

Parameterisation of Wetland Hydrology

W. Quinton¹, M. Hayashi², R. Schincariol³, N. Wright⁴






¹Cold Regions Research Centre, Wilfrid Laurier University

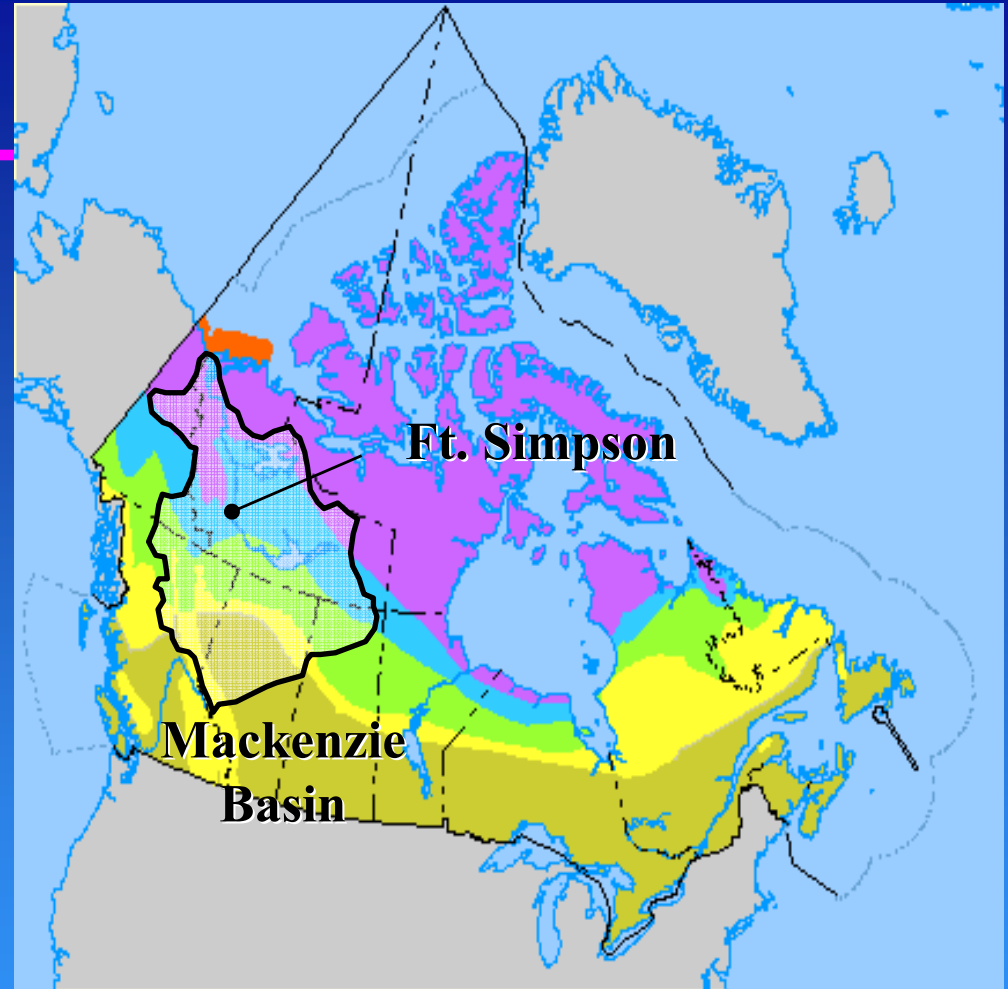
²Department of Geology and Geophysics, University of Calgary

³Department of Geology, University of Western Ontario

⁴Department of Geography, Simon Fraser University

Permafrost Area

-  Continuous (> 90%)
-  Discontinuous (50-90%)
-  Discontinuous (10-50%)
-  Isolated patches (< 10%)
-  No permafrost



