# Detailed Ecological Risk Assessment: N.E. British Columbia

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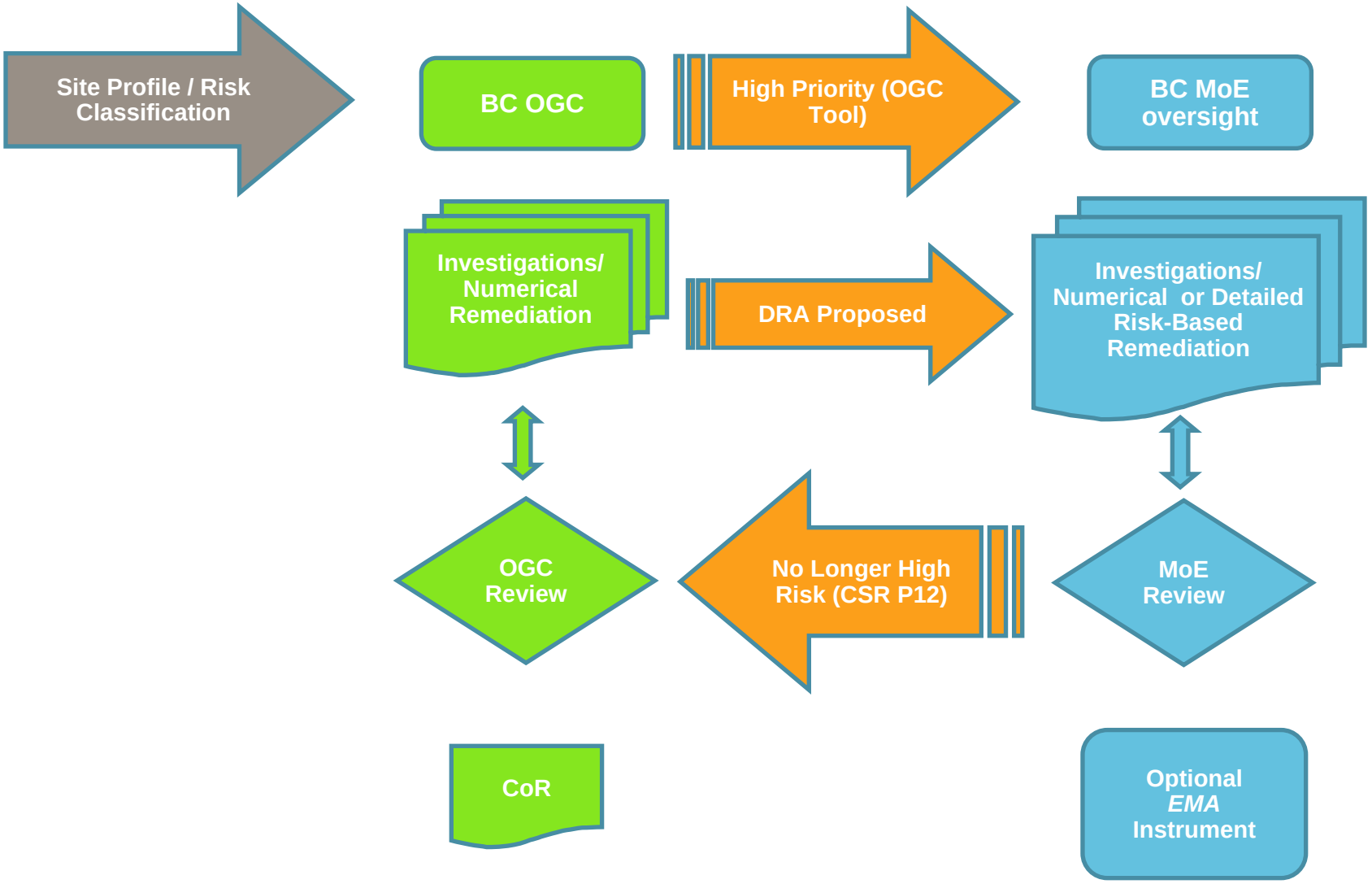
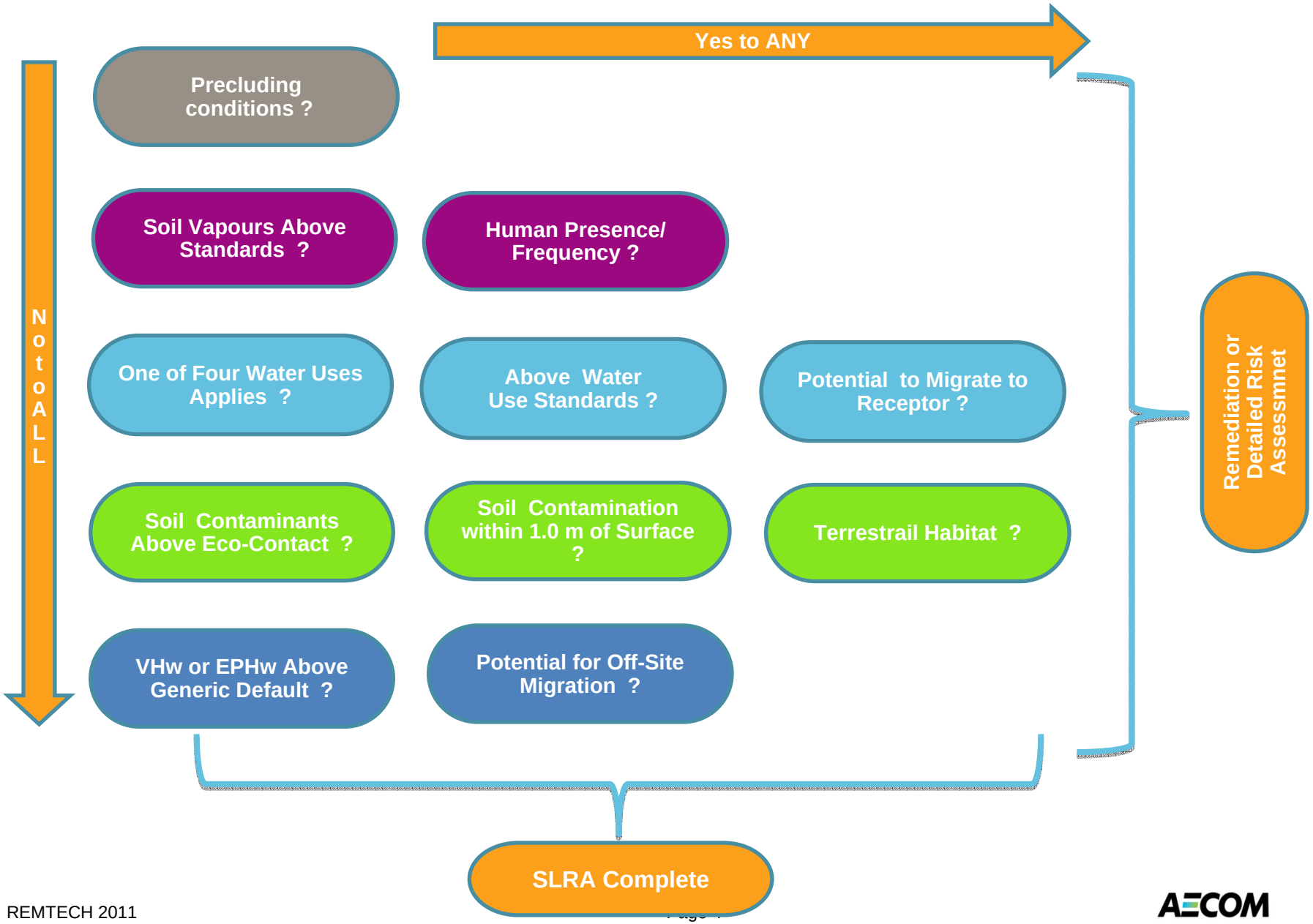
## Presentation Outline

