



Case Study Validation of the New Alberta *Reclamation Criteria for Wellsites and Associated Facilities for Peatlands*

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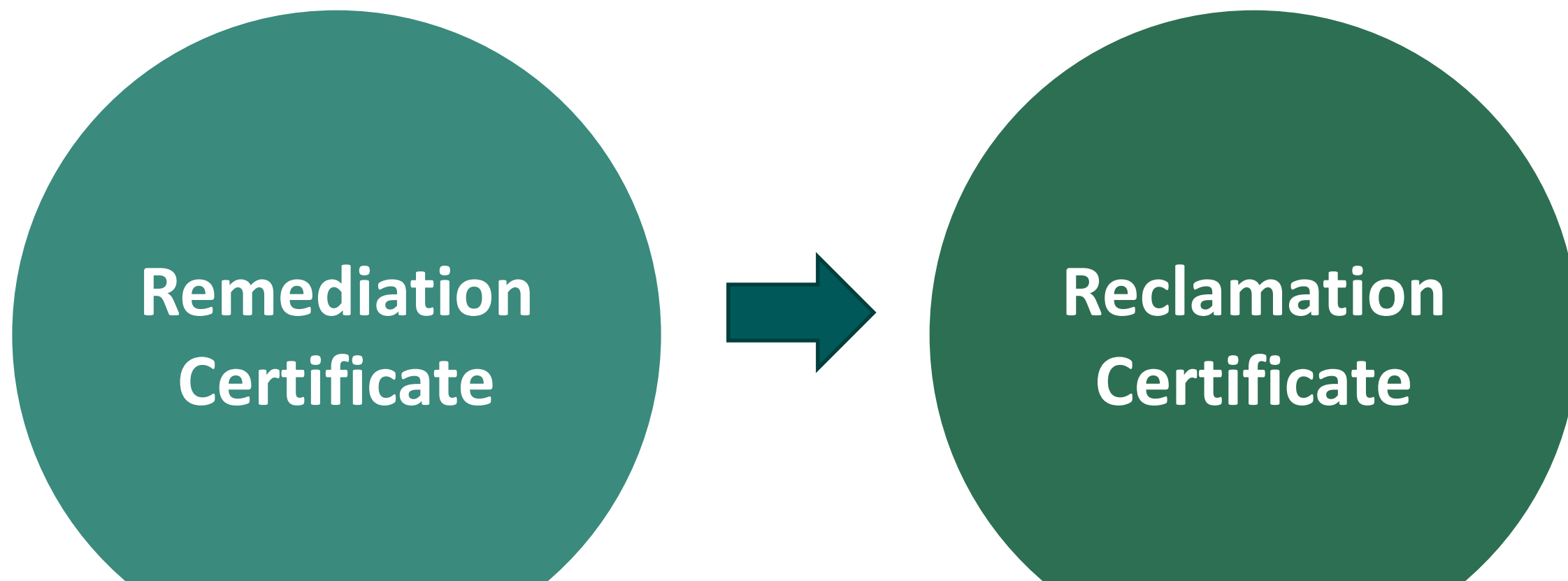
Background

- Alberta Reclamation Criteria for Wellsites and Associated Facilities (1994)
- 1995 update
- 2013 updates address cultivated, forested and native grassland ecosystems
- Oct 2015 update adds peatlands →

Reclamation Criteria for Wellsites and Associated Facilities for Peatlands



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- Reclamation criteria intended “to be used to to be used to evaluate whether a site has met or is on a trajectory to meet equivalent land capability”





Remediation
Certificate

Reclamation
Certificate

For ecological protection goals, two instruments will ideally be aligned: i.e., rely on similar lines of evidence, especially for saline water release sites addressed through site-specific risk assessment



Objectives

- critically evaluate the AEP 2015 peatlands reclamation criteria based on data obtained for a large number of boreal peatland sites from 2007 through 2015, including from reference plots and salt-affected areas
- Discuss levels of residual salt at which the peatland reclamation criteria are generally met (i.e. thresholds of residual contamination beyond which land capacity is impaired)



Outline

- summary of the AEP (9015) peatlands reclamation criteria
- the criteria in light of lines of evidence used in the evaluation of ecological risks associated with salt spills
- Relationships between residual salt concentrations, remediation goals and the reclamation criteria



Peatlands Reclamation Criteria

- apply to wellsites, pipelines, access roads, and associated facilities such as pits, campsites, log decks, and offsite sumps;
- peatlands formally defined as “lands covered by peat to a minimal depth of 40 cm”
- “to be used to evaluate whether a site has met or is on a trajectory to meet equivalent land capability”