Natural Resources
Canada

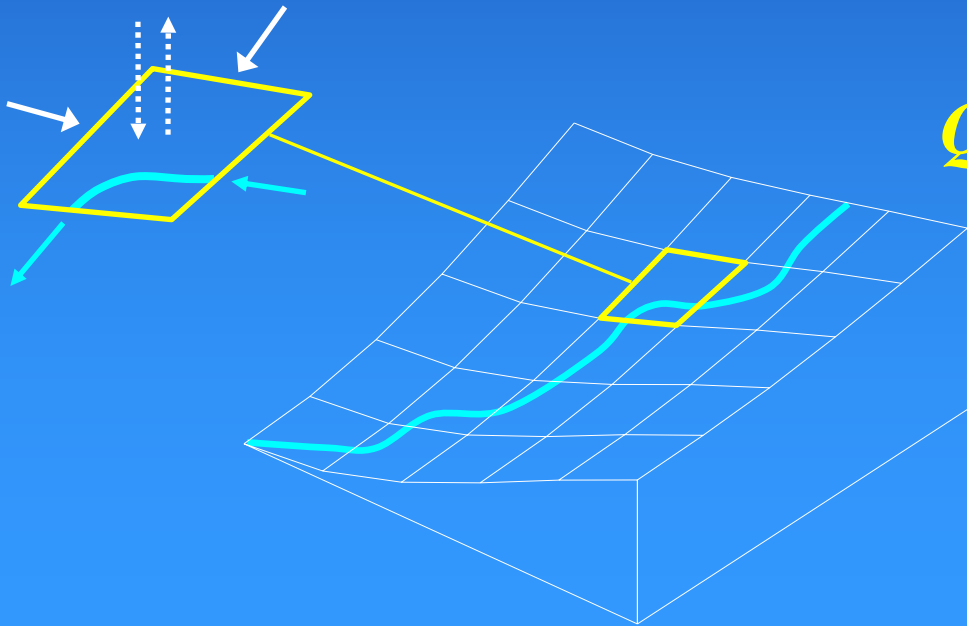
Ressources naturelles
Canada

Canada



Major Research Activities at Scotty Creek:

- Detailed process studies
- Develop and test hydrological models
- Parameterize for basin-scale



