

Western Boreal Wetlands & Orchids



Dr David Locky, PWS, PBIOL



Outline

- Wetlands!
- Threats to wetlands
- Wetlands and plant (orchid!) diversity
- Drivers of diversity in wetlands
- Orchids, protection, & conservation...

What is a wetland?

7. 9. 2000

A wetland is...

Land...

saturated with water...

to promote wetland or aquatic processes...

poorly drained soils,

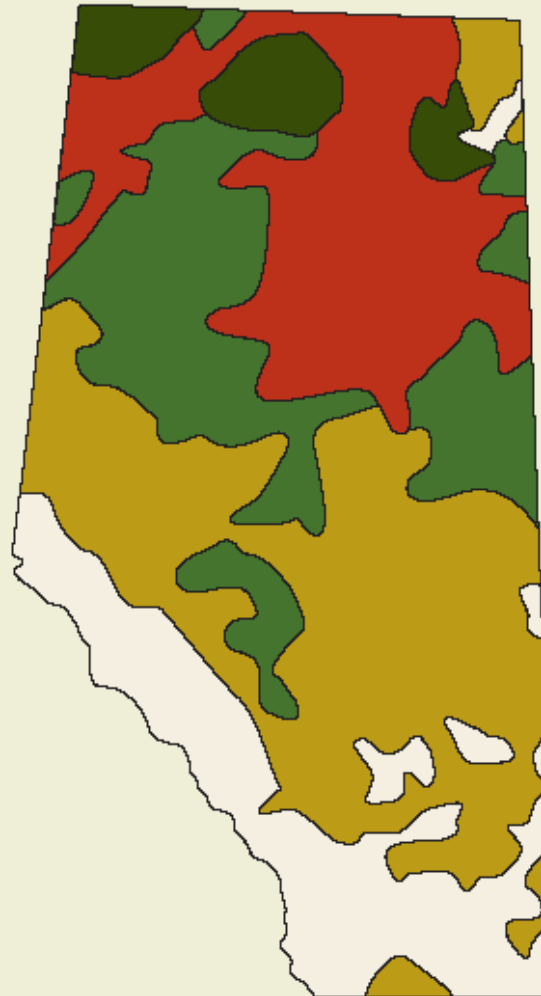
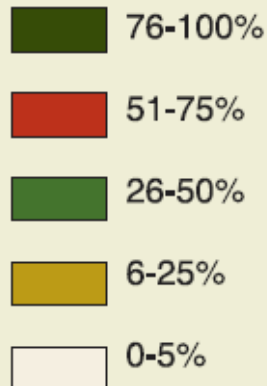
hydrophytic vegetation...

various kinds of biological activity

Alberta's Wetlands

93% of Alberta's wetlands are peatlands

WETLAND COVER



PRIMARILY
BOGS AND
FENS

PRIMARILY
MARSHES
AND PONDS

Two Main Wetland Types

Sloughs



Muskeg



Two Main Wetland Types

Sloughs

Mineral Soil Peatland

Muskeg



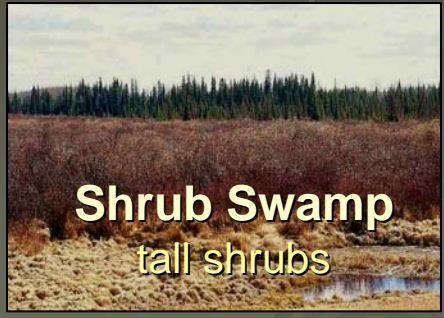
Western Boreal Wetlands

Mineral Soil

Peatland

> 40 cm peat soil

Precip



Swamp

Open - Treed

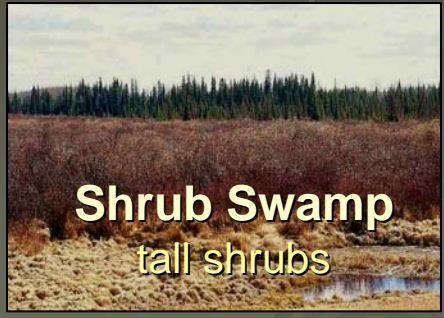
Western Boreal Wetlands

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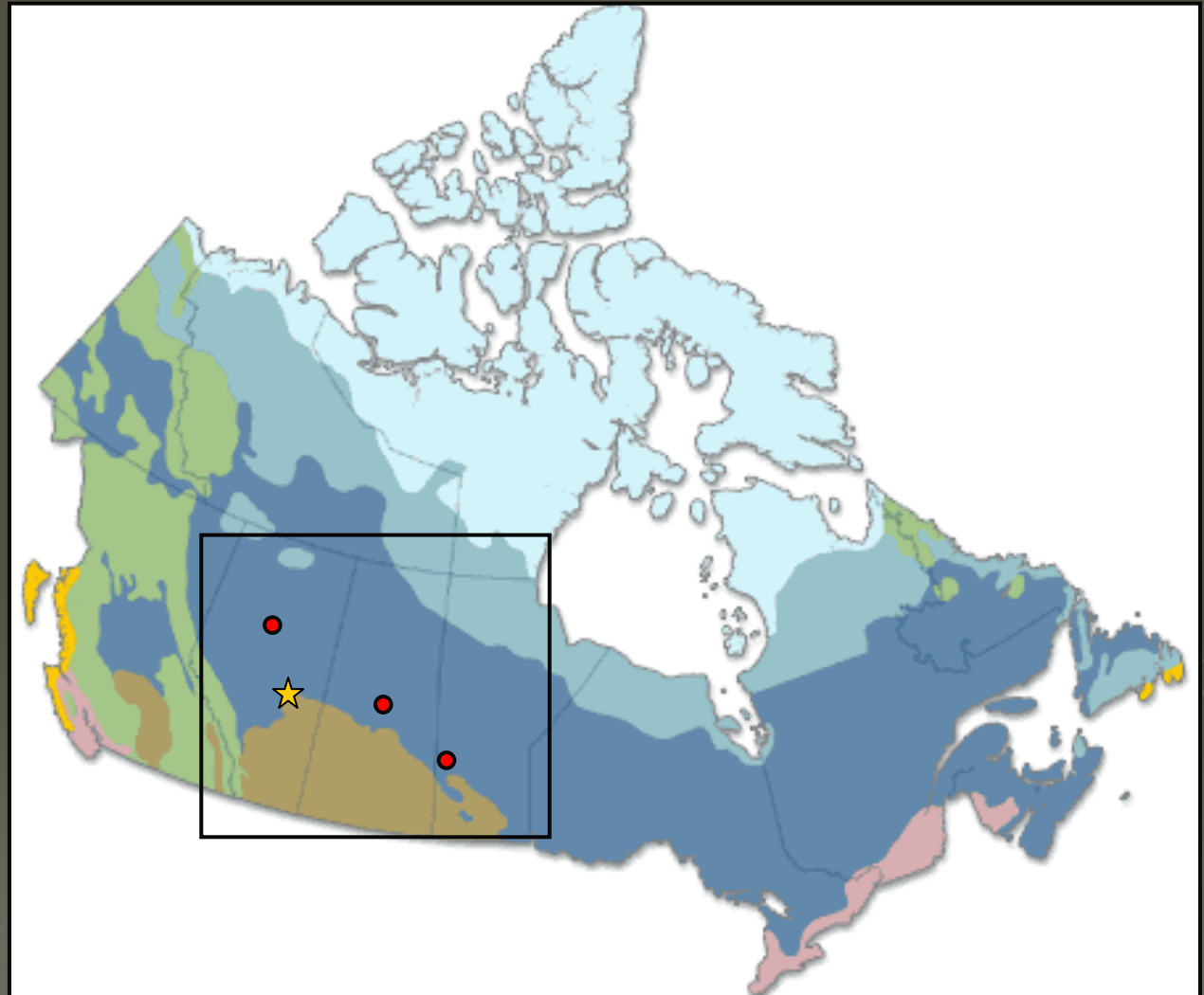
Open - Treed

Peatlands by Hydrology, Water Chemistry, & Vegetation

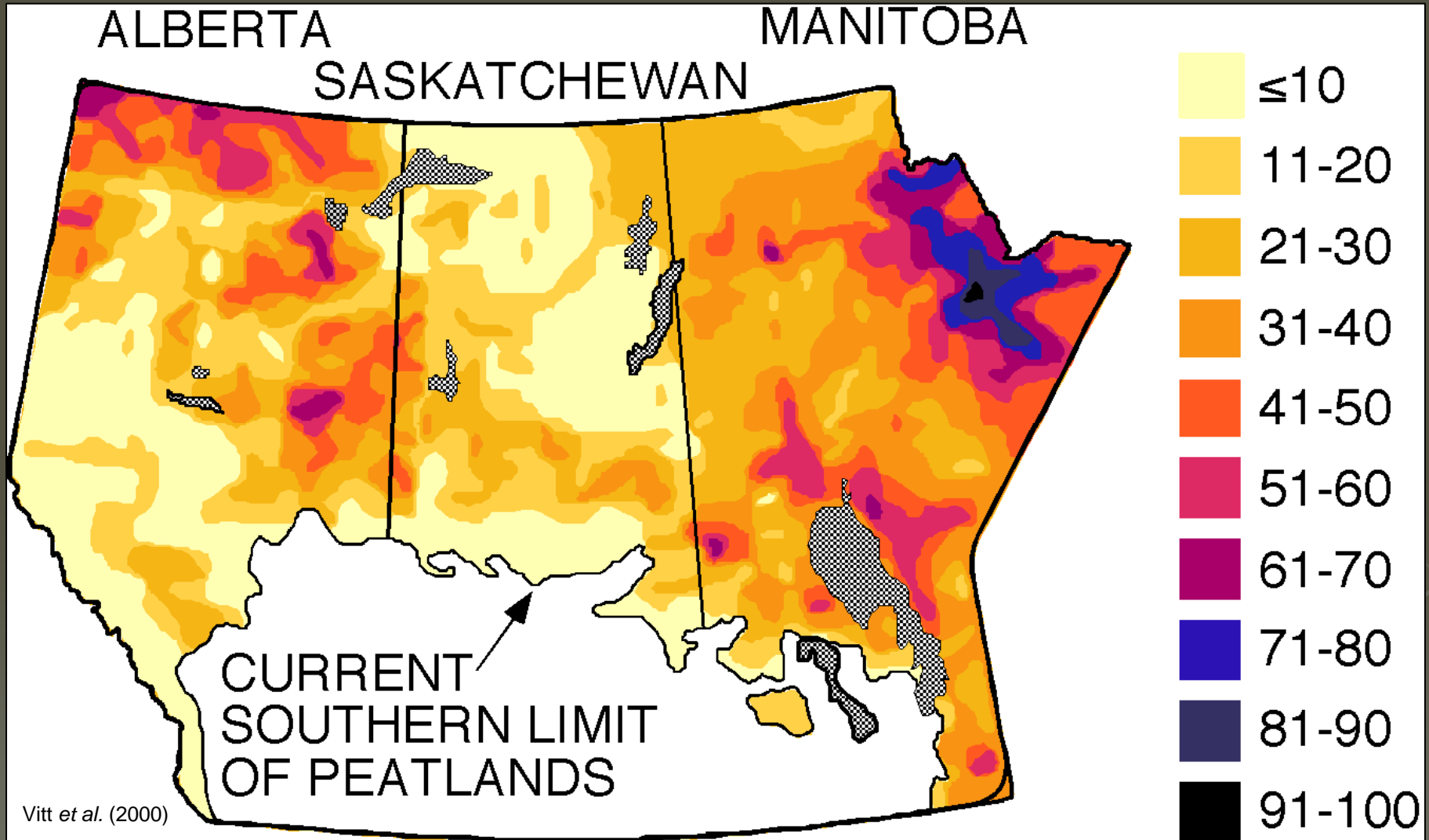
PARAMETER	BOGS	FENS		
		POOR	MODERATE-RICH	EXTREME-RICH
Hydrology	Ombrogenous (everything from above) <i>-but some geogenous for poor fens</i>	Geogenous (water from rain, runoff, & WT)	Geogenous (water from rain, runoff, and WT)	
pH	3.0-4.5	4.5-5.5	(5.5) 6.0-7.0	(6.5) 7.0-8.5
Alkalinity (μ equiv/l)	0	0 or very little	500-1000	000's
Cations (mg/l) (Ca, Na, K, Mg)	0-3	10-20	20-60	70-80
Nutrients (NO ₃ , NH ₄ , P)	No difference (don't define these systems)			
Vegetation Indicator Species	No plant indicators	Poor in indicators	Rich in indicator species	
Ground layer	<i>Sphagnum</i> spp.		Brown mosses	