Undisturbed Peatland Area Reclamation Criteria

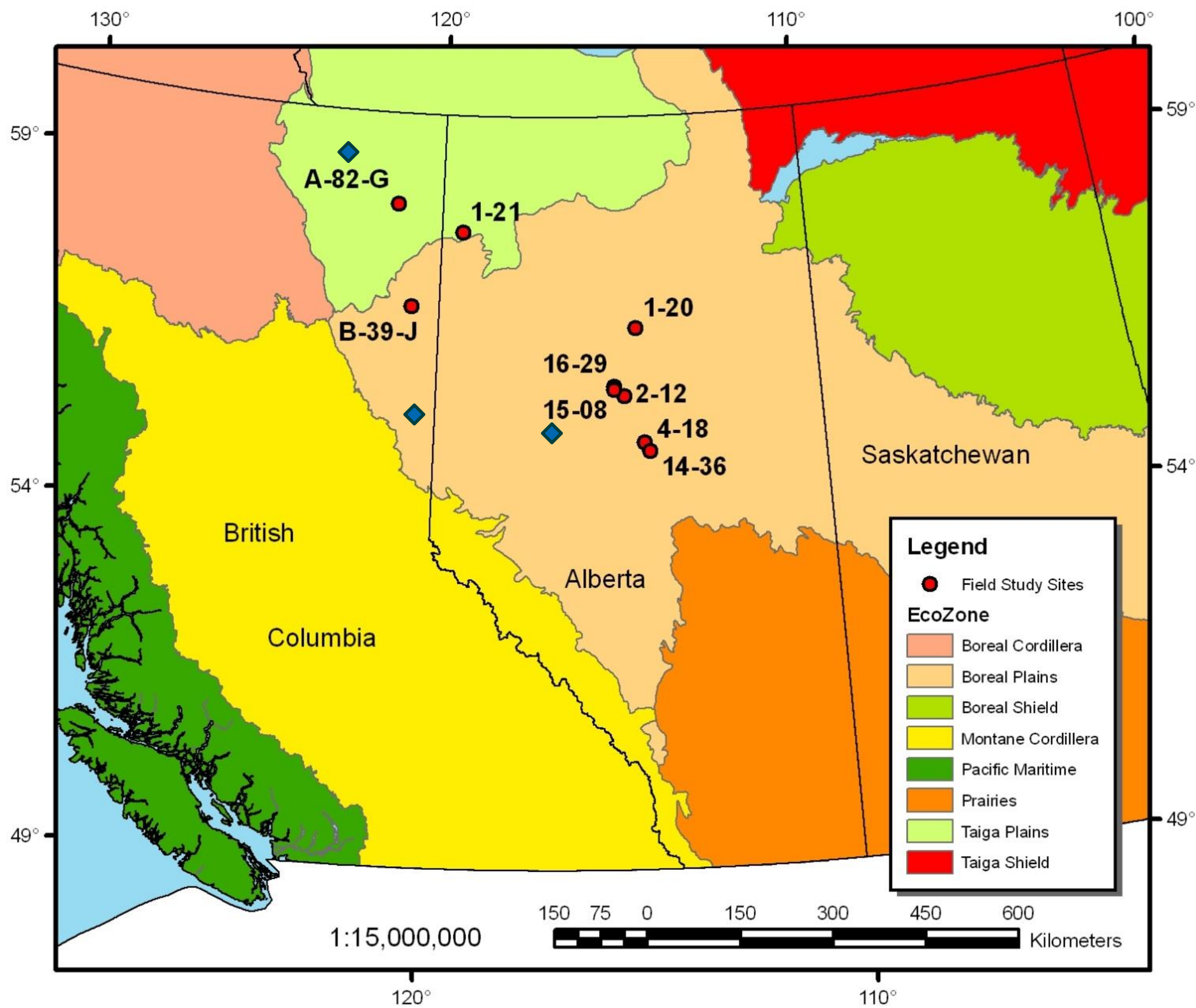
Vegetation Assessment Component	Acceptance Criteria
Desirable species cover	≥ 60% canopy cover of bryophytes ≥10% to 20% canopy cover for vascular plants
Undesirable species of vascular plants (pest species)	≤10% cover
Species richness (vascular plants)	Bog: ≥ 7 species Acid Fen: ≥ 7 species Circumneutral Fen (pH 5.5 – 7.0): ≥ 13 species Alkaline Fen (pH 7.0 – 8.5): ≥ 13 species Saline Fen: ≥ 4 species
Woody species (if present in offsite reference areas)	≥3 stems or 25 per cent canopy cover

Disturbed Peatland Area Reclamation Criteria

Vegetation Assessment Component	Acceptance Criteria
Desirable species cover	≥ 50% canopy cover of bryophytes and vascular plants
Undesirable species of vascular plants (pest species)	≤20% cover
Species richness (vascular plants)	Bog: ≥ 7 species Acid Fen: ≥ 6 species Circumneutral Fen (pH 5.5 – 7.0): ≥ 9 species Alkaline Fen (pH 7.0 – 8.5): 8 species Saline Fen: ≥ 4 species
Woody species (if present in offsite reference areas)	≥1 stem or 25 per cent canopy cover

Additional Landscape Assessment Criteria

Component	
Moisture Regime:	Does the site have the appropriate moisture regime for peat forming species?
Open Water/ponding or Upland Eco-site:	See grid assessment
Drainage:	Is the surface water flow and onsite drainage (e.g., cross site flow, direction, dispersion, ponding, depressional storage) impacting offsite vegetation?
Riparian Areas:	Have areas been reclaimed to riparian vegetation? If so, is bank stability or shore stability comparable to off-site?
Erosion:	Is soil erosion (e.g., rills and/or gullies) onsite comparable to offsite? (Based on a qualitative assessment of bare soil in relation to cover)
Bare Areas:	Is the amount, frequency, density of landscape scale bare areas onsite comparable with offsite?



Case Studies

**#1: 9 produced water spill sites
sampled in summers of 2008
and 2009**

**#2,3,4: 3 larger scale site-specific
ecological risk assessments
(2013, 2015, 2015)**

FIELD METHODS: Schematic of Sampling Scheme

Matching:

- Soil chemistry
- Surficial water chemistry
- Bryophyte characteristics
- Vascular plant characteristics
- Soil invertebrates (multiple depths)