- SECTION 1
  - Regulatory and Process Issues: OGC – MOE
  - SLRA versus DERA
  - DERA Expectations
- SECTION 2
  - Examples of Effects and Risk Characterization Tools at Upstream Sites
- SECTION 3
  - Aliphatic Hydrocarbons and DERA

# OGC – MoE Linkage



# SLRA Process



# DERA Expectations

## Comprehensive Problem Formulation

- Management Goals, History, Site Setting and Biophysical Features
- Contaminants of Concern, Exposure Pathways and Receptors
- Hypothesis, Assessment and Measurement Endpoints
- Conceptual Model, Risk Strategy or Work Plan

## Comprehensive Understanding of Exposure

- Analytical Data on Abiotic and Biotic Media
- Models

## Ecologically Relevant Effects Assessment

- Toxicity and Effects Data from Literature versus Site-specific
- Use of Toxicity Bioassays with Site-specific Media
- Observations and Field Surveys

## Risk Characterization

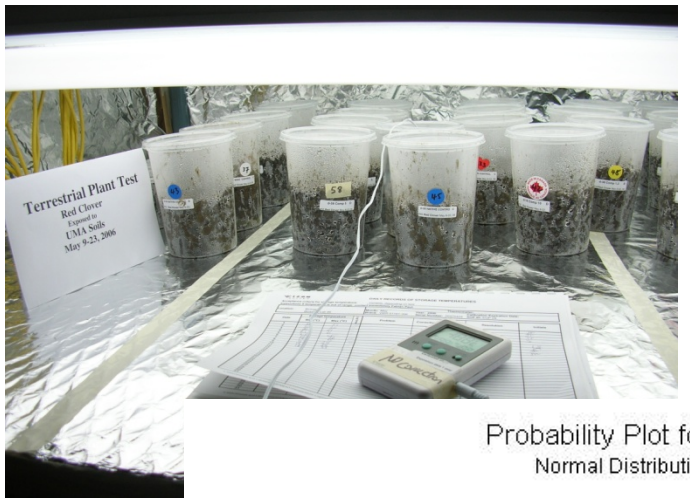
- Quotients, multivariate statistics, weight of evidence
- Judgment, narratives and uncertainty

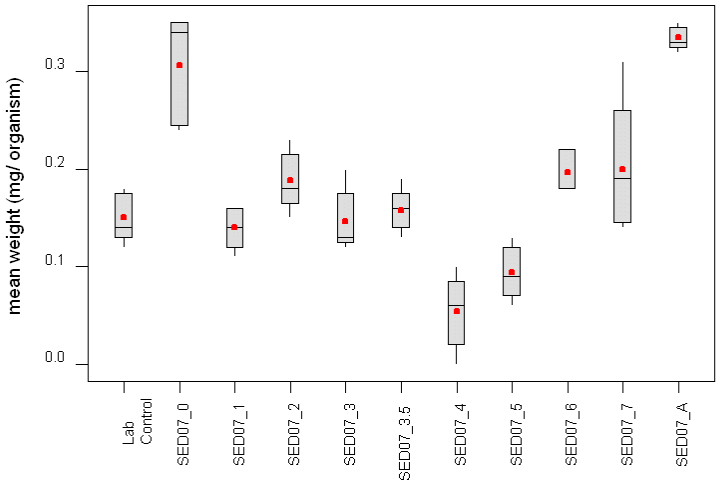
# Link Objective to Ecological Attribute, Measures & Risk Hypothesis