Canadian Wetland Regions

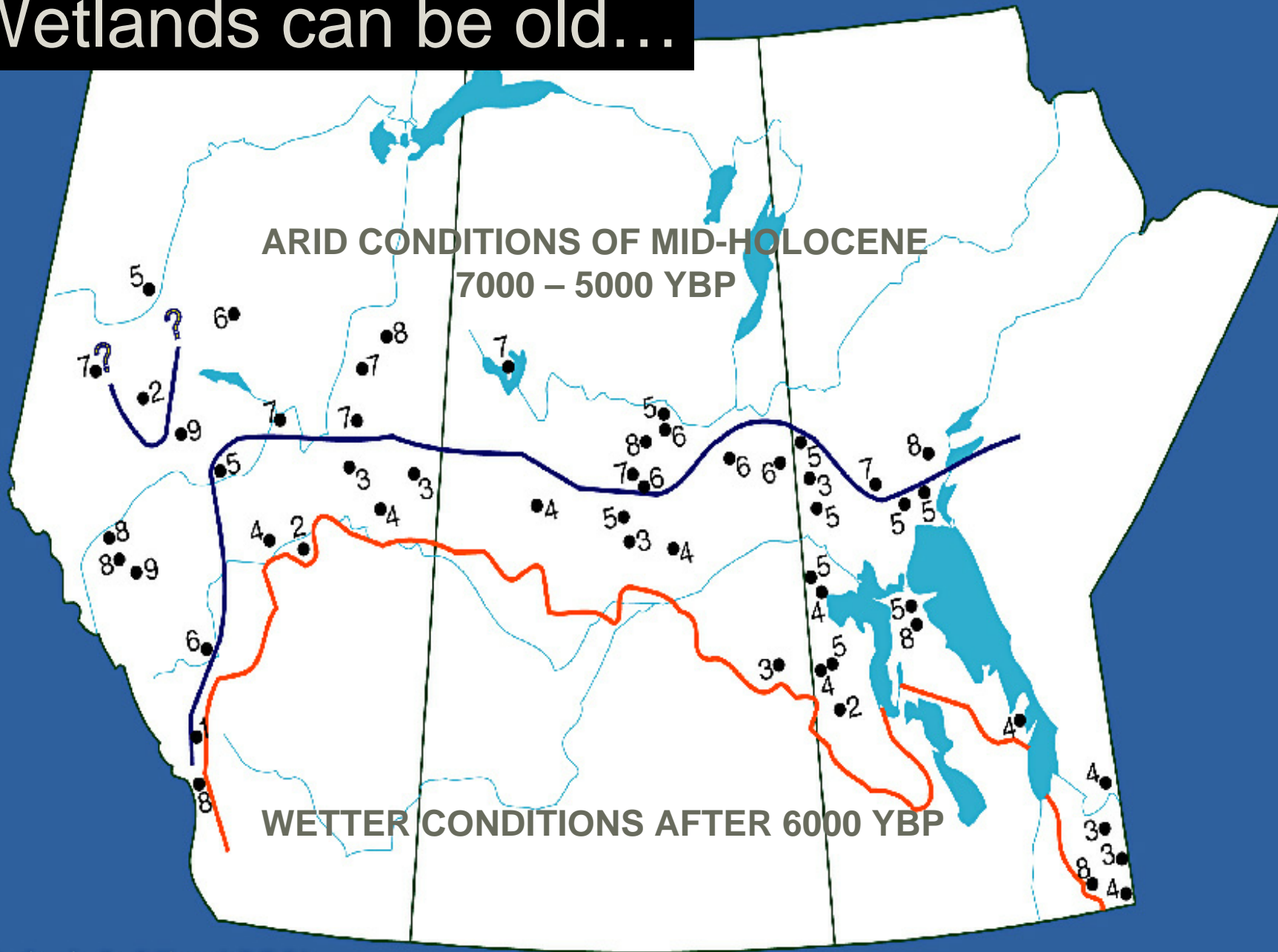
Region



Western Canadian Peatlands



Wetlands can be old...

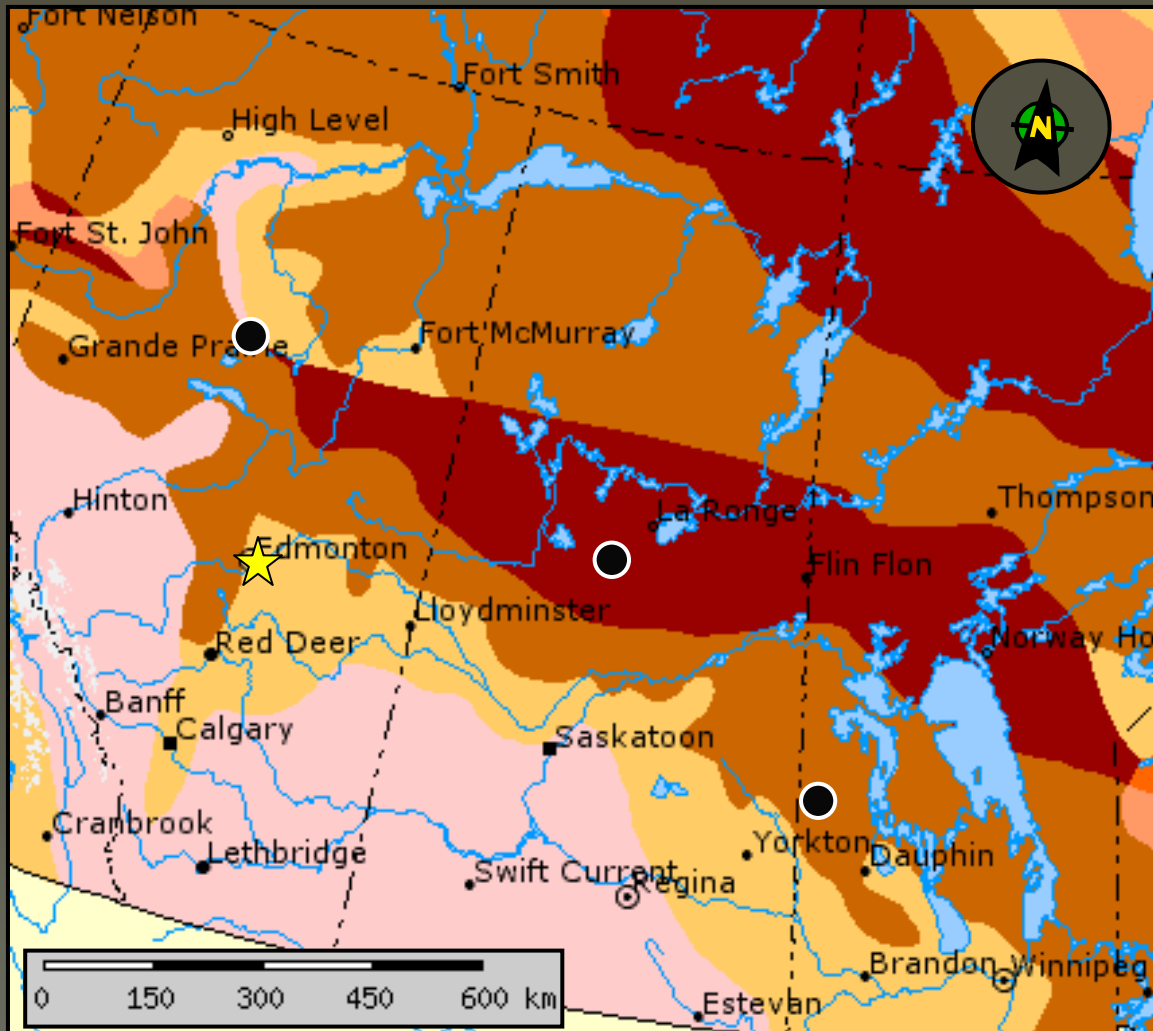


(Zoltai & Vitt 1990)

