

PTAC RFP 9

Soil Hydrophobicity

Julie L. Roy
Imperial Oil Resources

Research team

W.B. McGill	University of Alberta
J.L. Roy	Imperial Oil Resources
H.A. Lowen	University of Alberta
R.L. Johnson	Alberta Research council

Supporters

Imperial Oil Resources

University of Alberta

Alberta Environment

Gulf Canada Resources Ltd.

Petro-Canada

Talisman Energy Inc.

BP Canada Energy Company

Canadian Association of Petroleum Producers

Alberta Energy & Utilities Board

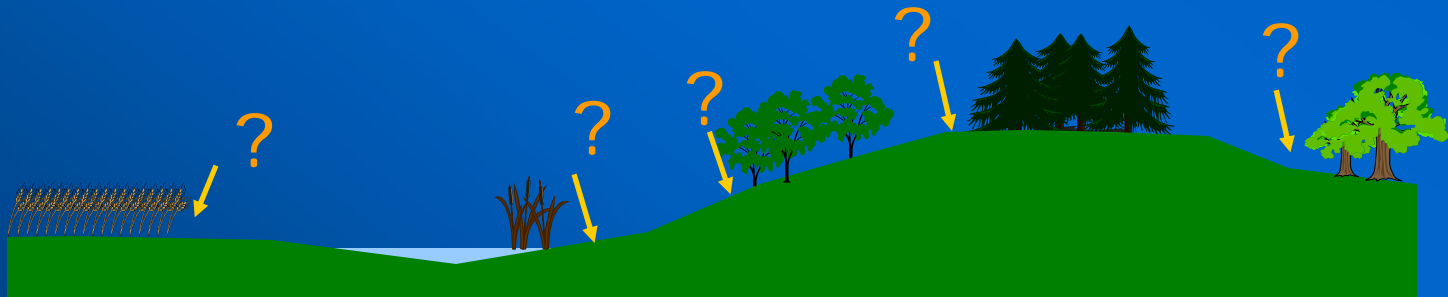
Veco Canada Ltd.

Problem



Research objectives

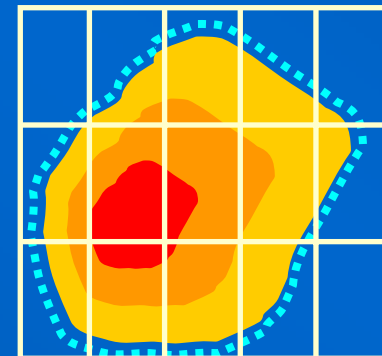
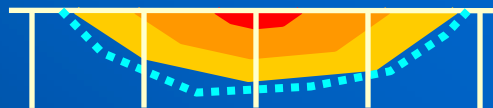
- 1 Compare soil, vegetation and site hydrology at 26 hydrophobic sites to determine if landscape-scale conditions predispose soils to developing water repellency



Research objectives

- 2 Compare the spatial distribution of soil water repellency and DEO content in soil at 12 sites to improve understanding of mechanisms involved in development of water repellency

— hydrophobic
..... contaminated



Project schedule

Phase I	◆ Field inspection of 26 hydrophobic sites	01 May 99 to 30 Jun 99
Phase II	◆ Intensive soil sampling ◆ Detailed vegetation and soil profile description at 12 of the 26 sites	01 Jul 99 to 31 Aug 99
Phase III	◆ Compilation of field data ◆ Analyses of soil samples (DEO, MED, TOC, TN, TC, pH, EC) ◆ Statistical analysis of results	01 Sep 99 to 31 Mar 00
Phase IV	◆ Preparation of final report and participants' packages	01 Apr 00 to 31 Aug 00

Cost

PTAC \$ 80 K

U of A \$ 60 K

+

a large in-kind contribution by IOR

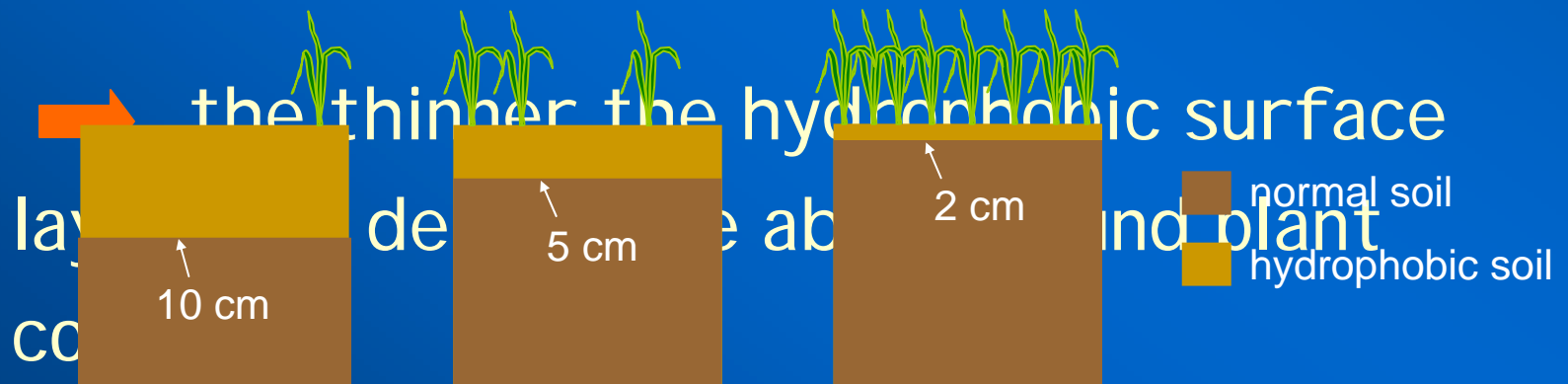
Key findings and implications

1. No evidence of common landscape-scale characteristics at inspected hydrophobic sites, except for a frequently high (< 1 m) water table at many but not all sites