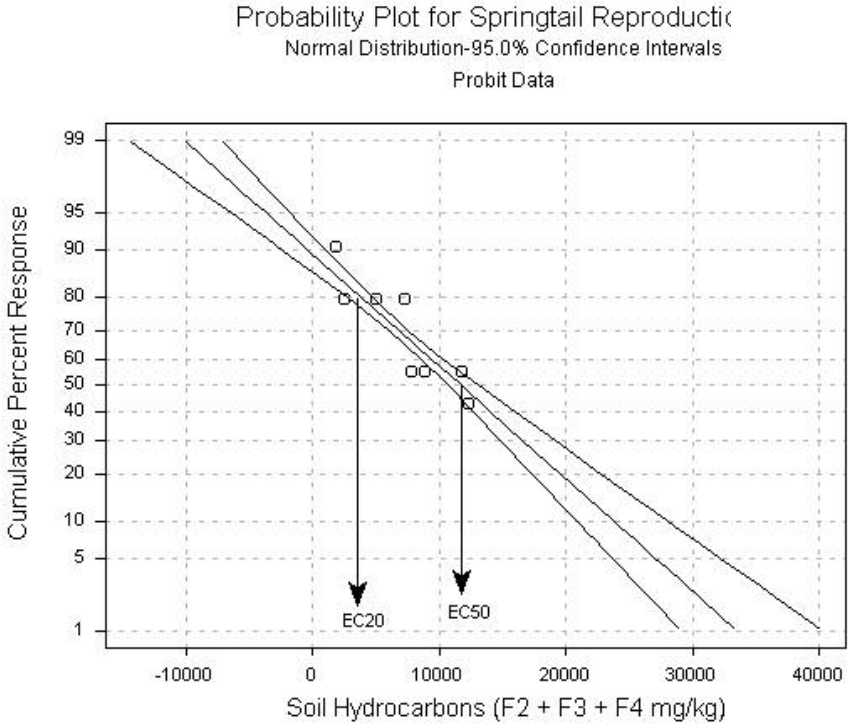
| M. Objective | Assessment Endpoint | Measurement Endpoint | Risk Hypothesis | Tools |
|---|---|---|---|---|
| Mature Forest Community | Soil quality supporting growth of common species<br><br>Acceptable rate of vegetative succession | Growth in select species<br><br>% site progressing to maturity over time. | Growth no less than 20% of reference soil.<br><br>>50% of site will reach secondary succession in ___ years | Weight of Evidence<br>•Bioassays<br>•Observation |
| Protection of open water communities | Sufficient aquatic invertebrates to support avian feeding | Water quality sufficient to protect 90 % of species | Water quality will not effect invertebrate density | •Monitoring<br>•Toxicity data from literature |