Peatlands: Direct Threats



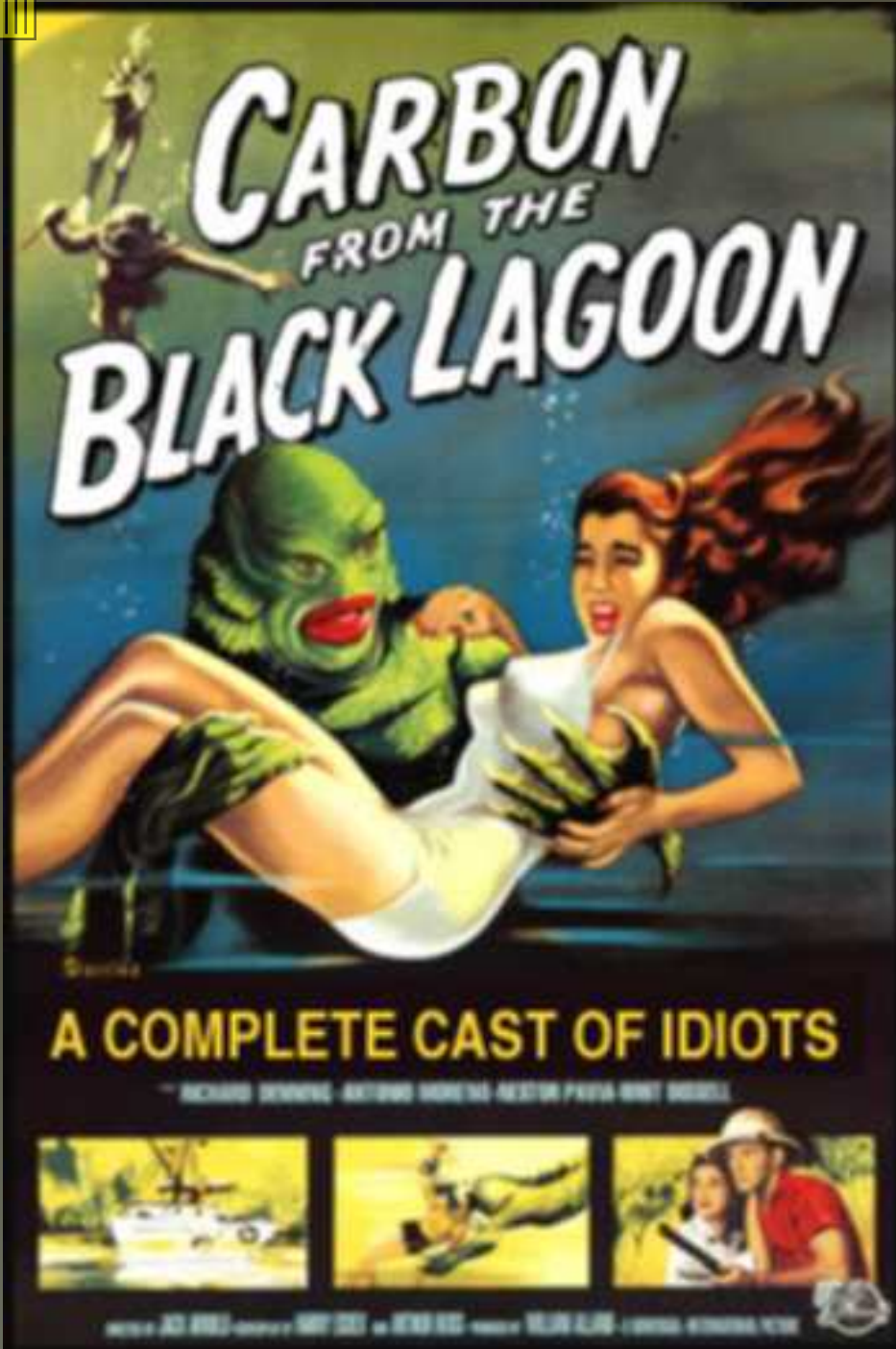
Peatlands: Indirect Threats



Sensitivity Level

- No Change
- Very Slight
- Slight
- Moderate
- Severe
- Extremely Severe

The Atlas of Canada (1999)



Ticking Time Bomb?

Wetlands contain 771 billion tonnes of greenhouse gases, one-fifth of all the carbon on Earth & about the same amount of carbon as is now in the atmosphere

Functional Importance

Sources

- Water
- Sediment
- **Biodiversity**



Sinks

- Water
- Organic Matter
- Carbon (Peat)



Transformers

- Chemistry
- Clean Water
- Slow Erosion



Peatlands & Biodiversity

- Peatlands are unique, complex ecosystems of global importance for biodiversity conservation
- Many species are only found in peatlands & are adapted to low nutrient availability & water-logging



Peatlands & Biodiversity



Ben Roston



Ben Roston

Peatlands & Biodiversity

- Species diversity may be lower, but peatlands have a higher proportion of characteristic species than upland ecosystems in the same biogeographic zone



Peatlands & Biodiversity

- Important for biodiversity far beyond their borders
 - maintain hydrological & microclimate features of adjacent areas
 - provide temporary habitats or refuge areas for upland species

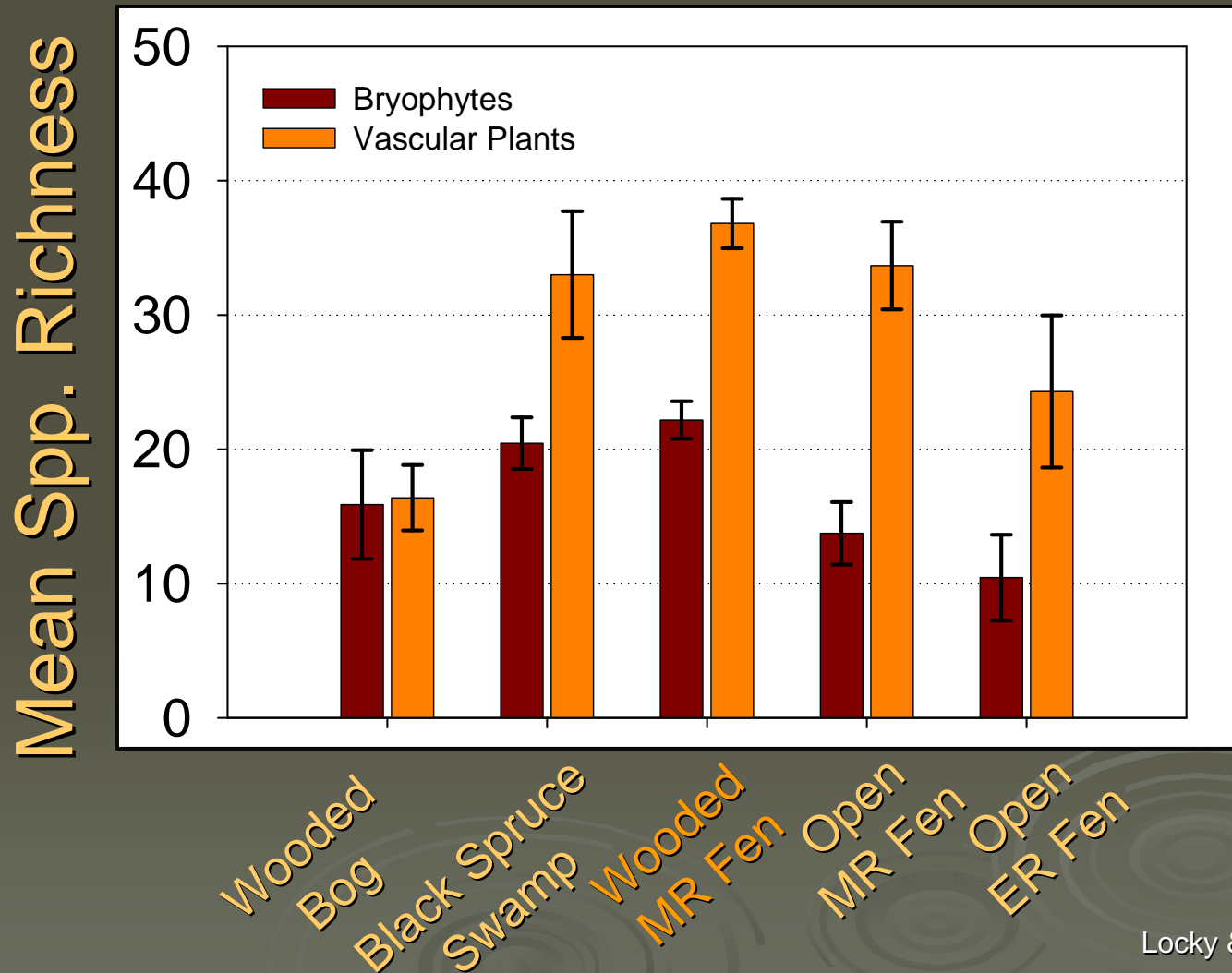


Peatlands & Biodiversity

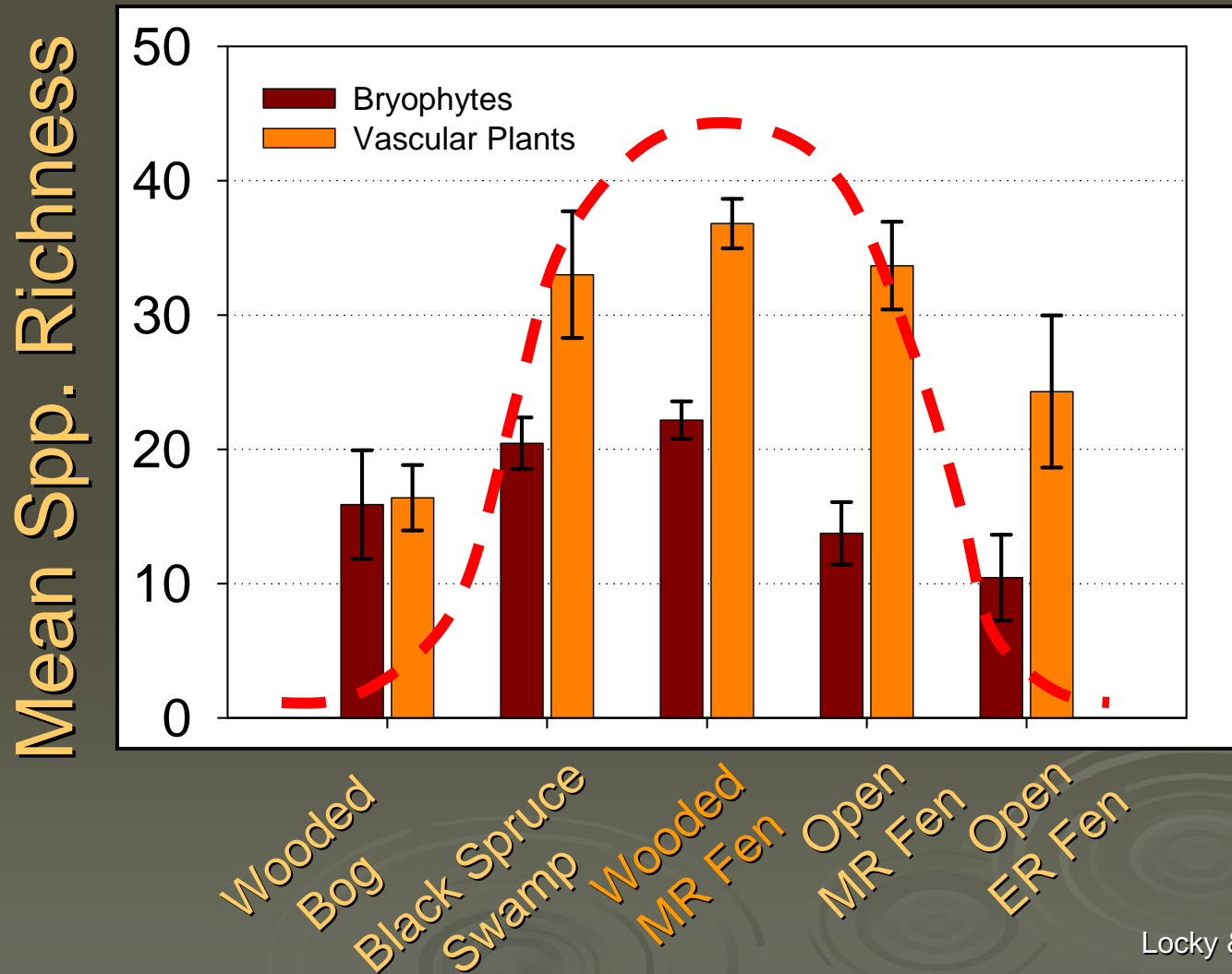
- Often the last remaining areas in degraded landscapes &, thus, mitigate fragmentation