→ can't predict where soil water repellency will develop or where vegetation

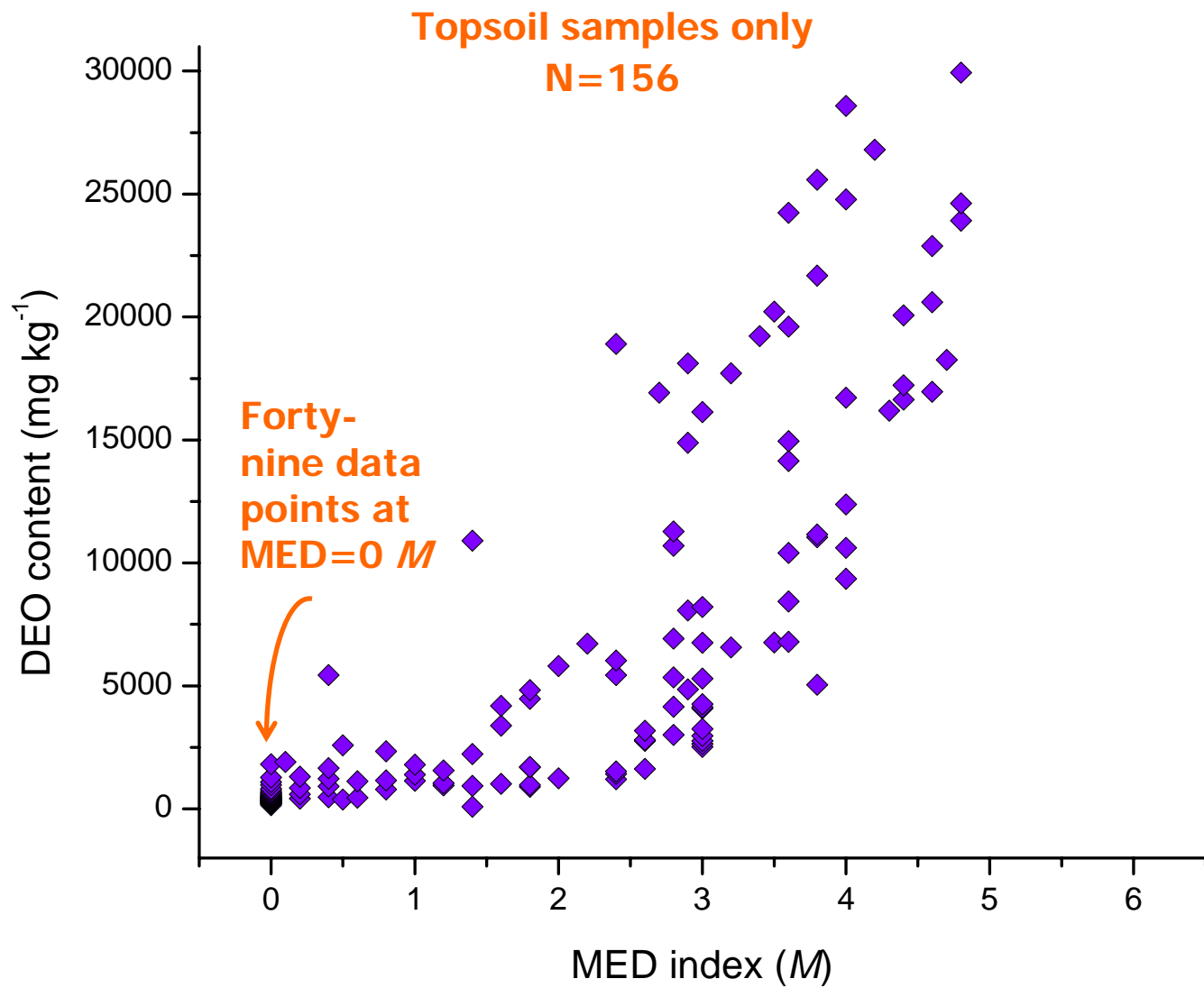


2. Plant growth is visibly retarded or impeded at sites characterized by a relatively thick (> 5 cm) hydrophobic surface layer



3. There is a strong positive correlation between the DEO content and MED index of soil at hydrophobic sites

➔ the higher the soil DEO content, the more severe the soil hydrophobicity



4. Pristine soils tend to have a DEO content $\leq 1000 \text{ mg kg}^{-1}$

➔ a soil DEO content $> 1000 \text{ mg kg}^{-1}$ usually indicates that the soil contains DEO from pollutant sources

5. Soil samples having a MED > 1.0 M tend to have a DEO content > 2500 mg kg⁻¹

➔ there is little doubt that such samples contain residues from oil contamination

6. Oil does not need to be present in subsoil for surface soil to develop hydrophobicity

➔ removing ALL soil of $> 2500 \text{ mg kg}^{-1}$ DEO and $> 1.0 \text{ M MED}$ should prevent recurrence of hydrophobicity at existing hydrophobic sites

7. In collaboration with AE, AEUB, and five large oil companies, it was not possible to find > 30 sites to include in the study

➔ better knowledge of the current extent of the problem in Alberta will help research planning and budgeting

Announcements

- No follow-up PTAC study has been planned for the near future
- The final report titled "Hydrophobic soils: Site characterization and hypothesis testing (1999/2000)" is available through PTAC
- A technical presentation will be delivered to all interested PTAC members in Feb or Mar 2001 (tentatively scheduled for 23 Feb 2001)