# DERA Effects and Risk Characterization Upstream Oil & Gas Sites

# DERA Tools: Bioassays



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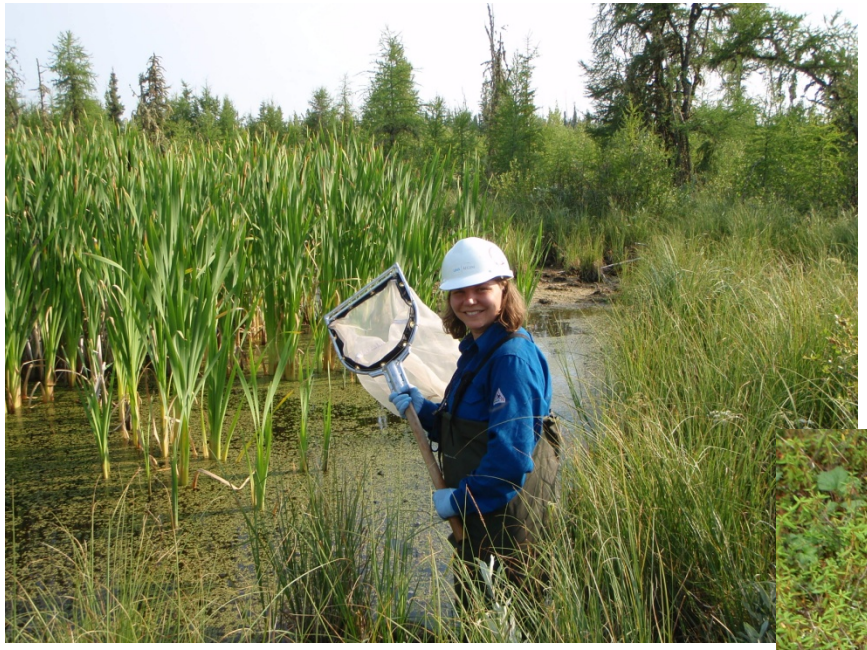
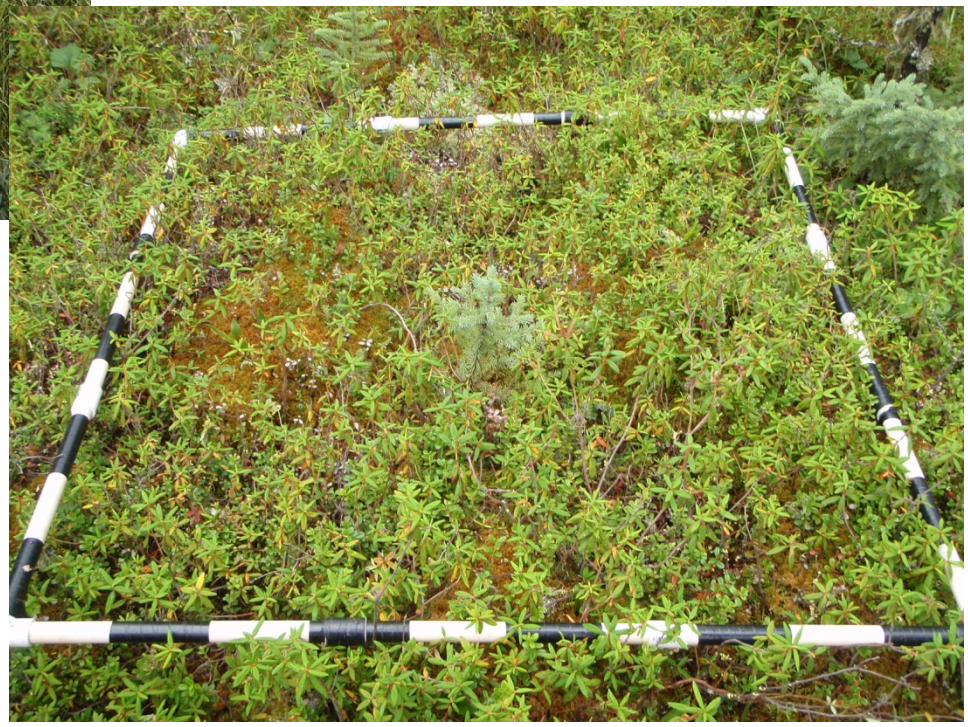
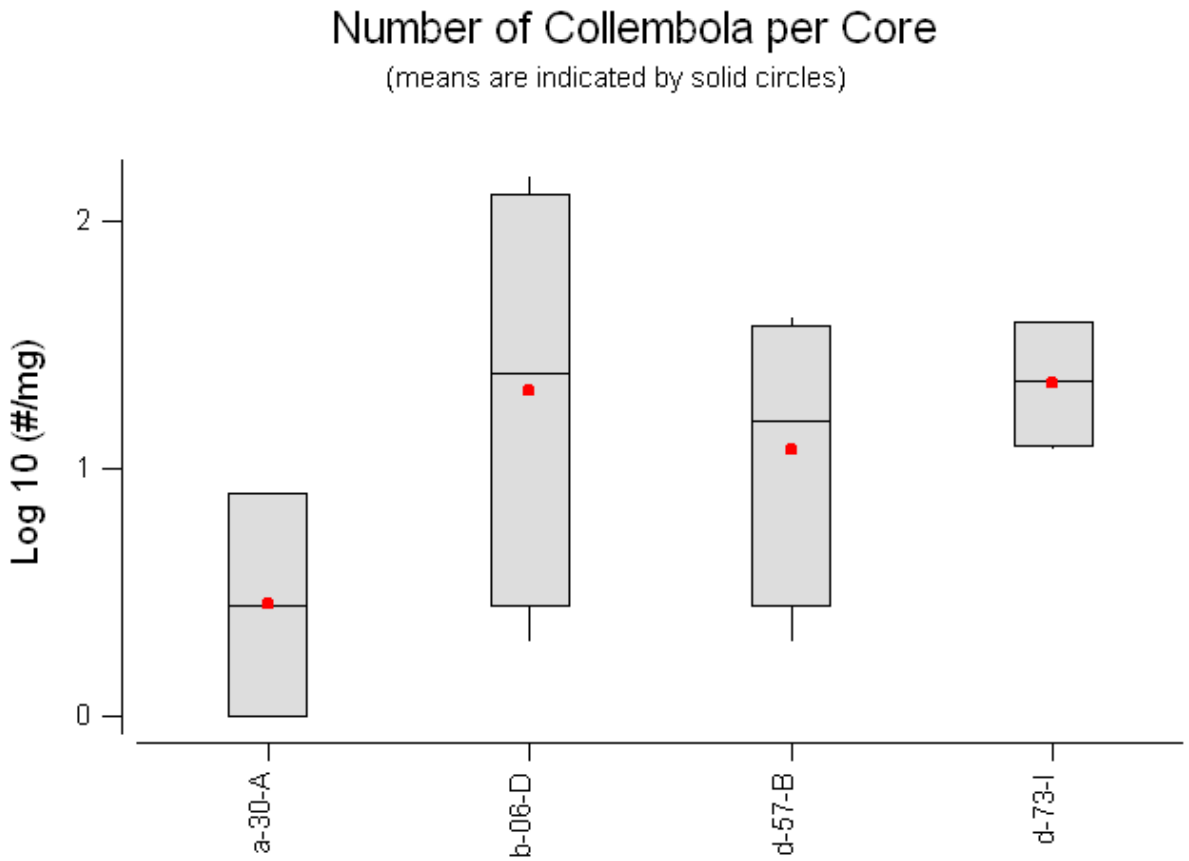
# DERA Tools:  Ecological Observations



