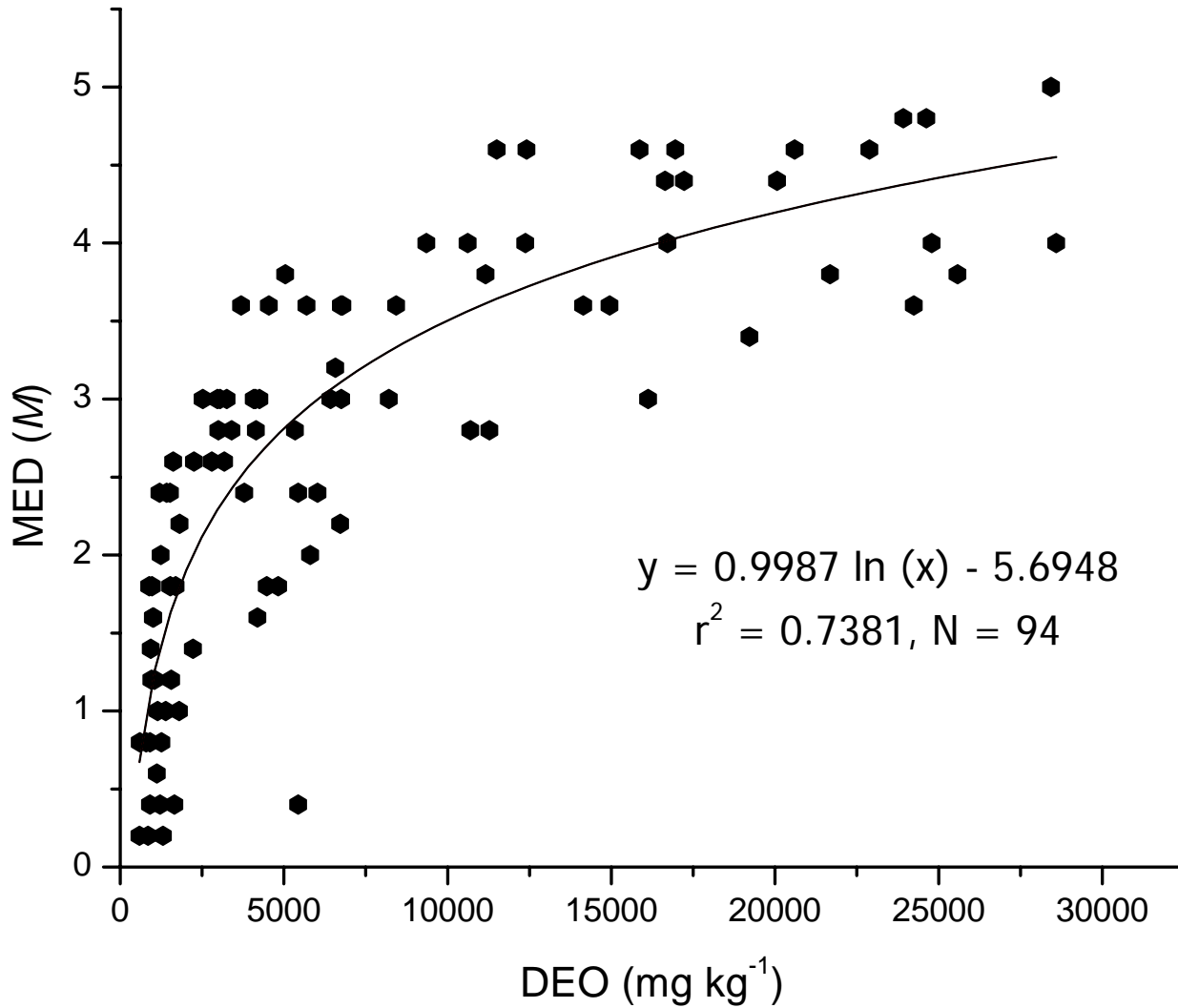
We did so by regressing DEO on MED using data from profile and grid samples obtained from 12 study sites