Plant Diversity in Boreal Peatlands



Plant Diversity in Boreal Peatlands



Plant Rarity



Plant Rarity Rankings

Provincial Rank	Global Rank	Definition (Occurrences)
S1	G1	5 or fewer
S2	G2	6 – 20
S3	G3	21 – 100
S4	G4	Secure >100
S5	G5	Secure

Orchids in Boreal Peatlands

Wooded (W) or Open (O)	W	W	W	O	O	Rarity		
Scientific Name and Authority	Bog	Swamp	MR Fen	MR Fen	ER Fen	AB	SK	MB
<i>Amerorchis rotundifolia</i> Banks		*	*			S5	S5	S5
<i>Arethusa bulbosa</i> L.				*		NA	S1	S2
<i>Coralhiza maculata</i> (Raf.) Raf.			*			S3	S4/5	S4
<i>Coralhiza striata</i> Lindl.		*	*			S3?	S2/3	S3?
<i>Coralhiza trifida</i> Chatelain			*	*		S5	S4?	S5
<i>Cypripedium acaule</i> Ait.		*	*			S3	S4?	S5
<i>Goodyera repens</i> (L.) R. Br. ex Ait. f.		*	*			S5	S5	S5
<i>Liparis loeselii</i> (L.) Rich. ex Lindley			*			S1	S1/2	S3?
<i>Listera borealis</i> Morong		*	*			S4	S1	S2
<i>Listera cordata</i> (L.) R. Br. ex Ait. f.		*	*			S4	SNR	S4?
<i>Malaxis monophyllos</i> (L.) Sw.			*			S2	S1/2	S2?
<i>Malaxus paludosa</i> (L.) Sw.			*			S1	S1	S1
<i>Platanthera dilitata</i> (Pursh) Lindl. ex Beck			*	*		S3	S2	S5
<i>Platanthera hyperborea</i> (L.) Lindl.		*	*	*	*	S5	SNR	S5
<i>Platanthera obtusata</i> (Banks ex Pursh) Lindl.	*	*	*			S5	S5	S5
<i>Platanthera orbiculata</i> (Pursh) Lindl.		*				S3?	S2/3	S3
<i>Spiranthes romanzoffianum</i> Cham.			*			S5	S5	S5
Total	1	9	15	4	1			

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<i>Platanthera dilitata</i> (Pursh) Lindl. ex Beck			*	*		S3	S2	S5
<i>Platanthera hyperborea</i> (L.) Lindl.		*	*	*	*	S5	SNR	S5
<i>Platanthera obtusata</i> (Banks ex Pursh) Lindl.	*	*	*			S5	S5	S5
<i>Platanthera orbiculata</i> (Pursh) Lindl.		*				S3?	S2/3	S3
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Total	1	9	15	4	1			

Rare Orchids in Wooded MRF



Large Round-leaf Orchid – S3



Dragon's Mouth – S2



White Adder's Mouth – S2



Bog Adder's Mouth – S1

Other Rare Orchids in Wetlands...

- Stemless Lady's-Slipper (*Cypripedium acaule*) – S2: Acidic conditions...
- Broad-lipped Twayblade (*Listera convallarioides*) – S2: Mineral-soil sites...
- Slender bog orchid (*Platanthera stricta*) – S2: Wet meadows...



Rare Sedges

Hovedstar (*Carex capitata*)
© Biopix.dk: JC Schou



Capitate Sedge – S2



Sitkanature

Fox Sedge – S2

Biodiversity: Mechanisms

Wooded Bog Black Spruce Swamp Wooded MR Fen Open MR Fen Open ER Fen

Low

Low

Low

Low

Diversity, Rarity

pH/Alkalinity

Conductance

Water table

Microhabitats

High

Diversity, Rarity

High

High

High

Low

Biodiversity: Mechanisms

Wooded Bog Black Spruce Swamp Wooded MR Fen Open MR Fen Open ER Fen



Diversity, Rarity

Diversity, Rarity

pH/Alkalinity
Conductance
Water table

Microhabitats

Low

High

Low


MR = Moderate-rich
ER = Extreme-rich

Locky & Bayley 2006



Wooded Moderate-rich Fen

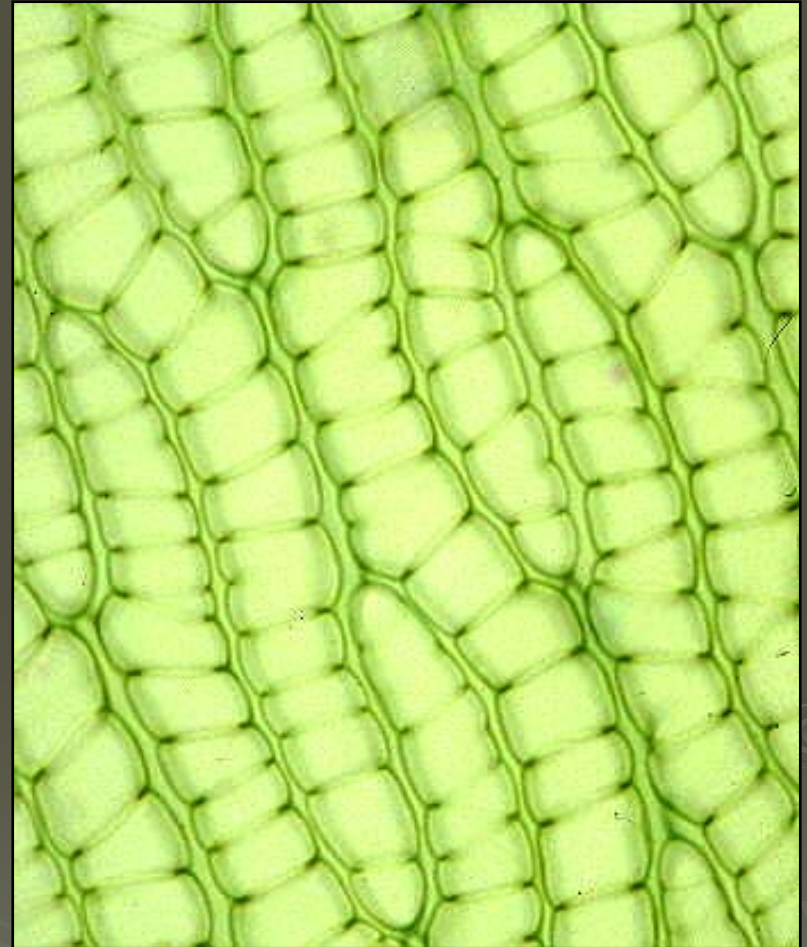
Vascular plant-bryophyte interaction

- 
- Effects on water table
 - Water storage
 - Competition
 - Supply of nutrients

Sphagnum Moss



Sphagnum leaves (40X)



Sphagnum hyaline cells in leaf (400X)

Sphagnum Moss & Orchids

Bog Adder's Mouth – S1



Warnstorff's sphagnum

Malaxis paludosa

- Frequent in Northern Europe, extremely rare in N.A.
- Unknown on the continent until 1904 (MN)
- Referred to as rarest orchid in North America
- Also easily overlooked
 - Small stature, thin stem
 - Smallest (green) flowers?
 - Green, like *Sphagnum* hummocks it likes
 - Leaves (2) often concealed in mosses



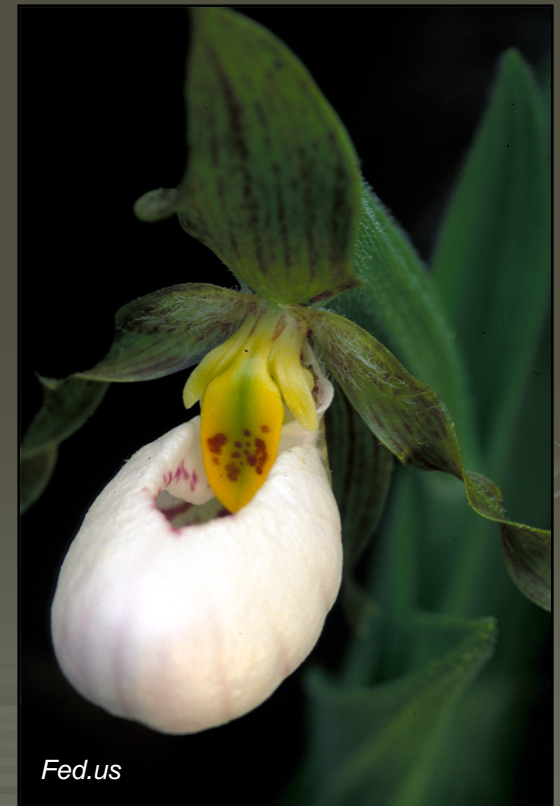


Protection of Orchids

- Legislation protecting rare plants in Canada is fragmentary and of limited effect
- Plants are a provincial rather than a federal responsibility; each province must enact its own endangered species legislation
- Feds under CITES is able to provide protection for plants that are on an internationally accepted list of controlled species: in Canada all orchids and cacti

Protection of Orchids

- In Canada, several species occur that are now so rare and restricted that their continued survival is endangered
- E.g., small white lady's slipper (*Cypripedium candidum*) was first plant protected under Ontario law -- now only in a few small colonies in SW Ontario, SK, MB, along with several isolated stations in US



Protection of Orchids

- Canada also has the Species at Risk Act (SARA)
- In AB, rare plants are not protected unless they are a SARA species
- But there are no SARA orchids in AB!