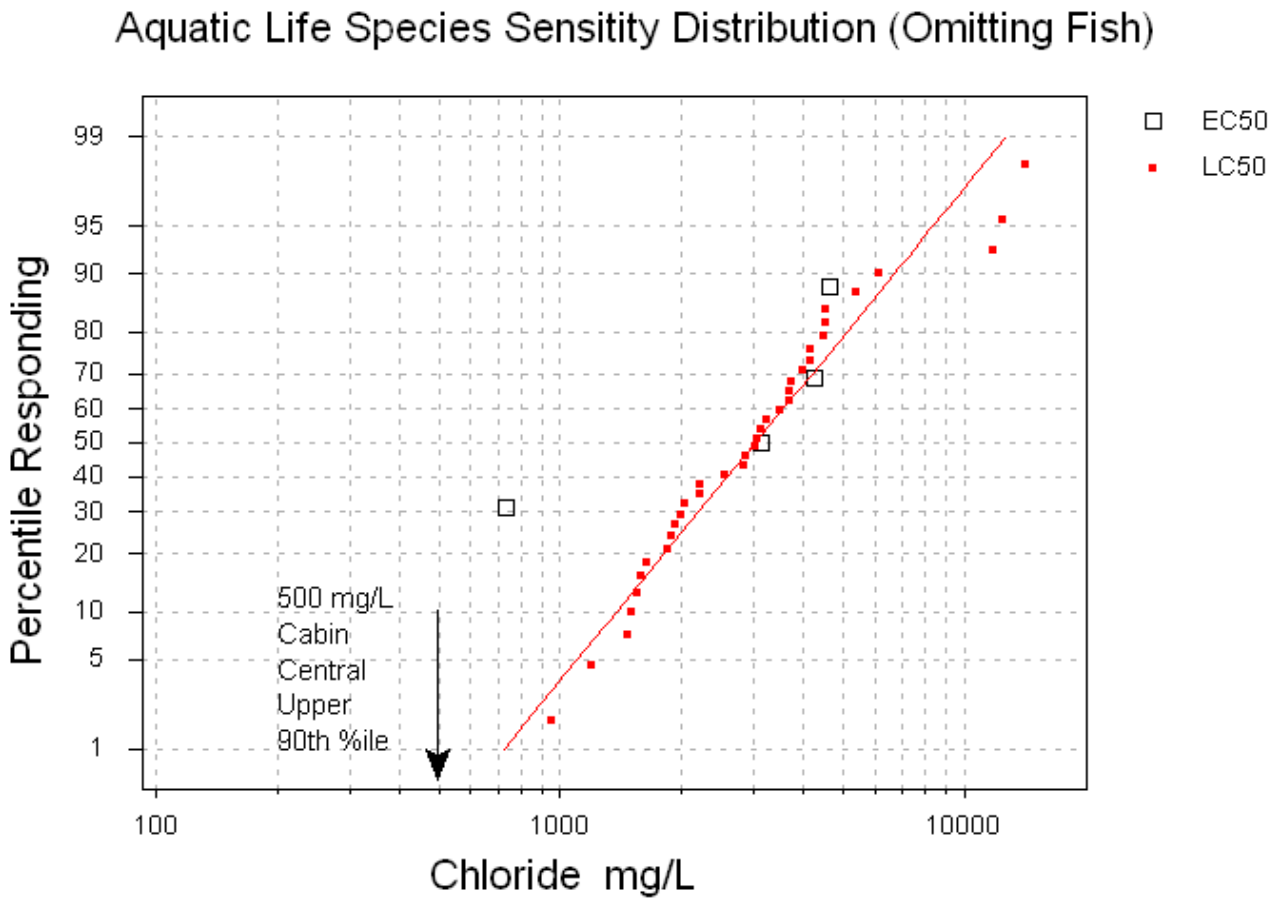


# DERA Tools:  Biological Surveys

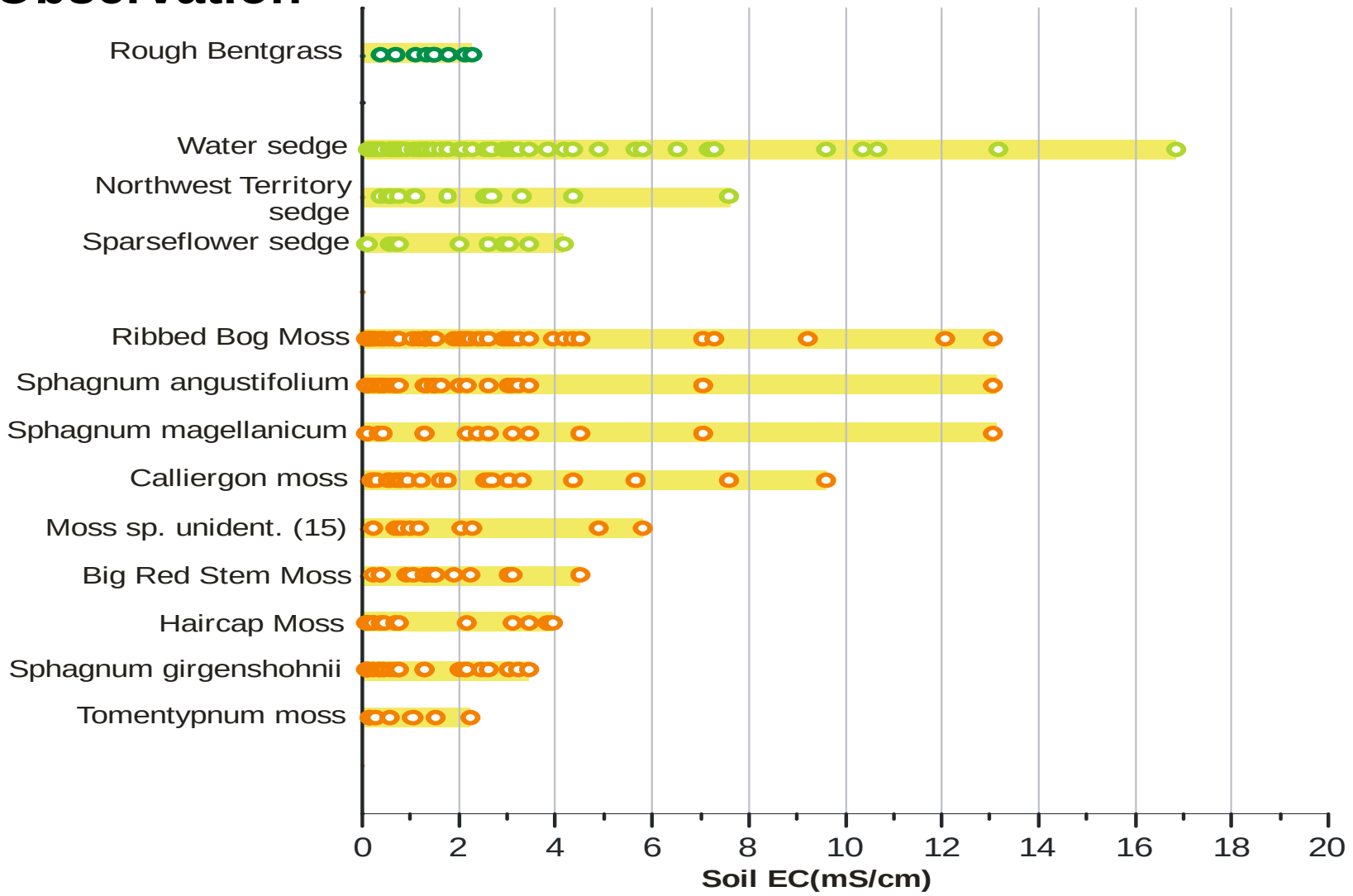


# DERA Tools: Vegetation mapping

# DERA Tools: Literature Toxicity Values



# DERA Tools: Risk Characterization from Biological Observation

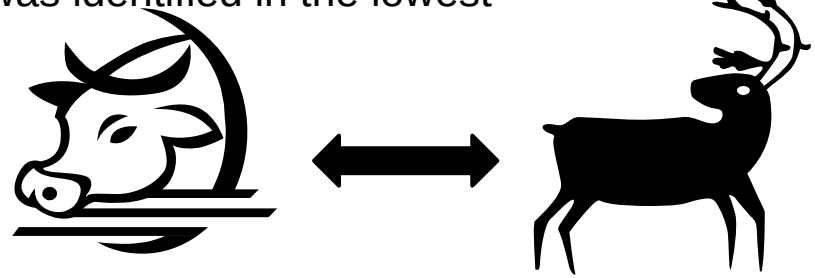


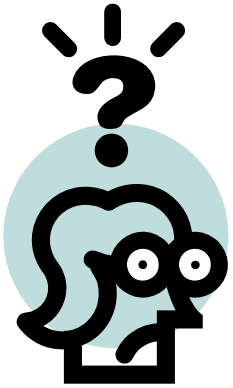
# Aliphatic Hydrocarbons: Wildlife Toxicity Reference Value Biotic Uptake Question

# Wildlife TRV: Aliphatic Hydrocarbons

## Stober (1962)_ Cow

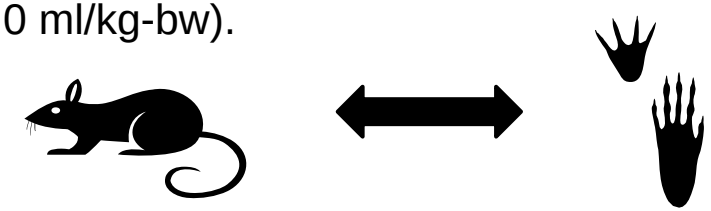
127 day oral administration of un-weathered crude oil in the diet of a 4 month old cow. Gastro-intestinal disruption was identified in the lowest dose (2.5 ml/kg-bw).

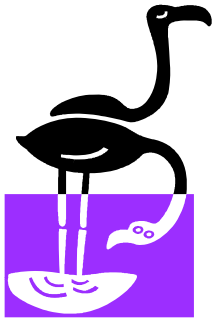




## Fisher et al, (2005) _ Rat

Gastic administration of Bonny crude oil to pregnant Wistar rats. Slight brain histological changes and cellular necrosis identified in litters from the lowest dose (3.0 ml/kg-bw).





# Aliphatic Hydrocarbons and Biotic Uptake in Terrestrial Habitat

- MacLeod *et al.* (2004) _ mathematical fugacity model predicting food chain transfer to fish, mammals and birds
  - No field validation and used carbon ranges too low ($C_3$ – $C_{12}$) for weathered crude
- Chaineau *et al.* (1996) _ field scale phytotoxicity and uptake study using 1.2% PHC contaminated soil
  - After 110 days of growth maize stems and leaves showed no detectable aliphatic or aromatic hydrocarbon
- Brandt *et al.* (2002) _ field scale, multi year quantification of poly-aromatic hydrocarbons in soil and terrestrial biota following crude oil well blow out near Trecate, Italy in 1994.
  - mice and grasshoppers consistently displayed lower tissue PAH then frogs and vegetation
  - 17 month after blowout biotic tissue levels were below those observed in soil

# Thank You

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