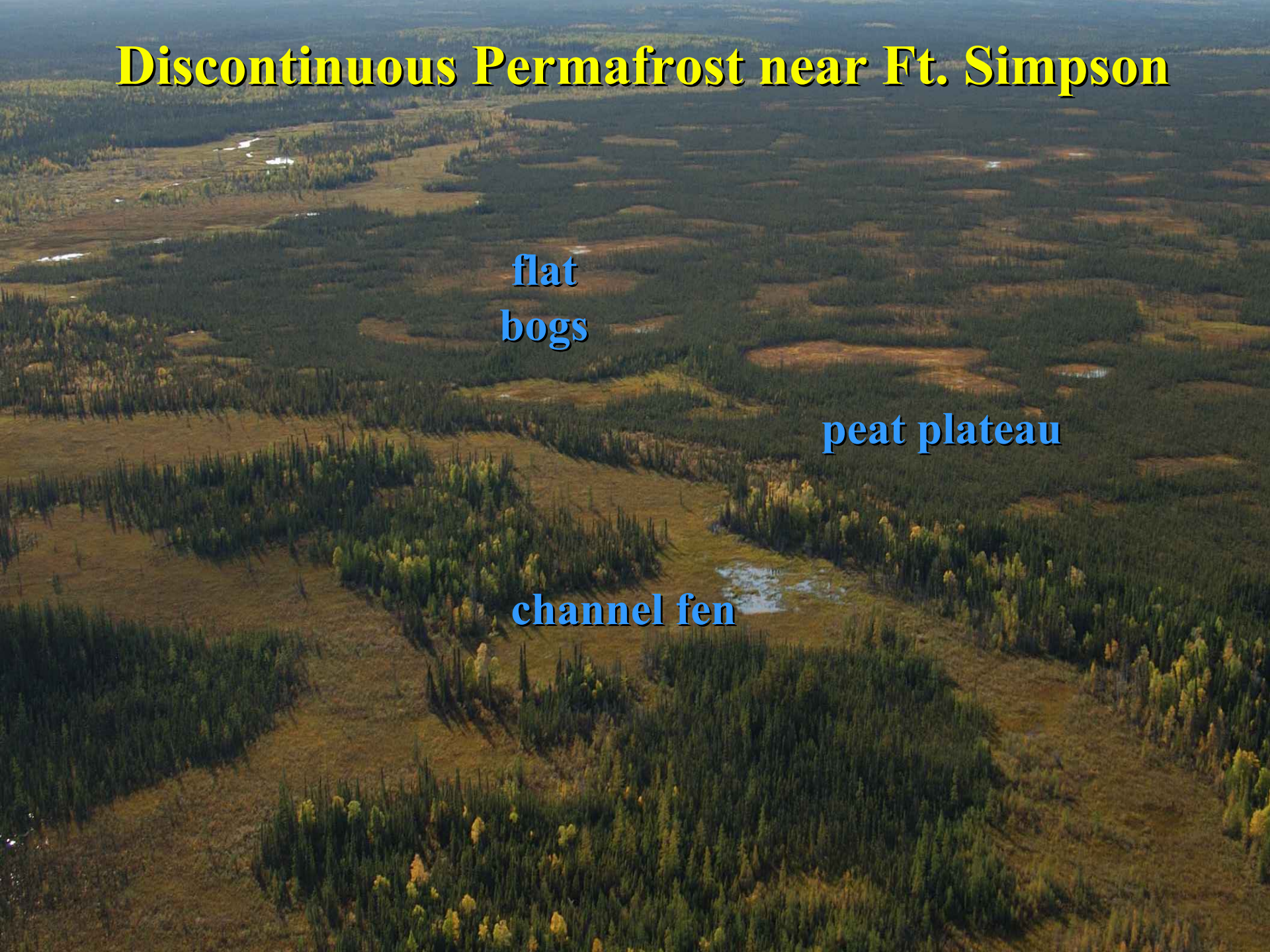
$$Q = f(a, b, c, \dots)$$

Discontinuous Permafrost near Ft. Simpson

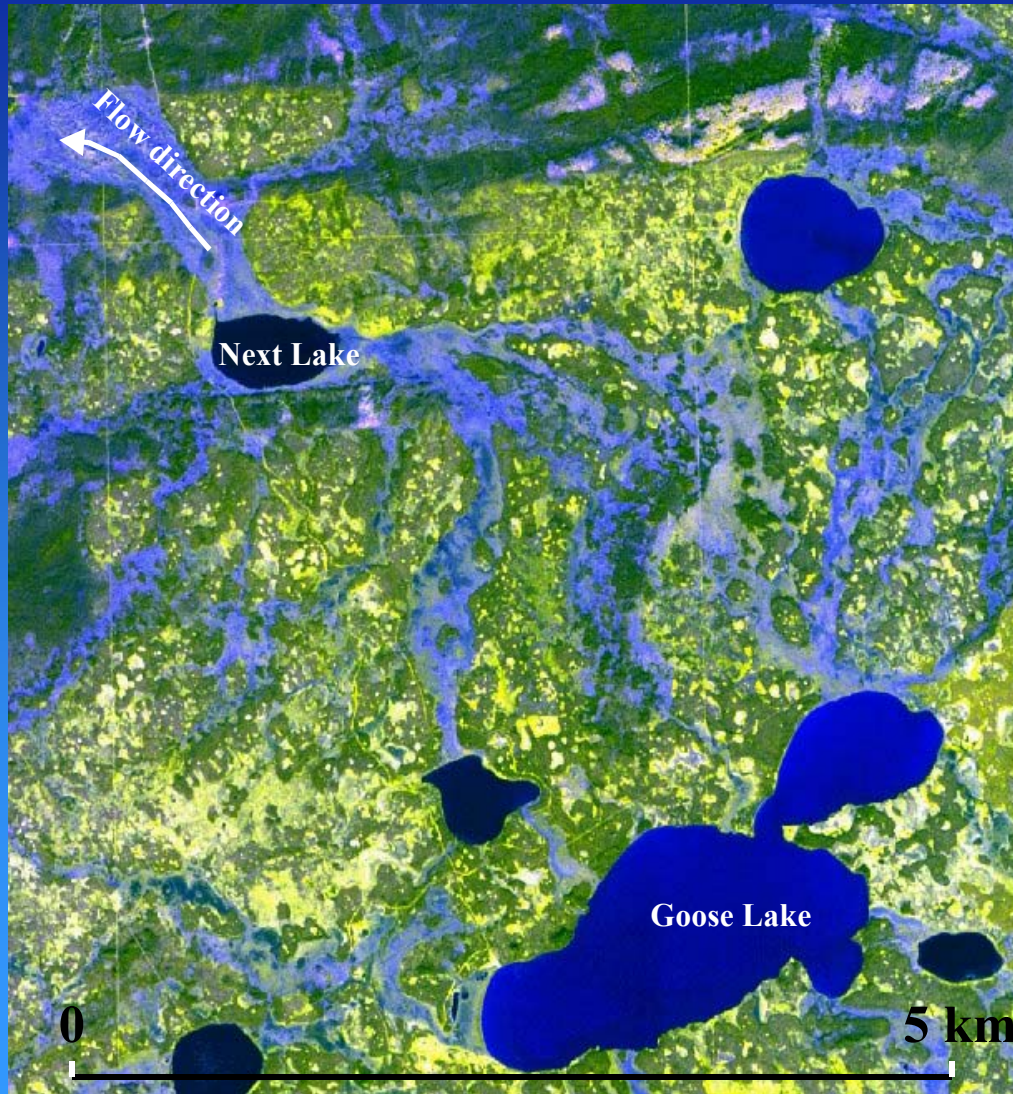
flat
bogs

peat plateau

channel fen



Three Major Cover Types:

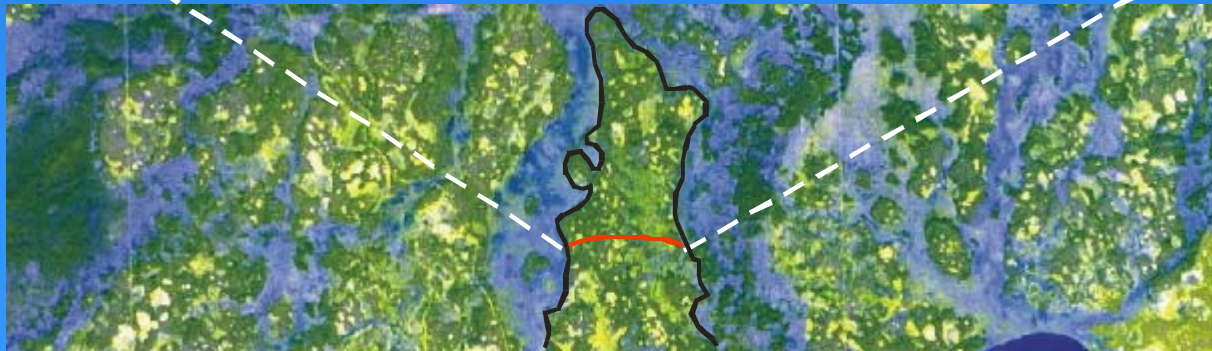
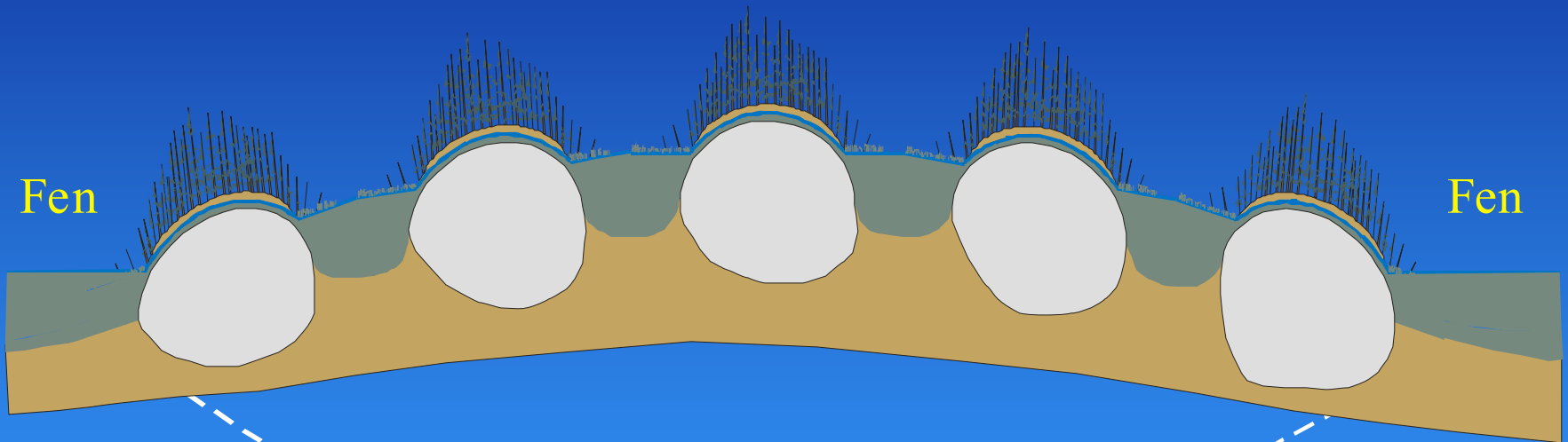


3 Major Types:

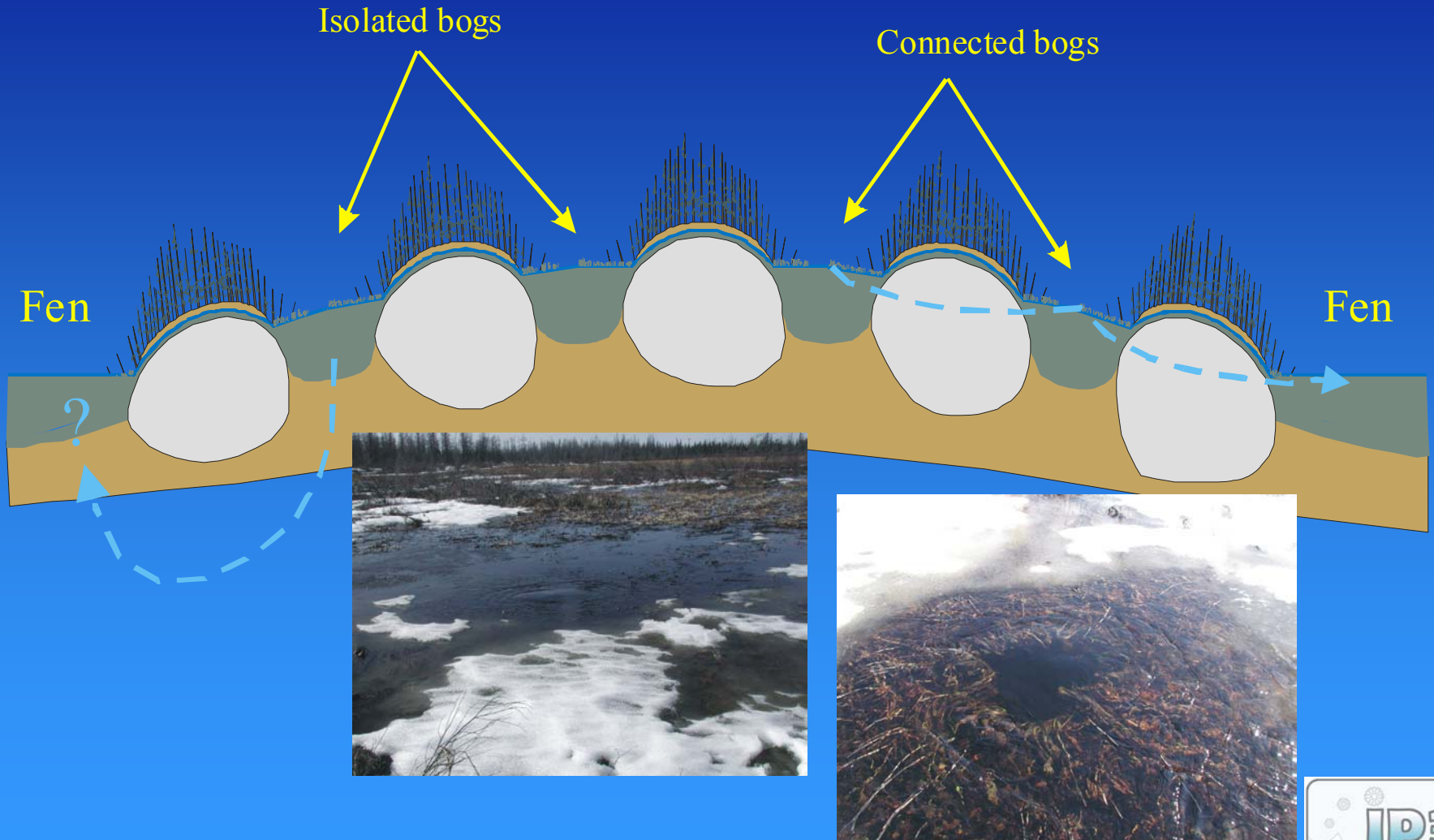
- a) Peat Plateaus
- b) Channel Fens
- c) Flat Bogs
 - Isolated
 - Connected