SARA Orchids (Canada)

I. Extirpated Species

None

II. Endangered Species

Eastern Prairie Fringed-orchid, (*Platanthera leucophaea*)

Western Prairie Fringed-orchid, (*Platanthera praeclara*)

Small White Lady's-slipper, (*Cypripedium candidum*)

Purple Twayblade, (*Liparis liliifolia*)

III. Threatened Species

Phantom Orchid, (*Cephalanthera austiniae*)

III. Special Concern Species

None

Other Protection Tools

- Water for Life: AB's Strategy for Sustainability
- NAWMP
- Protected Areas
- Conservation Easements
- Ecological Gifts
- Municipal Bylaws

Wetland Policy in Alberta

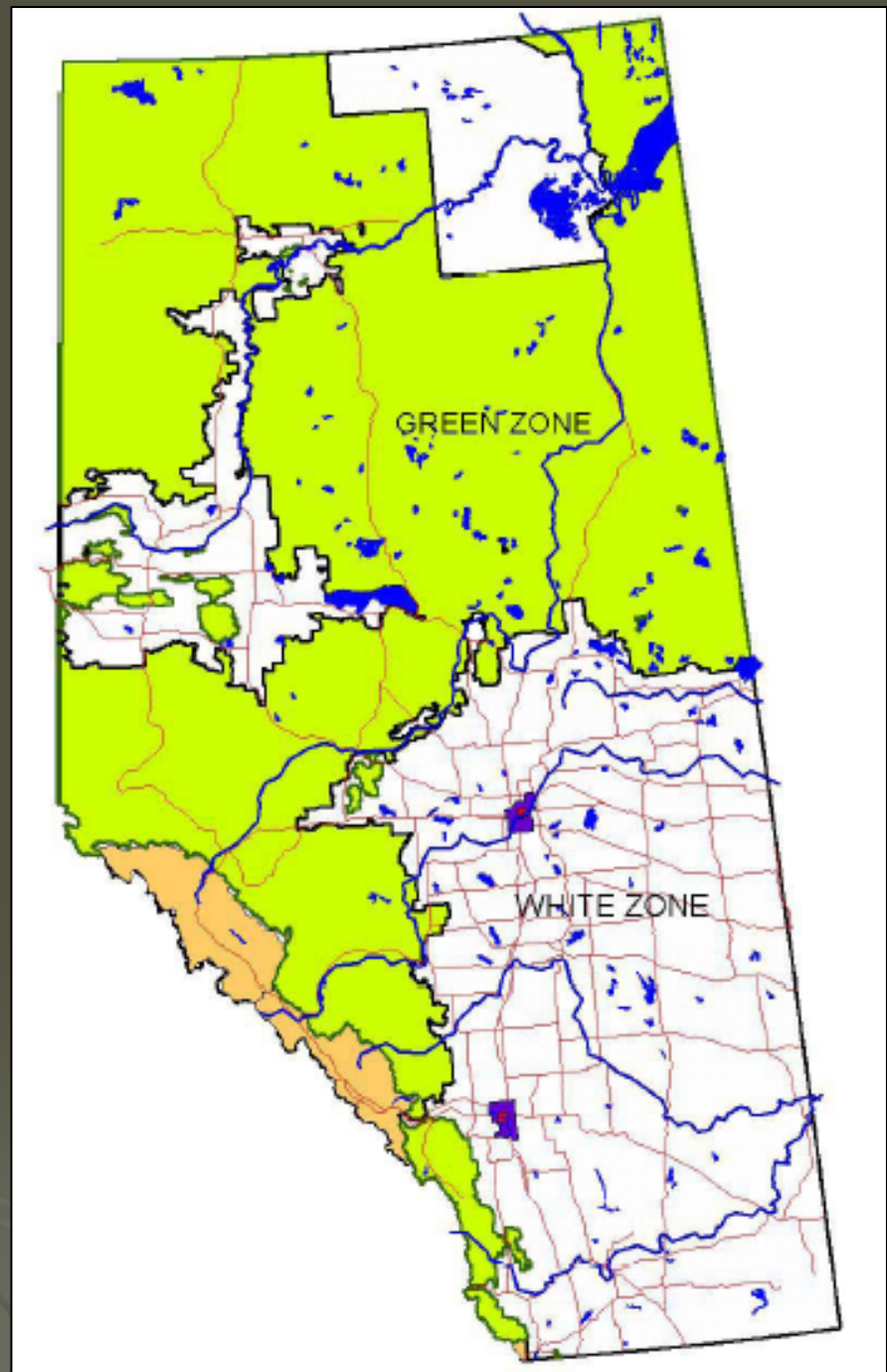
Zone Specific

Green Zone

- Forestry, Resource Extraction
- Peatlands

White Zone

- Agriculture, Urbanization
- Prairie potholes



Terrestrial Ecozones of Canada

- | | | | |
|--|-------------------|---|--------------------|
|  | Arctic Cordillera |  | Boreal Shield |
|  | Northern Arctic |  | Atlantic Maritime |
|  | Southern Arctic |  | Mixedwood Plains |
|  | Taiga Plains |  | Boreal Plains |
|  | Taiga Shield |  | Prairies |
| | |  | Taiga Cordillera |
| | |  | Boreal Cordillera |
| | |  | Pacific Maritime |
| | |  | Montane Cordillera |
| | |  | Hudson Plains |



Ecoregions

- Large enough to encompass natural processes (fire & flooding) & capture representative plant and animal species, & natural communities
- ...Yet small enough to serve as platforms for conservation planning and action.



Ecoregions & Conservation

- More ecologically relevant planning unit than political boundaries
- Standard tool for conservation planning from local to continental scales
 - Nature Conservancy
 - World Wildlife Fund
 - USEPA
- Suitable for peatlands and that which lies within?