The data range selected for analysis was $MED > 0 M$ and $DEO < 30\ 000\ \text{mg kg}^{-1}$

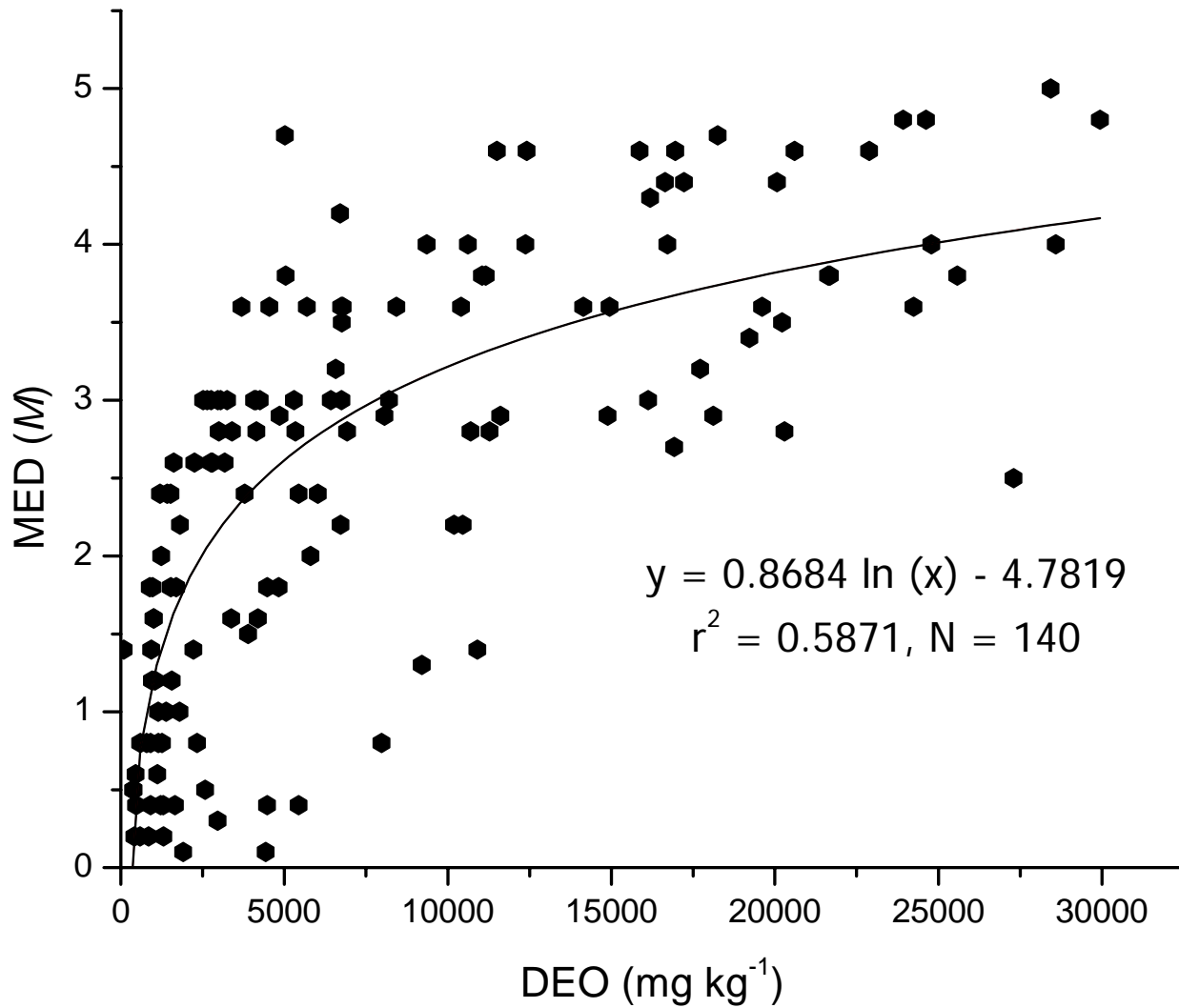
Profile samples



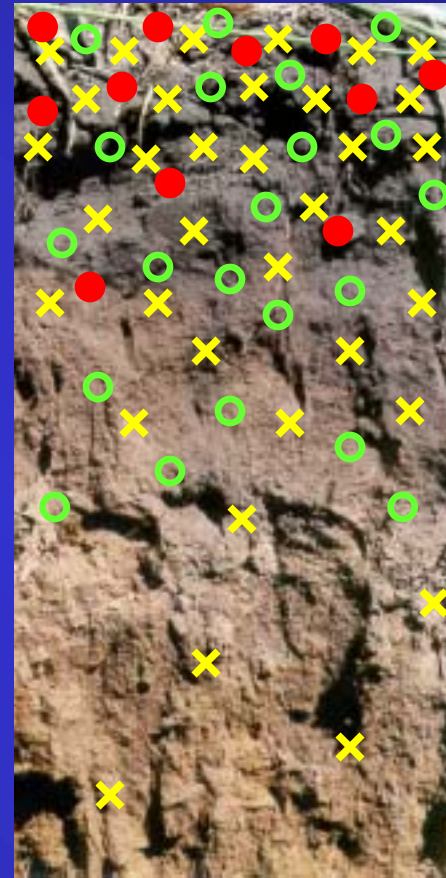
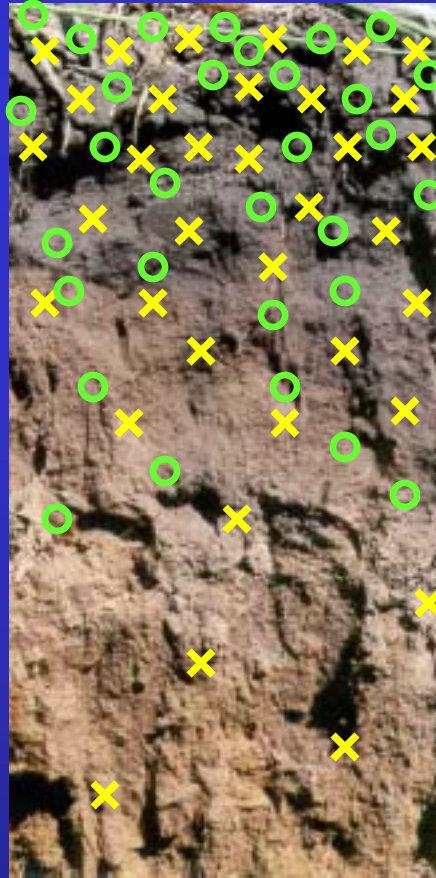
Grid samples



Combined samples



- × Native OC
- DCM-soluble OC of petroleum origin
- DCM-insoluble OC of petroleum origin



The fraction of measured TOC that is
“solvent-insoluble OC of petroleum origin (●)”
in water-repellent soil is:

19 % in A horizon soil

3 % in B horizon soil

0 % in C horizon soil

The “solvent-insoluble OC of petroleum origin (●)”
may occur as:

- i) intact petroleum compounds that have become strongly associated with native soil organic matter or clay minerals
- ii) modified petroleum compounds that have been converted to humic material or other microbial products

Main Conclusions

- 1 There is a strong positive correlation between DEO and MED in the studied water-repellent soils
- 2 It seems compounds causing water repellency in these soils contain DCM-insoluble C of petroleum origin

- 3 Removing soil contaminated with above-criteria PHC should protect most sites against development of petroleum-related soil water repellency
- 4 There is some evidence that rapid intervention (i.e. bioremediation effort) following a spill can prevent development of soil water repellency