Conceptual Model:

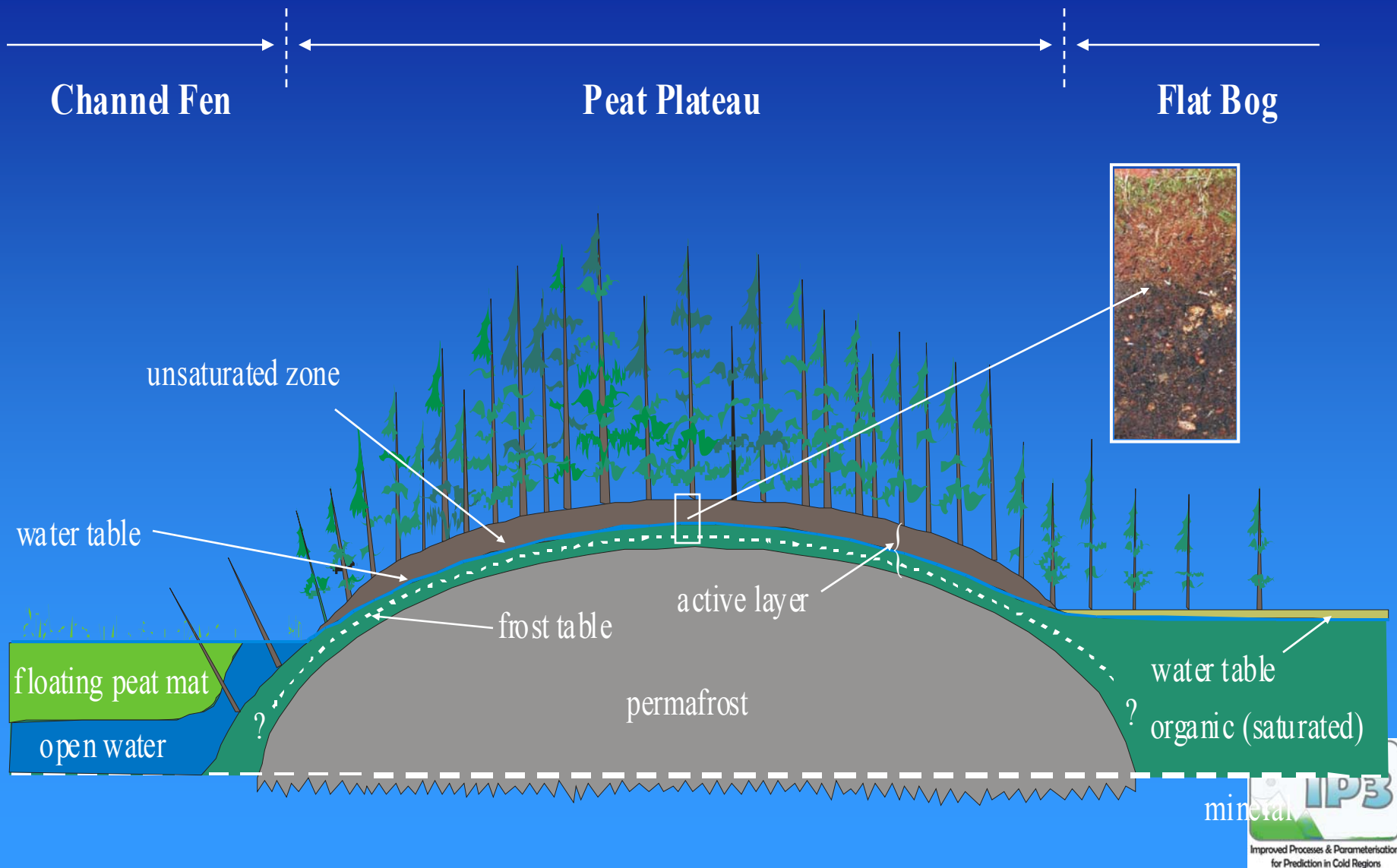
Peat Plateau – Bog Complex



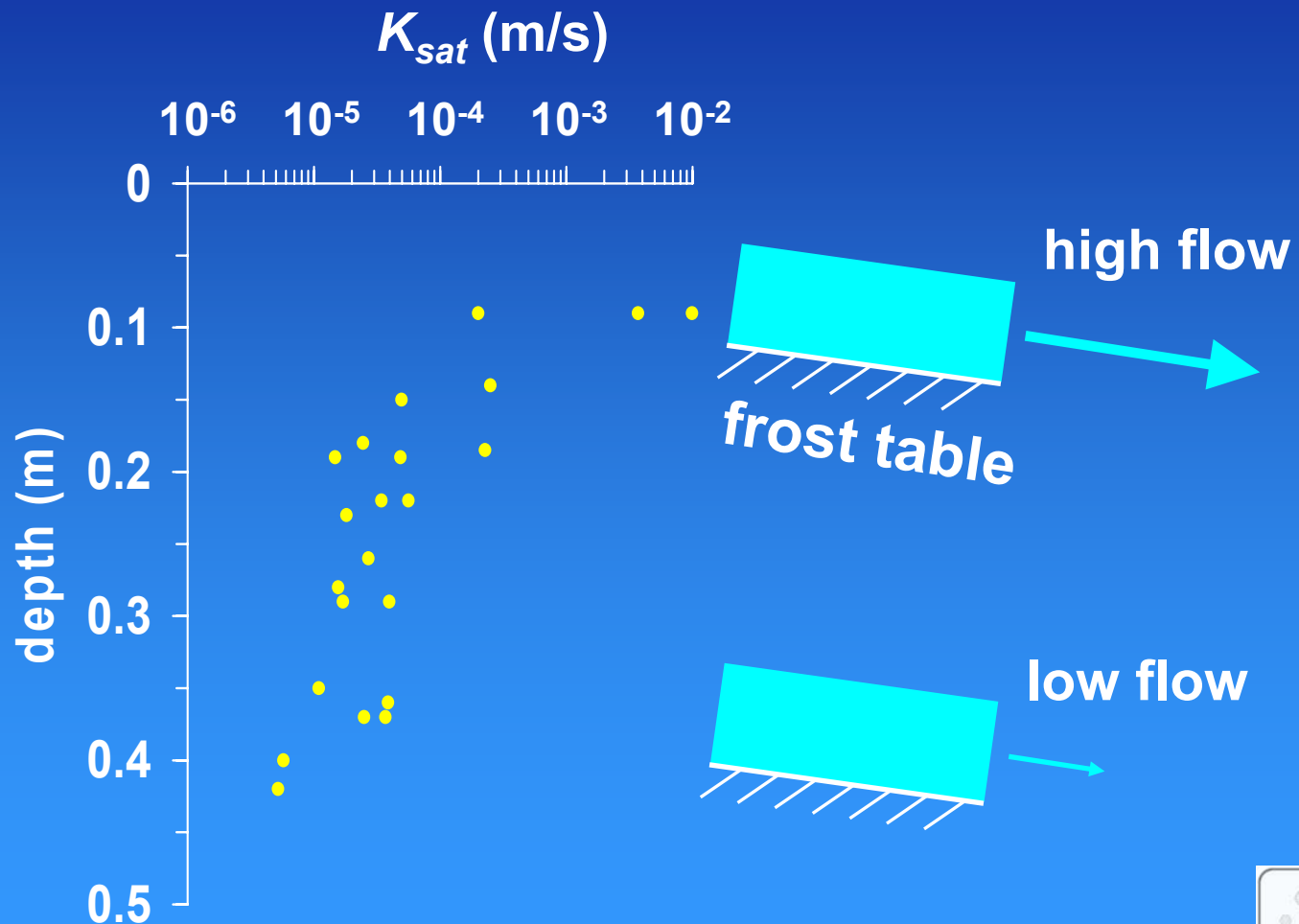
Conceptual Model:



Peat plateaus:

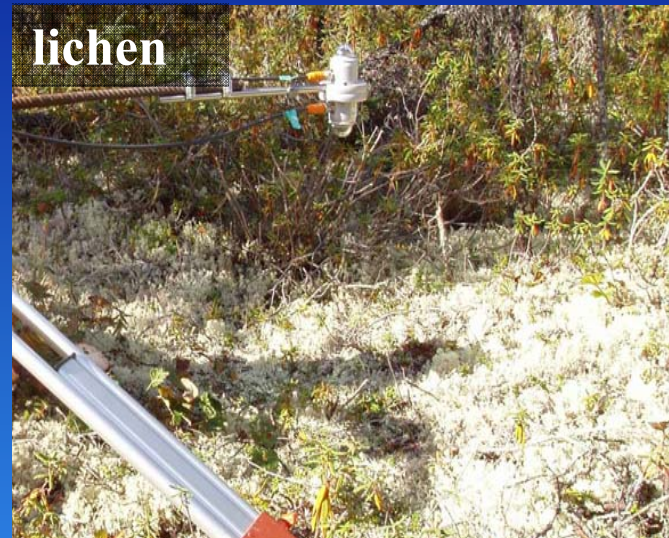


Position of Saturated Layer Controls Drainage:



What controls frost table depth?