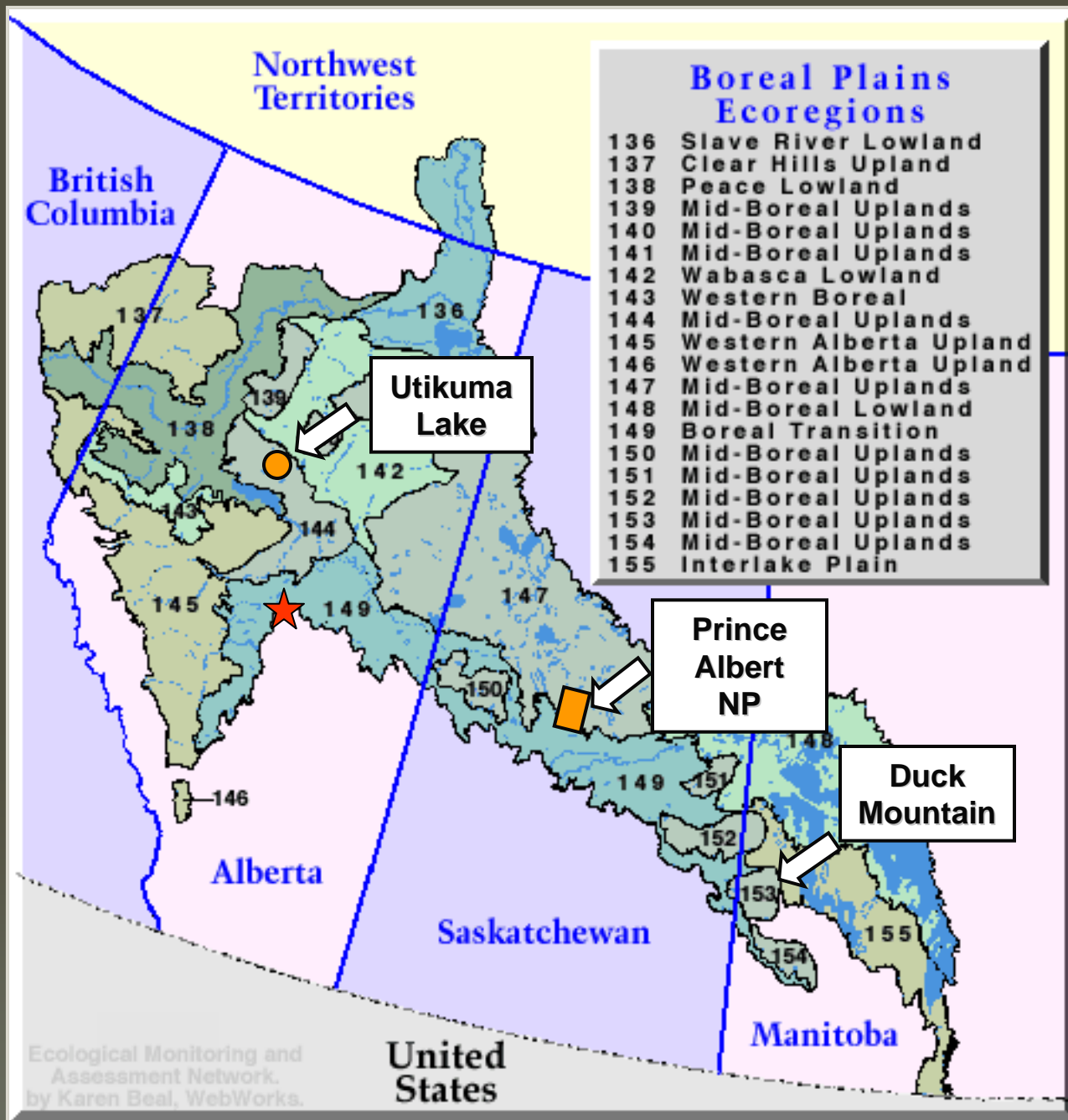




Case Study: Western Boreal Fens

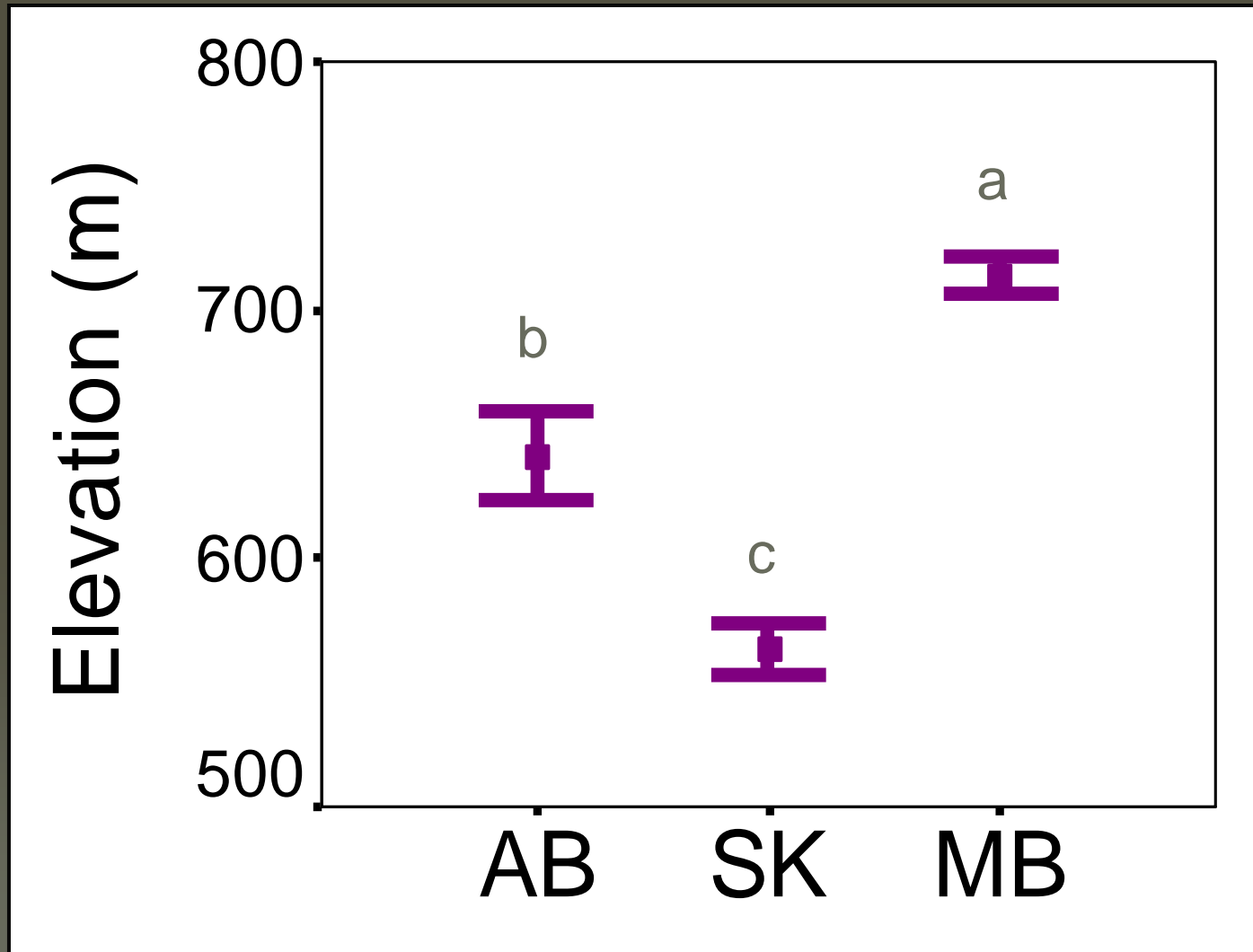
What happens when you examine plant diversity, species rarity, & community composition in WMR fens along a longitudinal & a latitudinal transect in the Mid-Boreal Uplands Ecoregion?



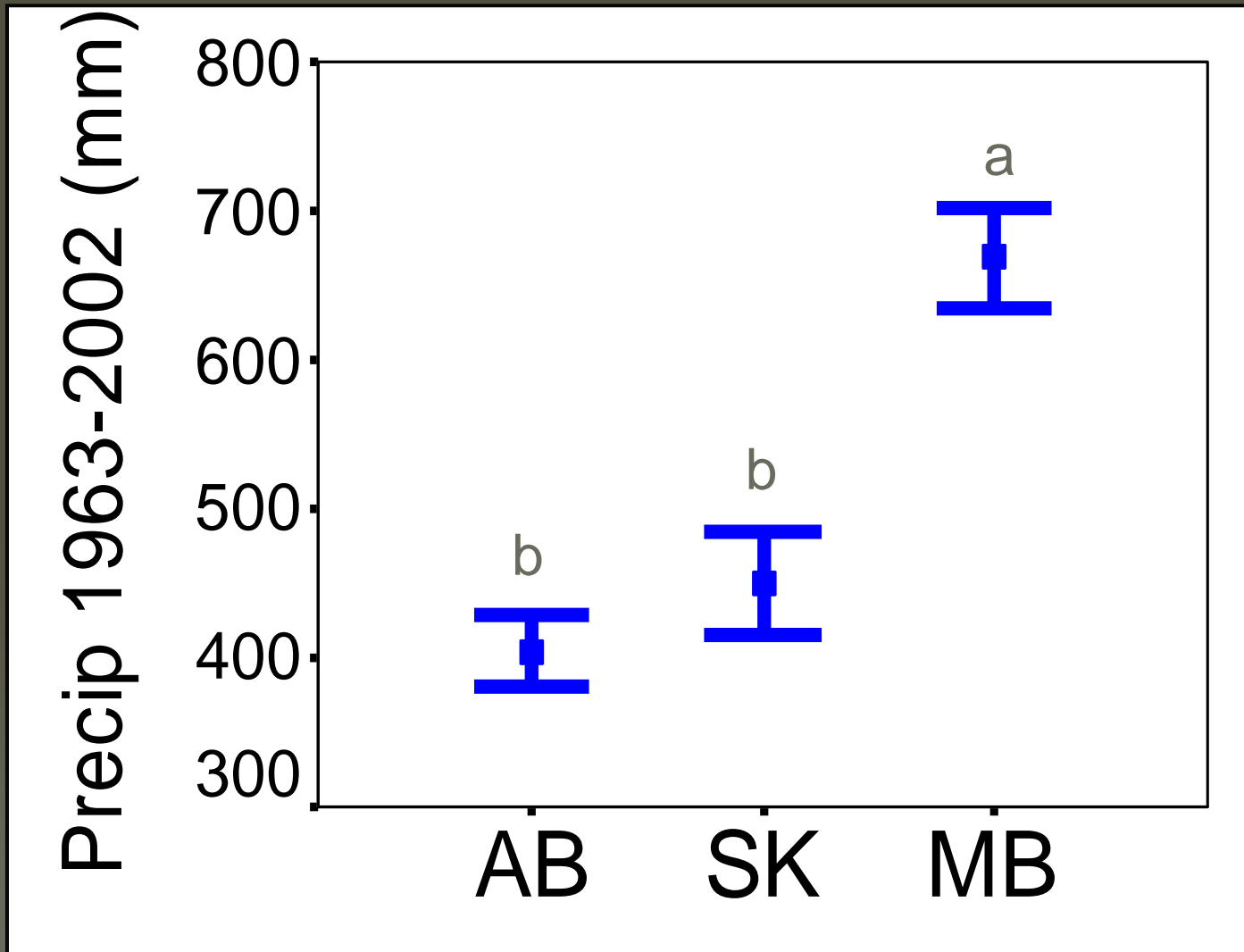


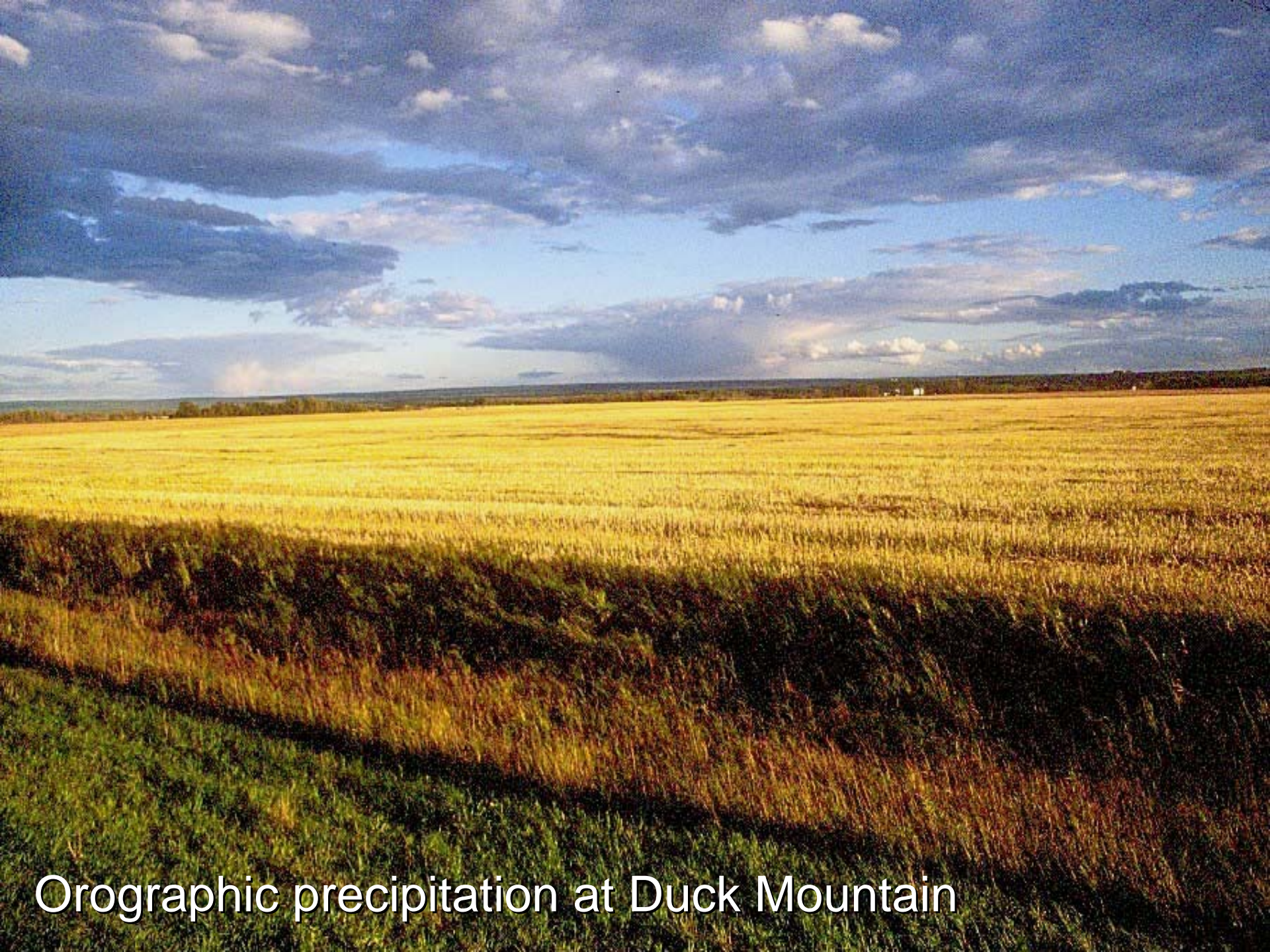
Adapted from the Ecological Monitoring and Assessment Network