High Salinity

1 m x 1 m

4-8 quadrats/transect

cores

4-5 transects/site

Soil:
Soil Invertebrates

FH: Fibric Horizon

ASW: Above Surface Water

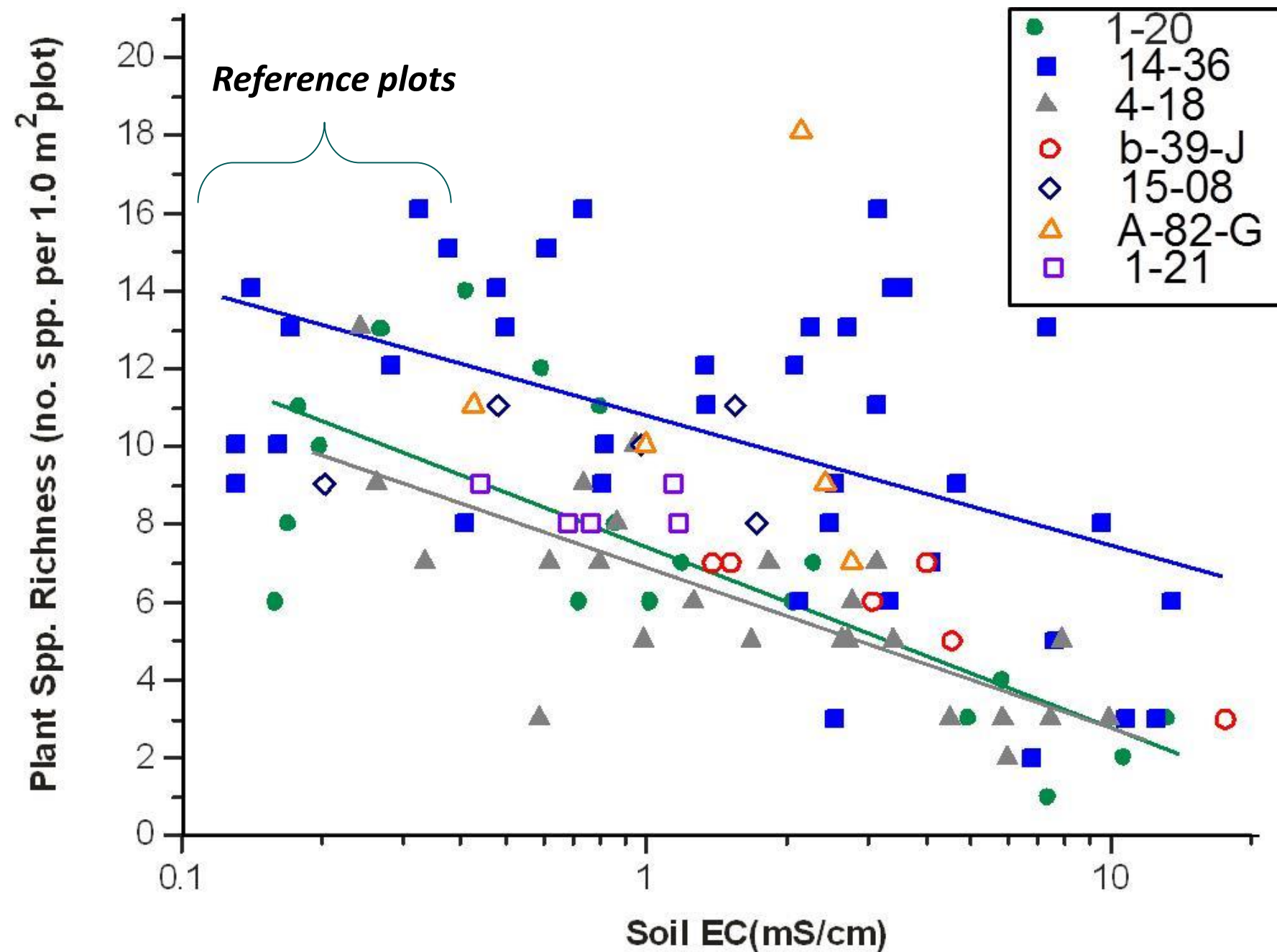
BSW: Below Surface Water
Water

Low Salinity
(background/ref)



*Elizabeth Vincer when
she's not doin' eDNA
stuff*

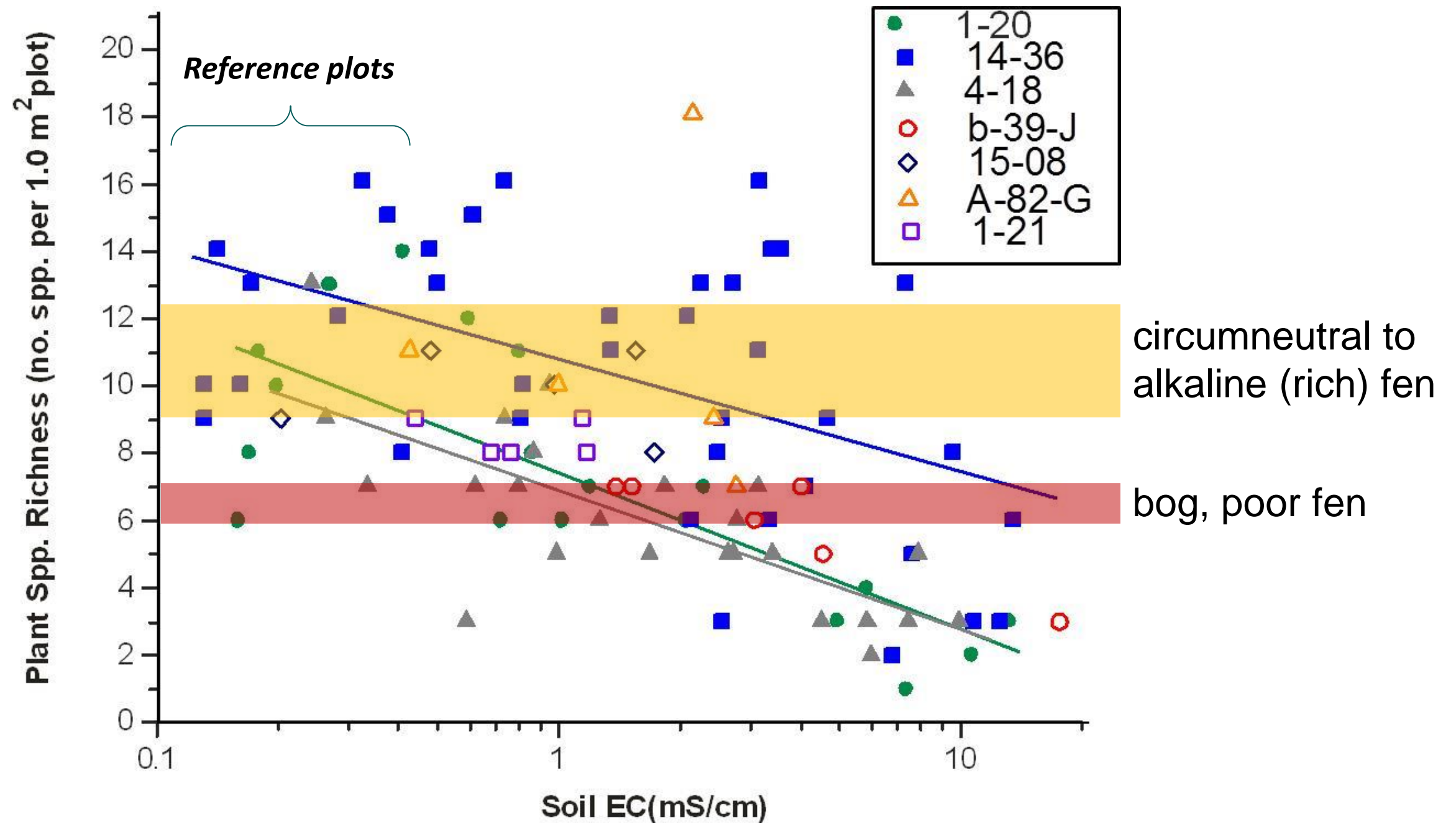
Tape demarcates
3 m x 3 m plot



Case Study #1: Vegetation species richness was inversely correlated with the log(10) of soil salinity, measured as electrical conductivity or as sat. paste salt ions.