- Canopy density
- Surface albedo
- Soil moisture
- other factors?



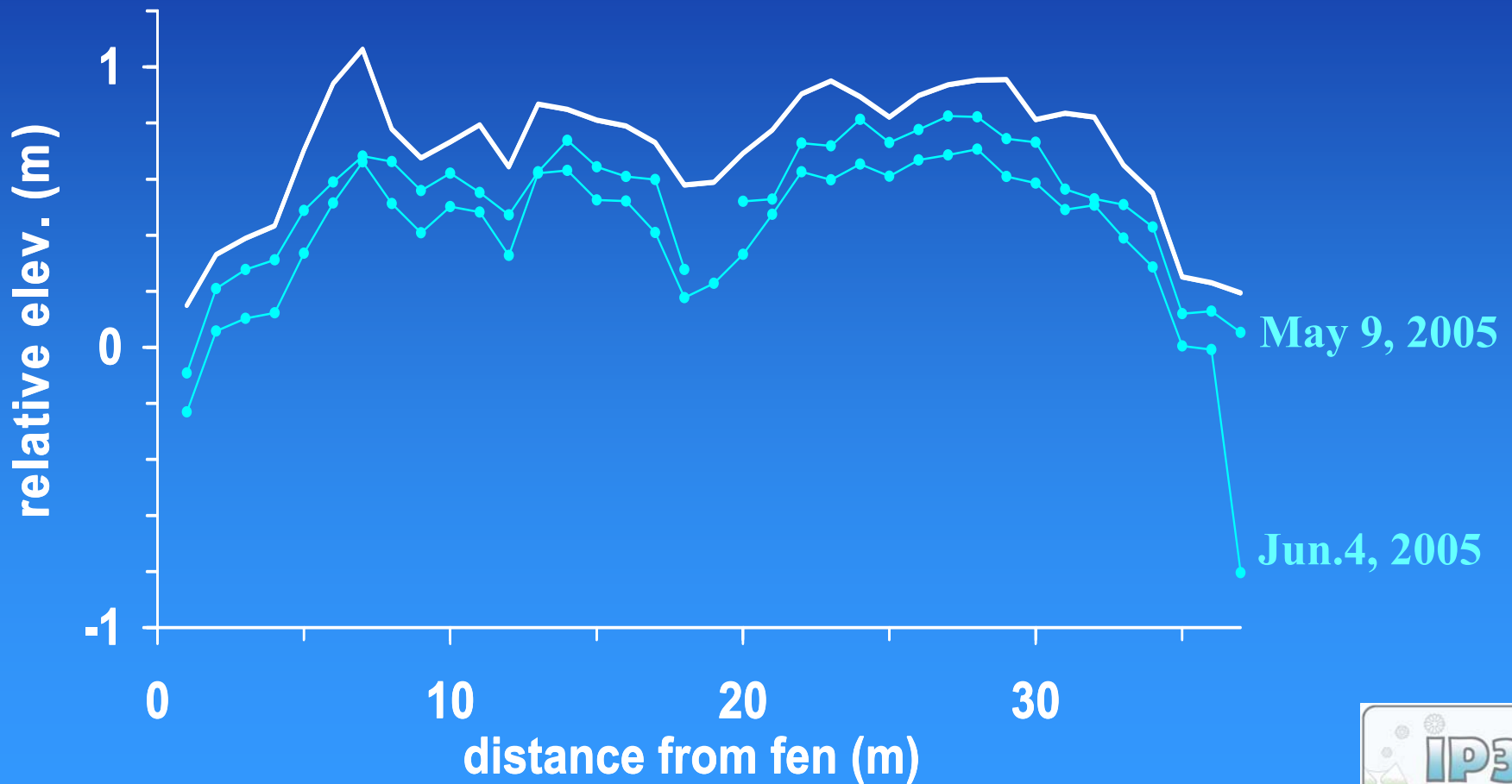
$$\alpha = 0.15$$