Elevation



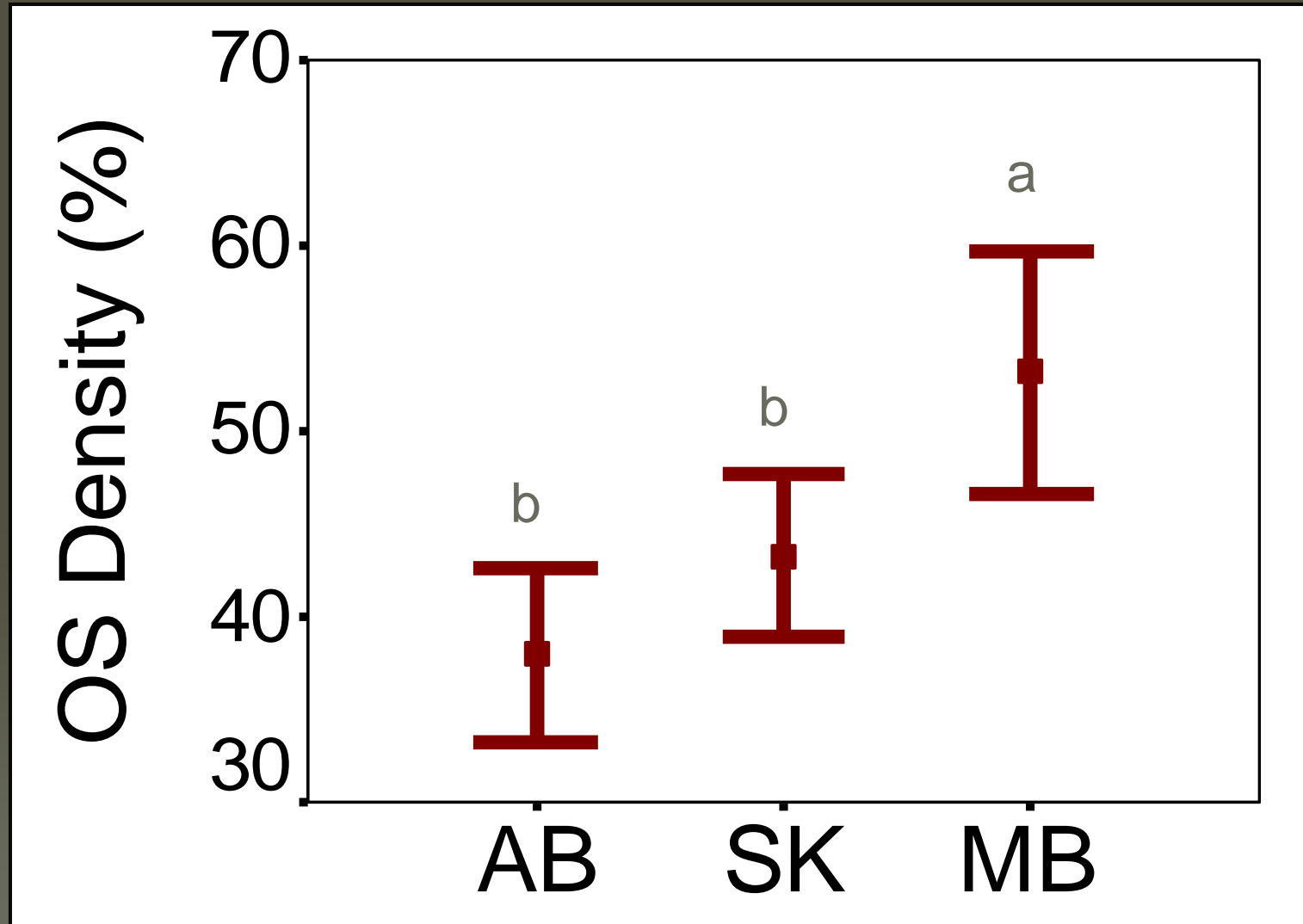
Precipitation



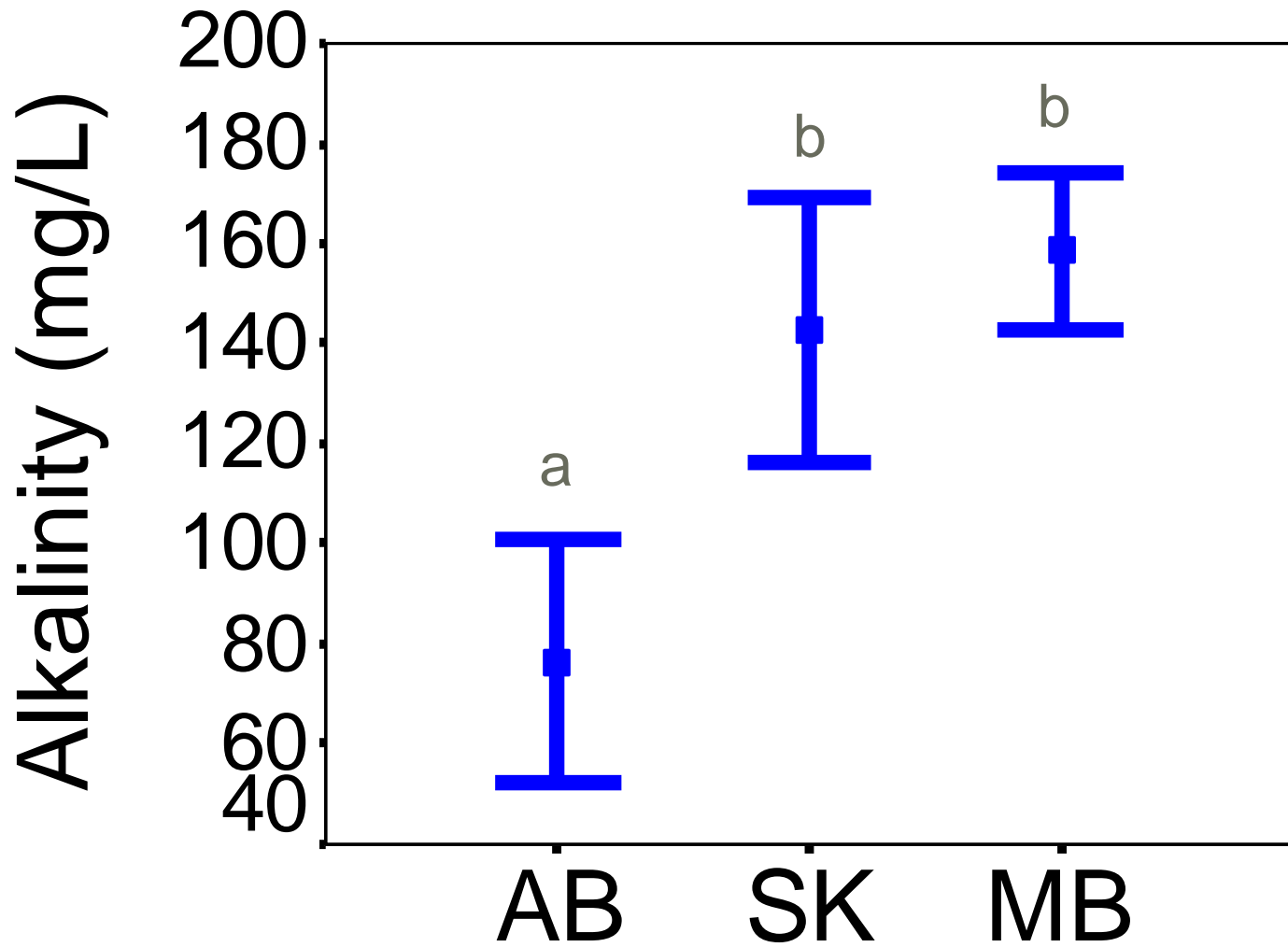


Orographic precipitation at Duck Mountain

Overstory Density



Alkalinity



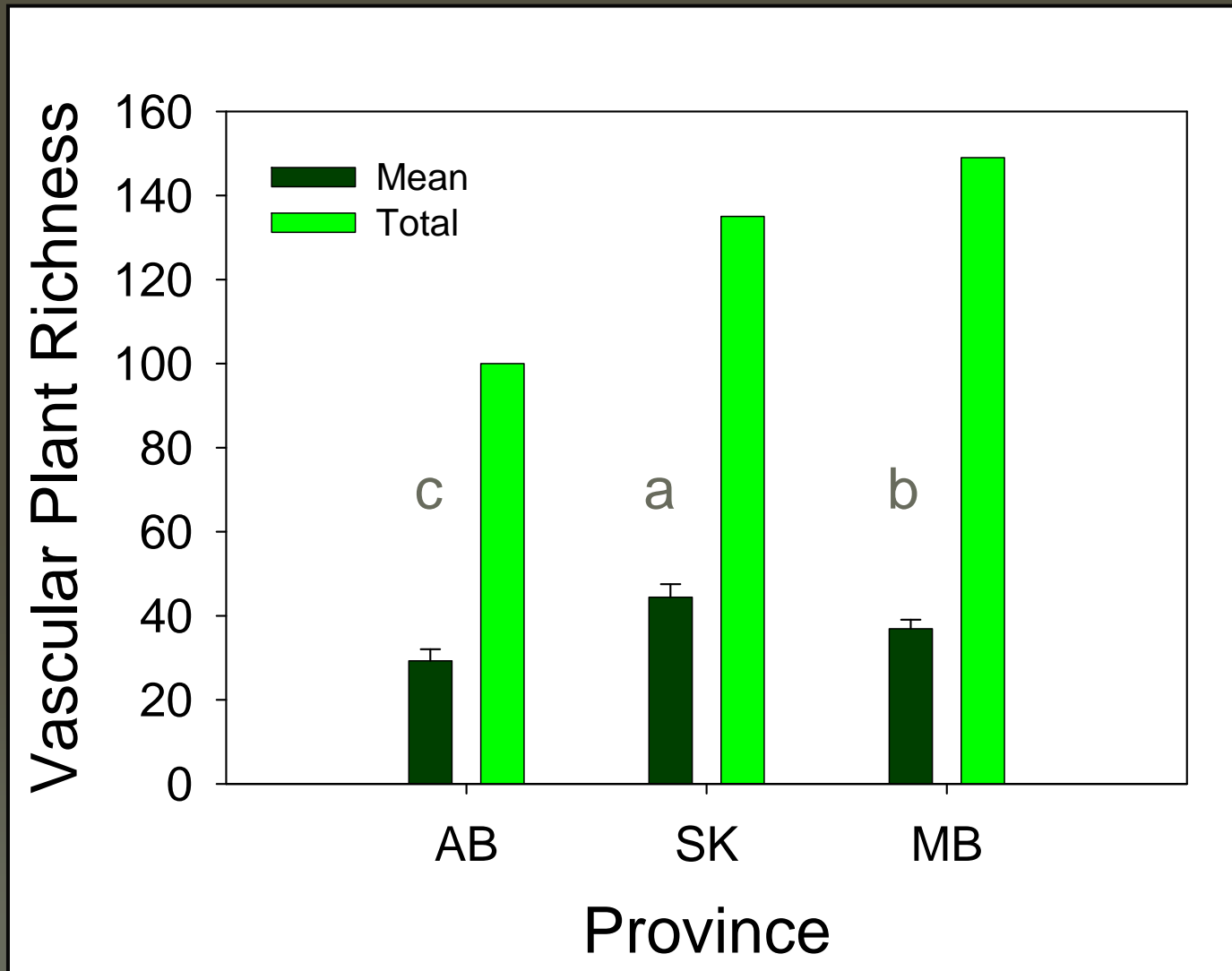


Plant Diversity - Region

- 273 species in total
- 86 bryophytes
- 187 vascular plants



Plant Diversity – Province

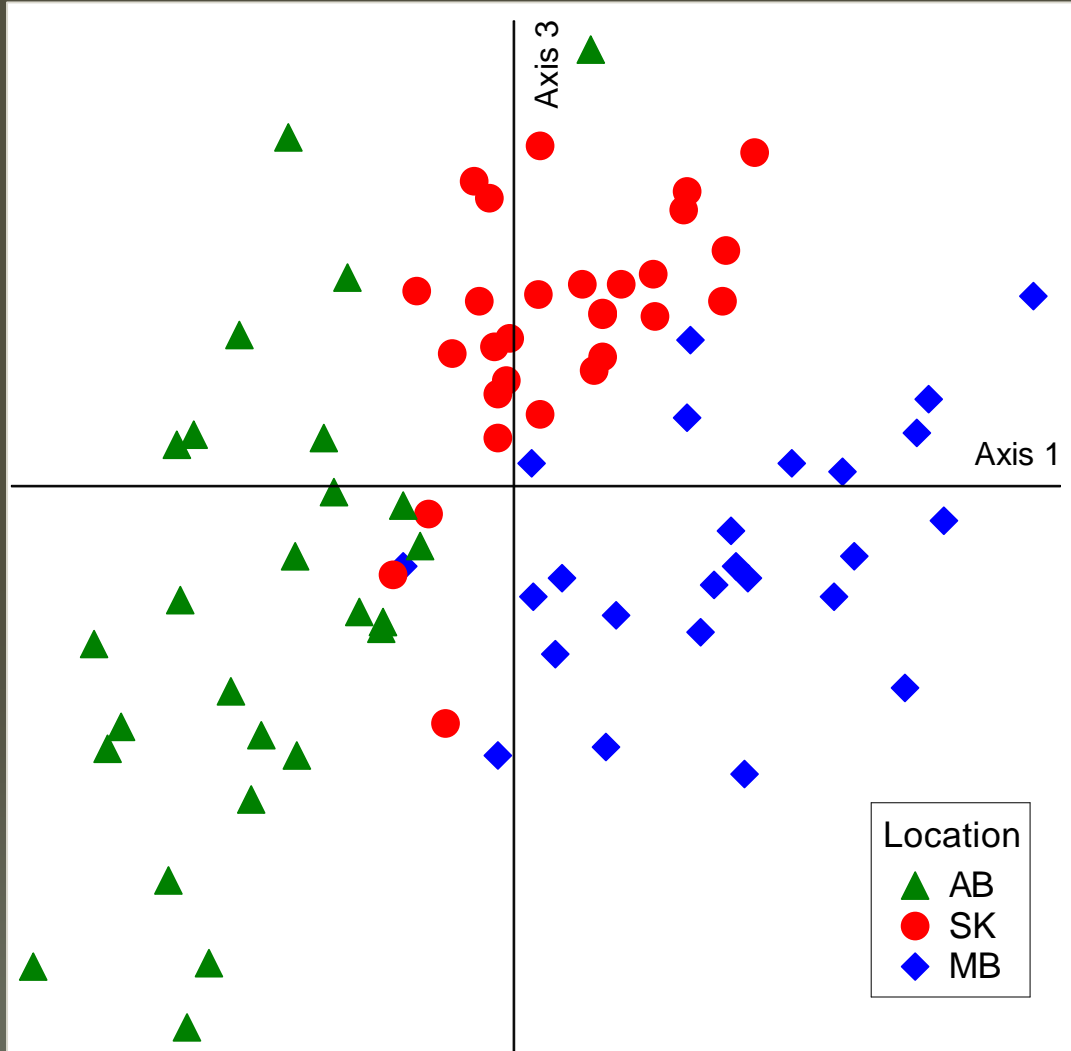


Provincially Rare Plants

Location				
AB	SK	MB	All	
<i>Lonicera caerulea</i> (S3)				1
<i>Galium labradoricum</i> (S3)	<i>Campanula aparanoidea</i> (S2S3)	<u><i>Liparis loeselii</i> (S2)</u>		5
<i>Carex prairieae</i> (S3)				
<i>Carex tenuifolia</i> (S3S4)				
<u><i>Cypripedium acaule</i> (S3)</u>	<u><i>Platanthera dilatata</i> (S2)</u>	<u><i>Listera borealis</i> (S2)</u>		4
	<u><i>Malaxis monophylla</i> (S1S2)</u>			
	5	3	2	10



Vascular Plant Community