Undisturbed Peatland Area Reclamation Criteria

Vegetation Assessment Component	Acceptance Criteria
Desirable species cover	≥ 60% canopy cover of bryophytes ≥10% to 20% canopy cover for vascular plants
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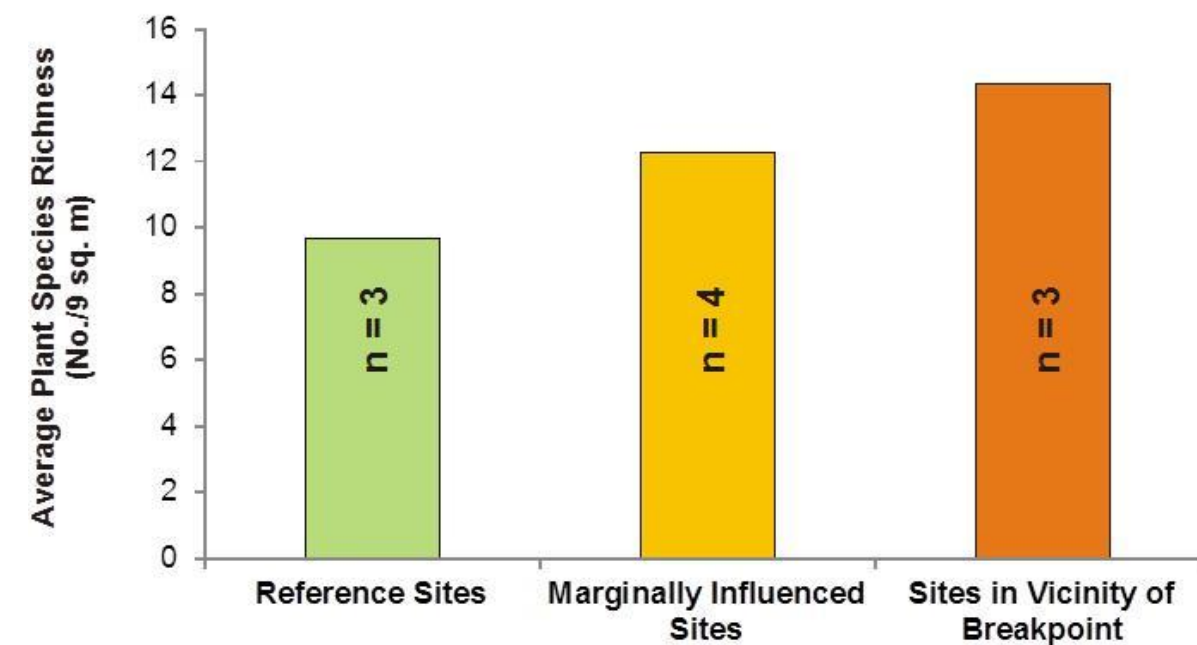
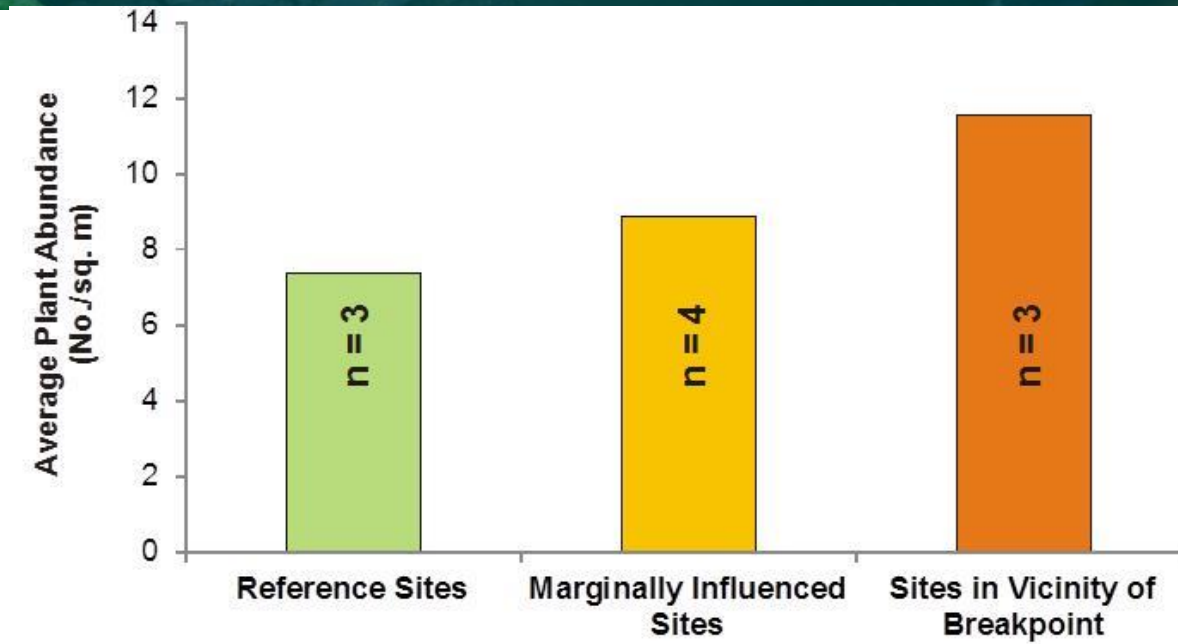
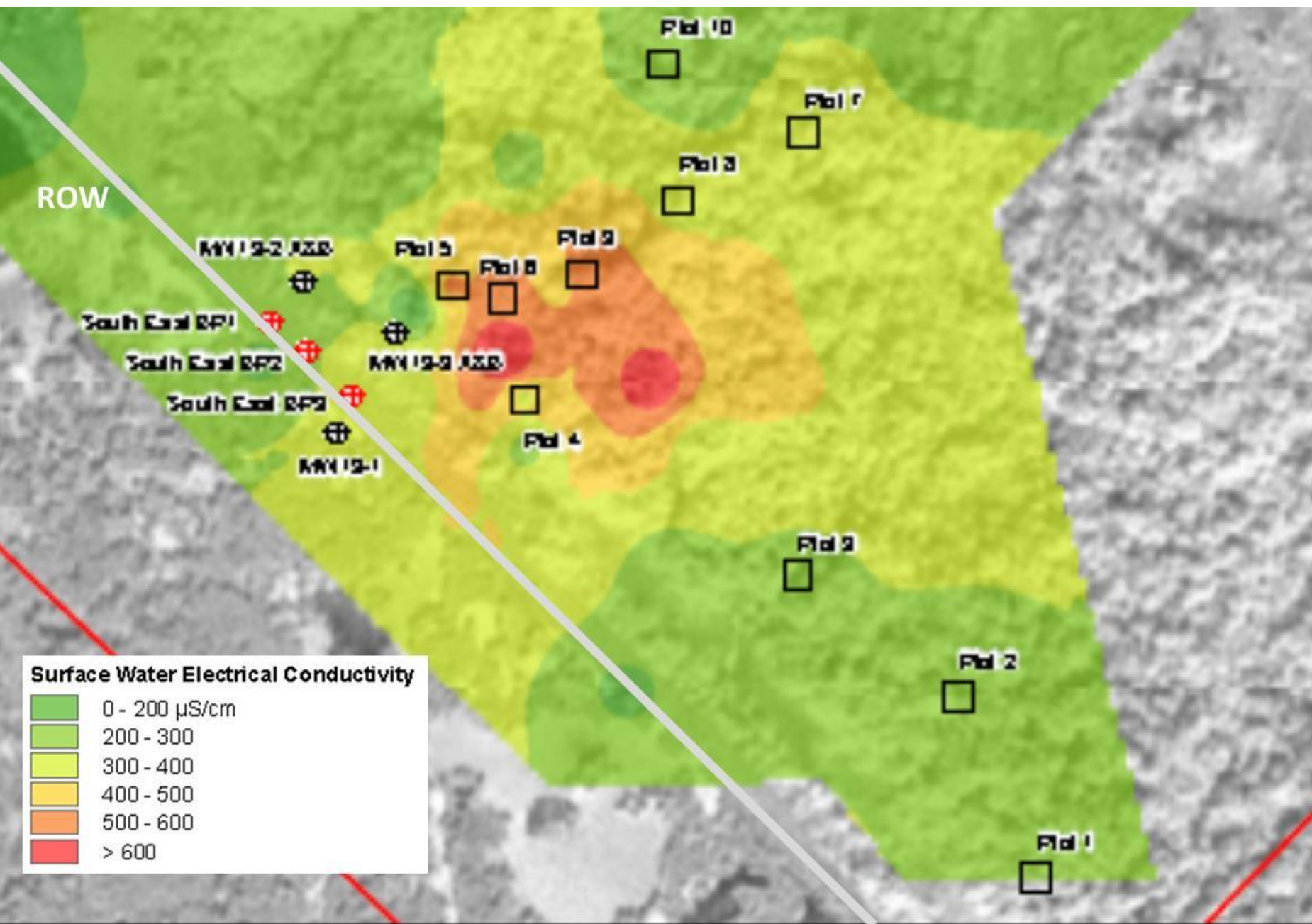


Vegetation species richness was inversely correlated with the log(10) of soil salinity, measured as electrical conductivity or as sat. paste salt ions.

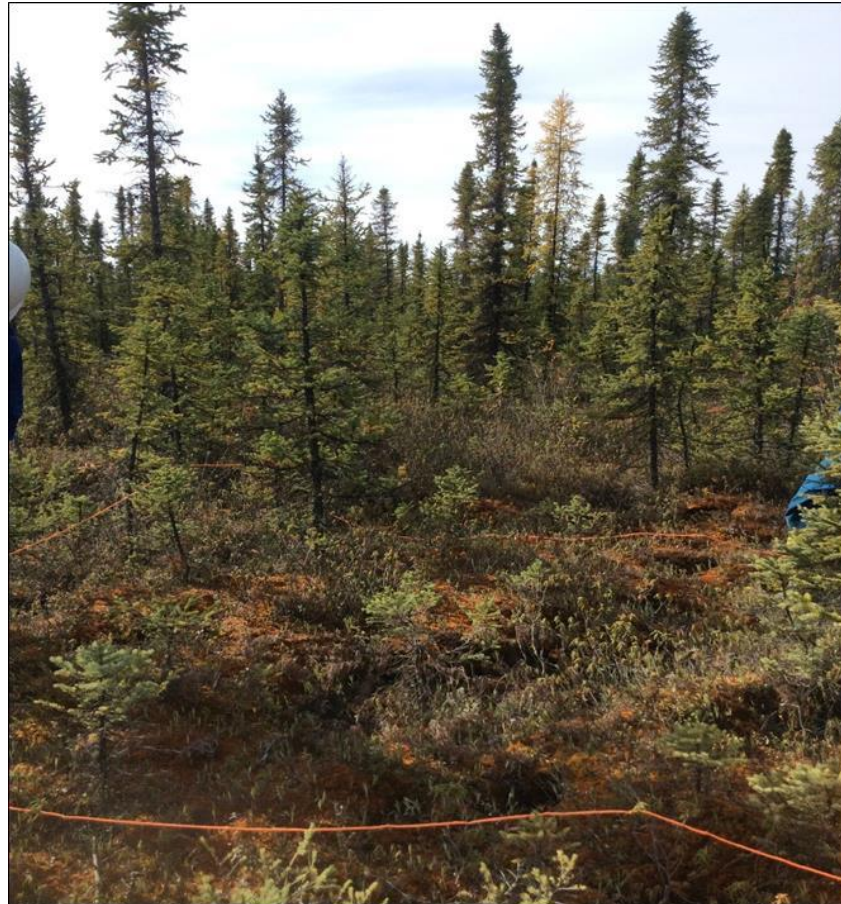
Case Study 2



...not a peatland as opposed to swamp/marsh complex