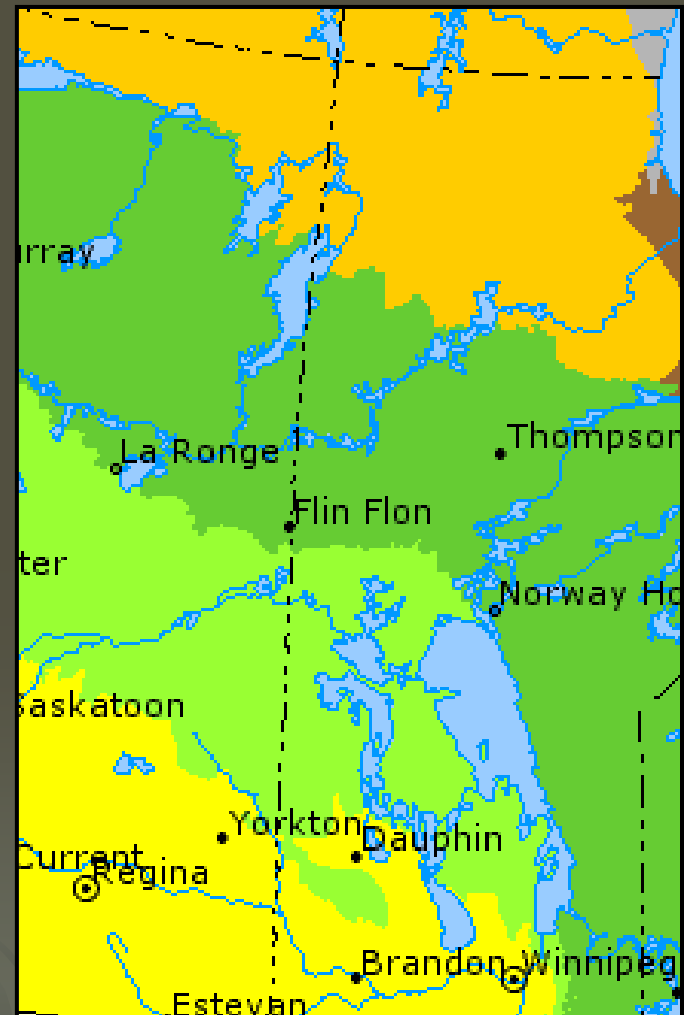
$N = 80$

Stress = 6.99

3-Dimensional Solution

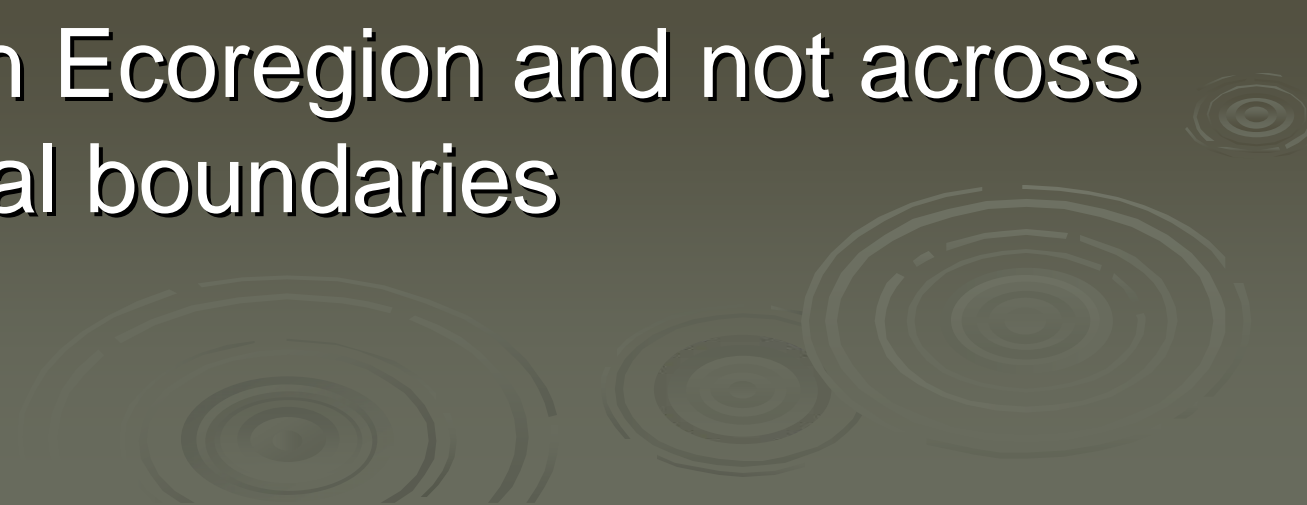
Richness & Environment

- Vascular plants decrease with latitude
- Bryophytes increase with latitude





Conservation Implications

- Plant community & environmental variables over a continental scale within a single Ecoregion shows a continuous change even in a single wetland type
 - ...within an Ecoregion and not across Ecoregional boundaries
- 

Conservation Implications

- For common wetland types, even those with a higher likelihood of rare plants (orchids!), Ecoregion level conservation may not make sense...



Conservation Implications

A matter of scale...

Management at finer scale, i.e.,
Ecodistrict-level, may be more
appropriate...





***Thank You
&
Happy Orchid-Hunting!***

David Locky
davidlocky@gmail.com