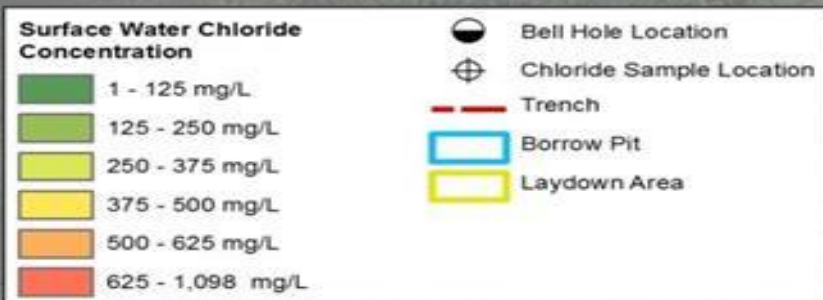


Case Study 3

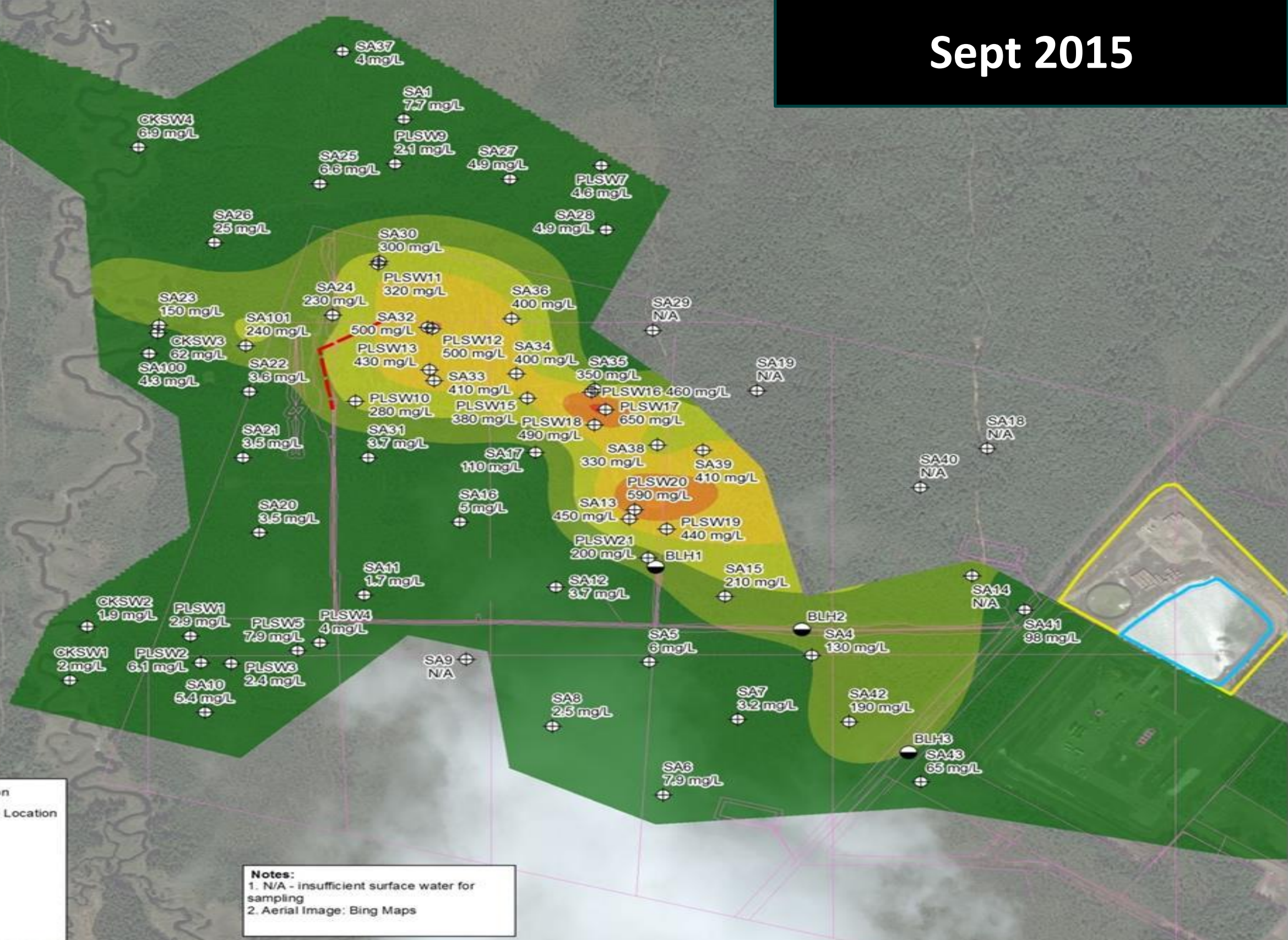


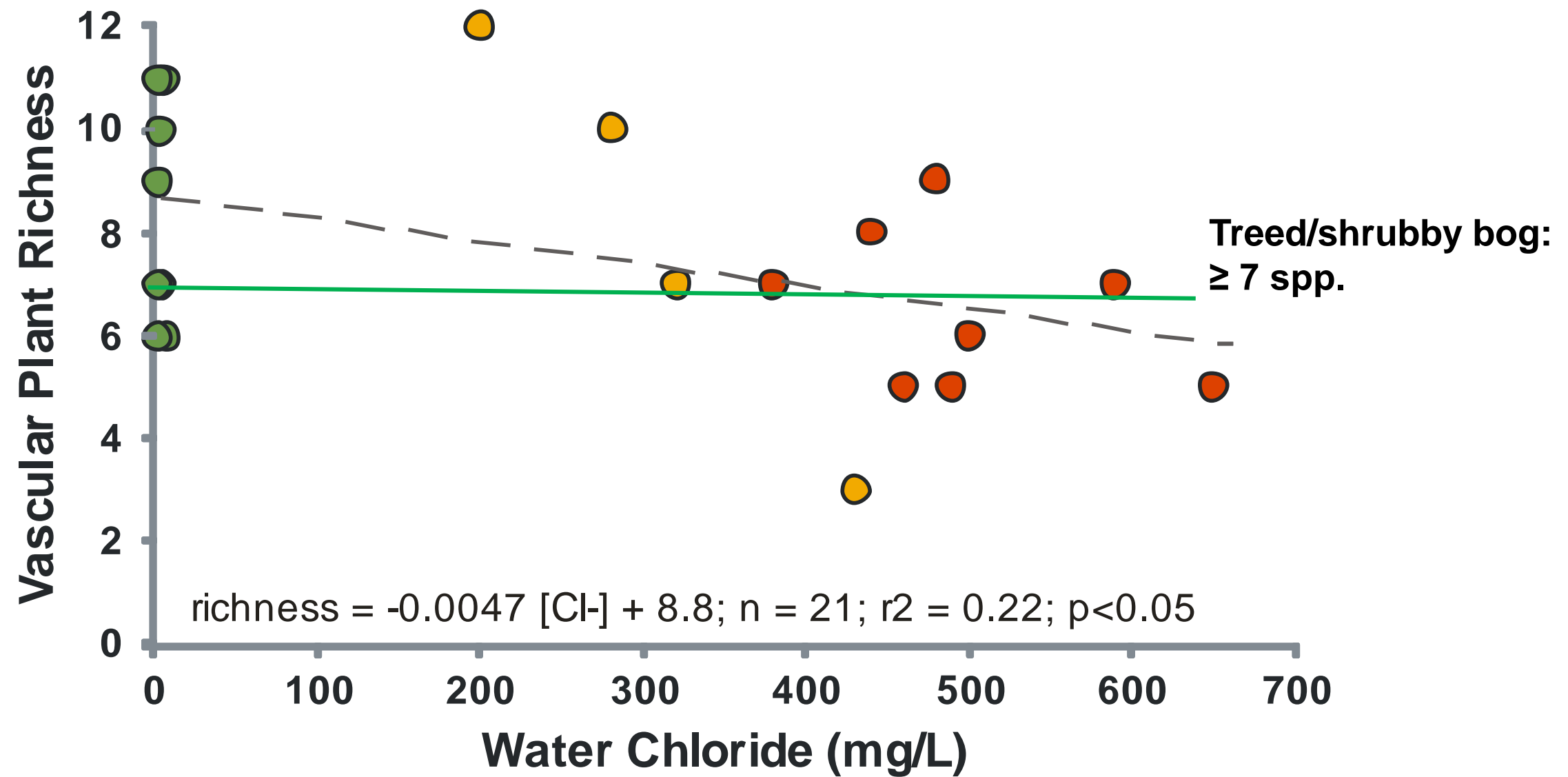
Sept 2015

200 m



Notes:
1. N/A - insufficient surface water for sampling
2. Aerial Image; Bing Maps

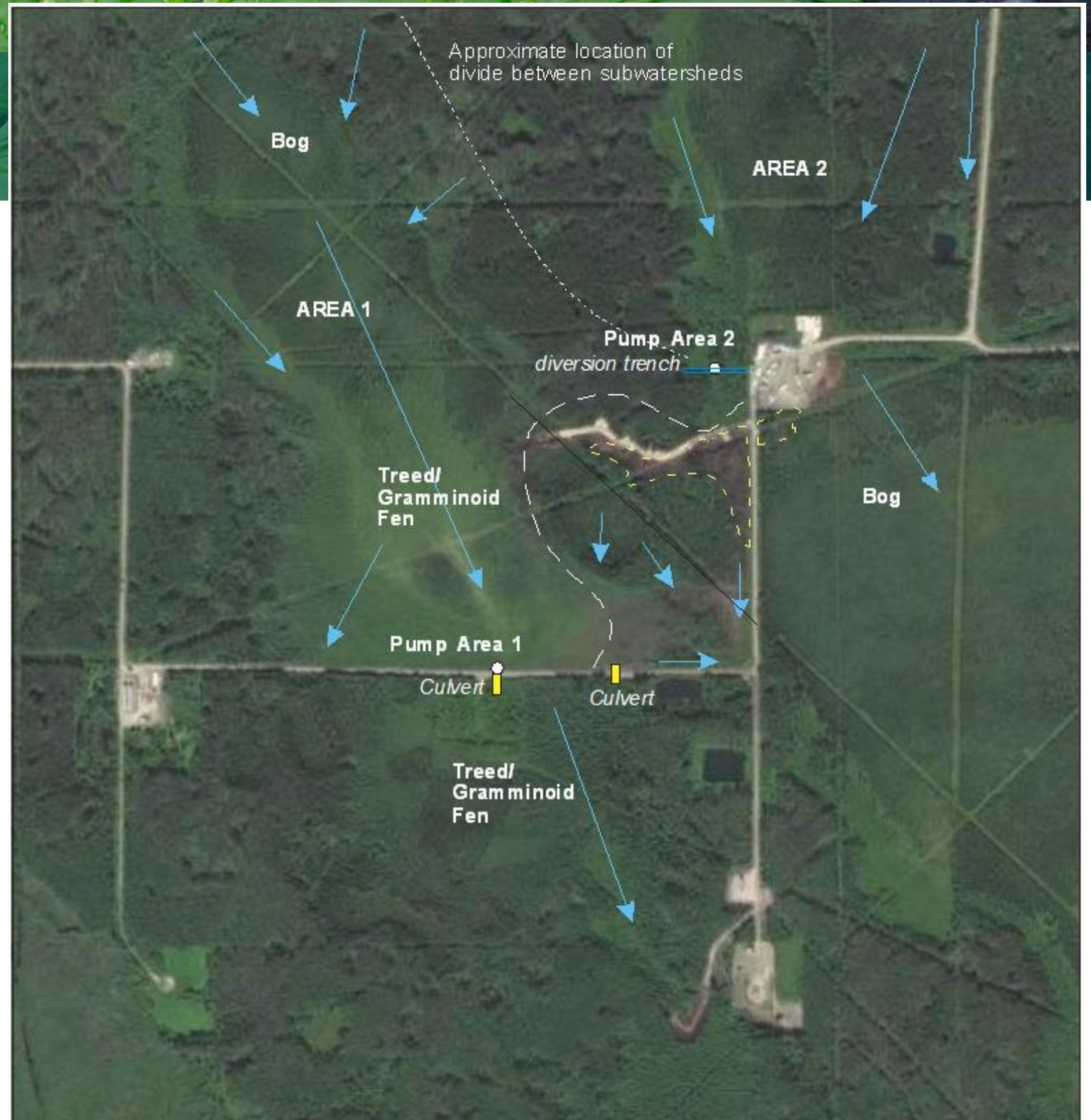




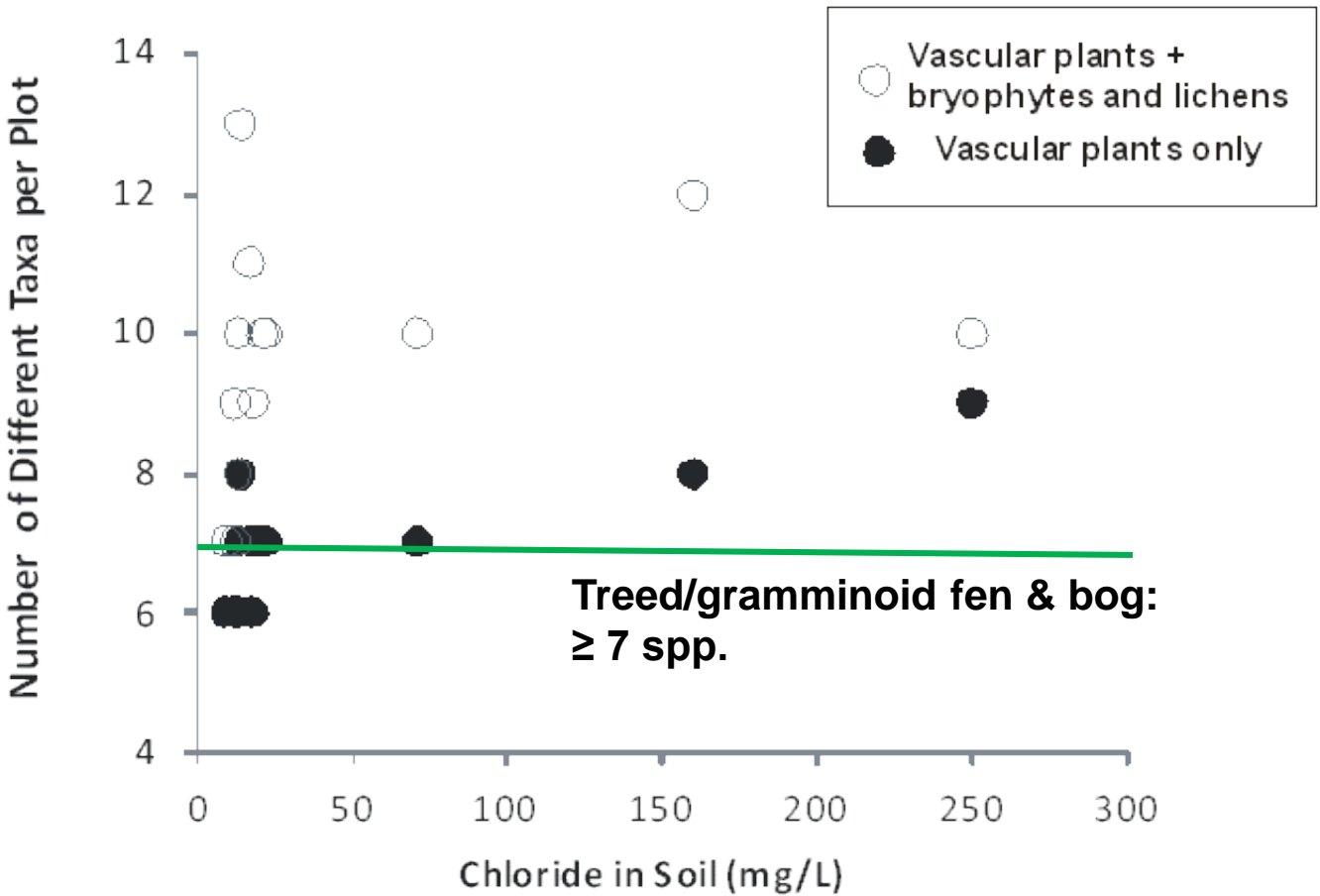
Case Study 4

Treed/gramminoid fen & bog ecosystems

pH 5.16 to 5.36



PLOT	Soil Chloride (mg/L)	Water Chloride (mg/L)	Species Richness (Vascular Plants)	Species Richness (Plants, Bryophytes, Lichens)	Vascular Plant Abundance (/m ²)	Percent Cover - Mosses
6	14	-	8	13	92.1	100%
7	21	-	7	10	80.4	100%
8	17	-	7	11	82.9	100%
4	18	-	6	9	75.3	100%
5	13	-	7	10	82.7	100%
10	13	12	6	8	71.2	100%
11	12	4.2	6	9	53.1	100%
12	9	3.5	6	7	61.3	100%
13	12	4.5	6	7	71.6	100%
1	71	-	7	10	49.8	100%
2	160	-	8	12	64.8	100%
3	22	-	7	10	89.2	100%
9	250	470	9	10	9.7	40%

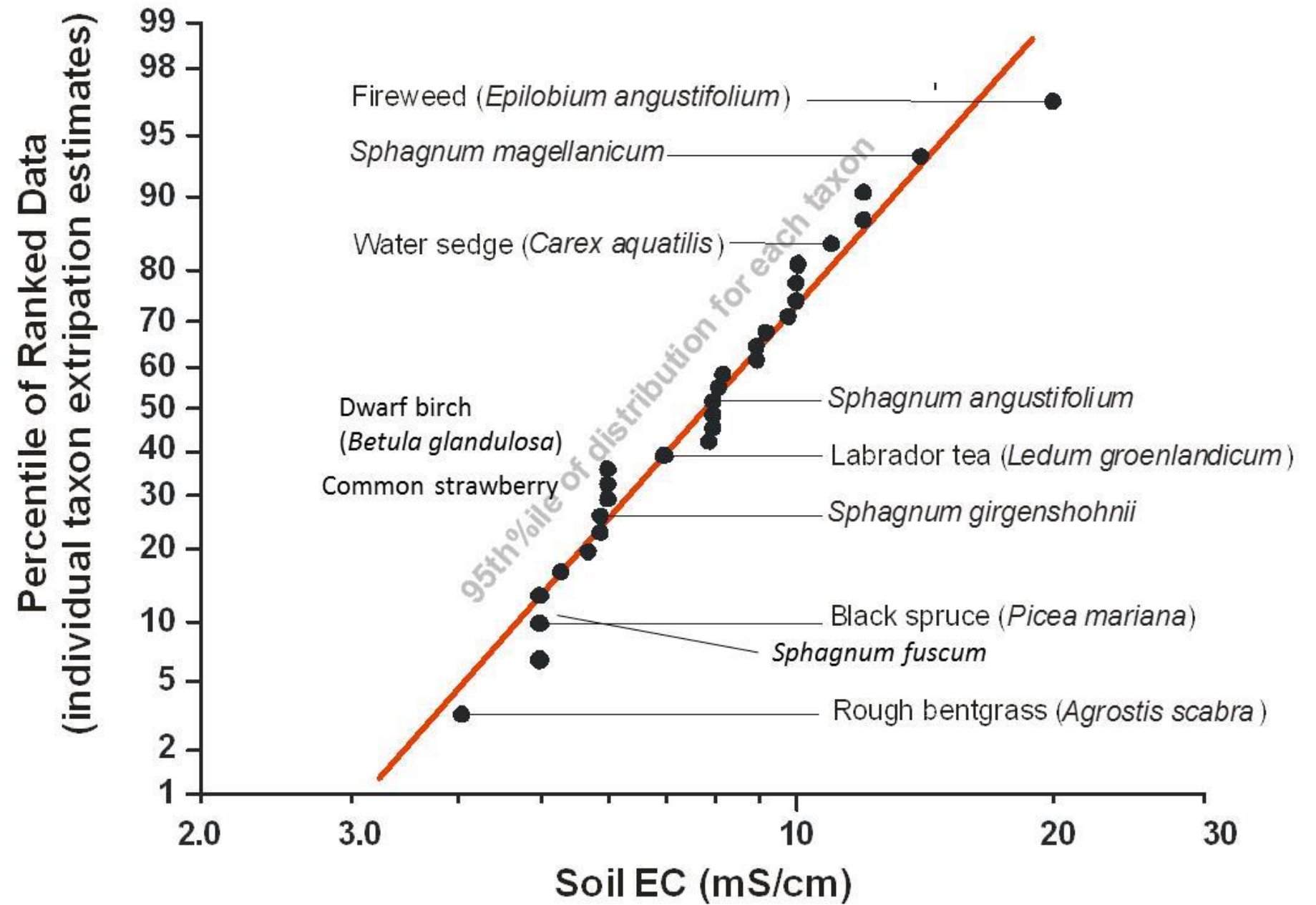




Lessons Learned

- Excellent example of strong alignment between risk-based site-specific remediation objectives and regulatory reclamation criteria based on equivalent land capacity!
- AEP (2015) Peatland Reclamation Criteria biological survey methods likely to be insufficient for –
 - burden of proof associated with detailed site-specific risk assessments in wetland settings to achieve regulatory closure
 - capturing local reference conditions, especially given the mosaic of wetland types that may be influenced by contaminant releases at a given site

Finally, ensuring adequate species richness may still result in loss of less tolerant but functionally important taxa



New information on relative sensitivity of different taxa is directly relevant for assessing degree of site impairment and recovery

Thank you. Questions?

Contact Us

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