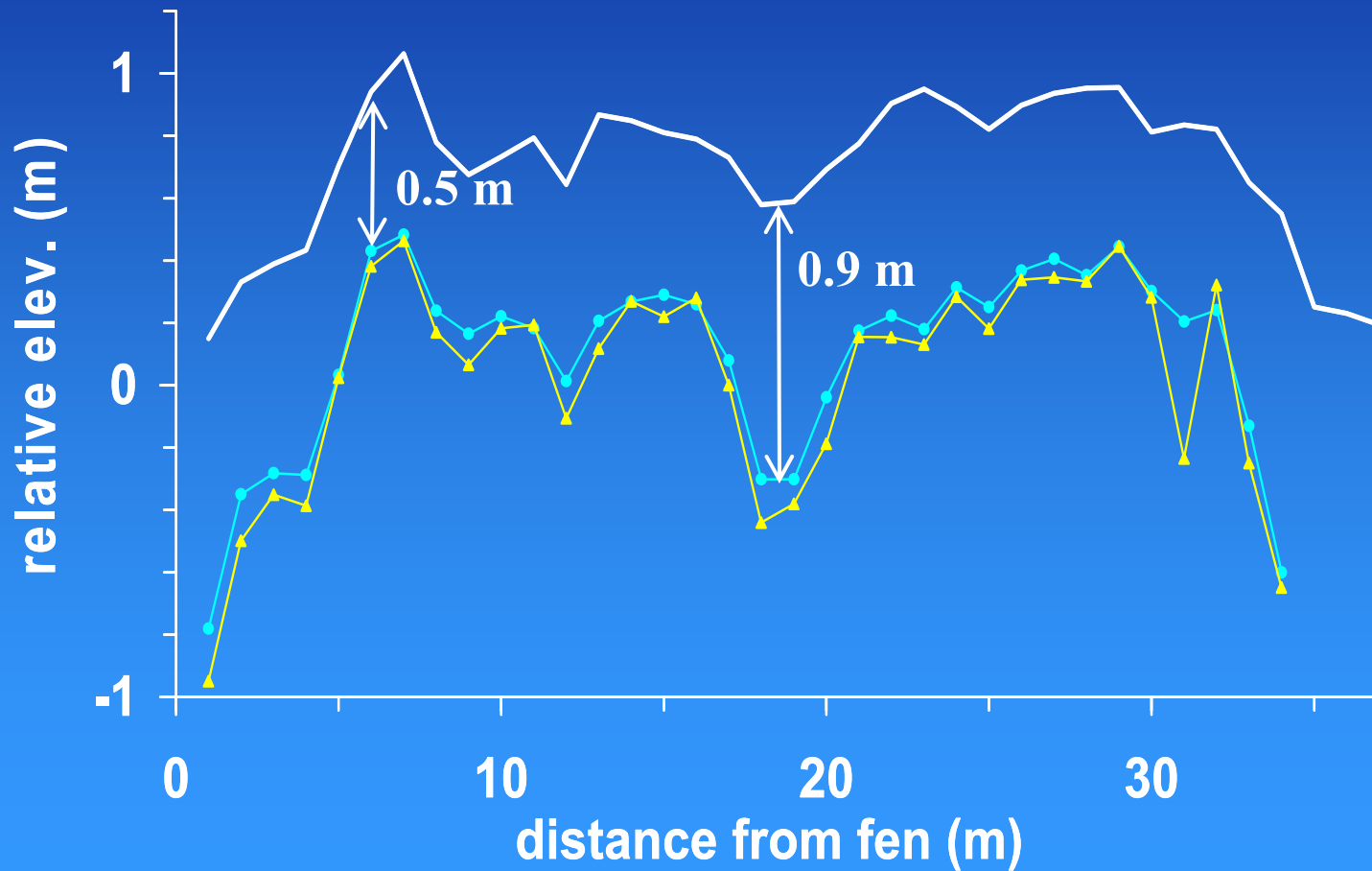
$$\alpha = 0.19$$



Frost Table Transect:

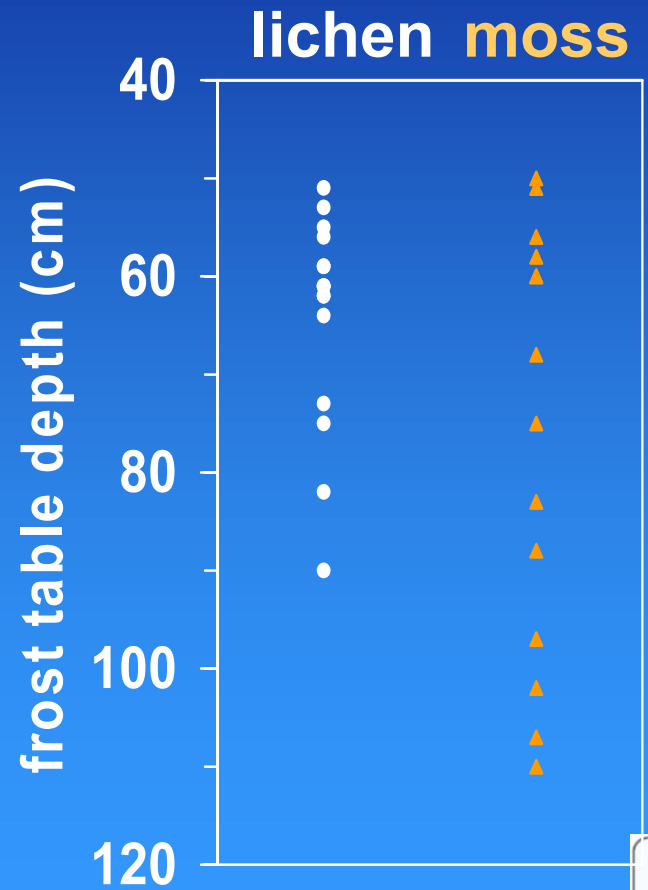
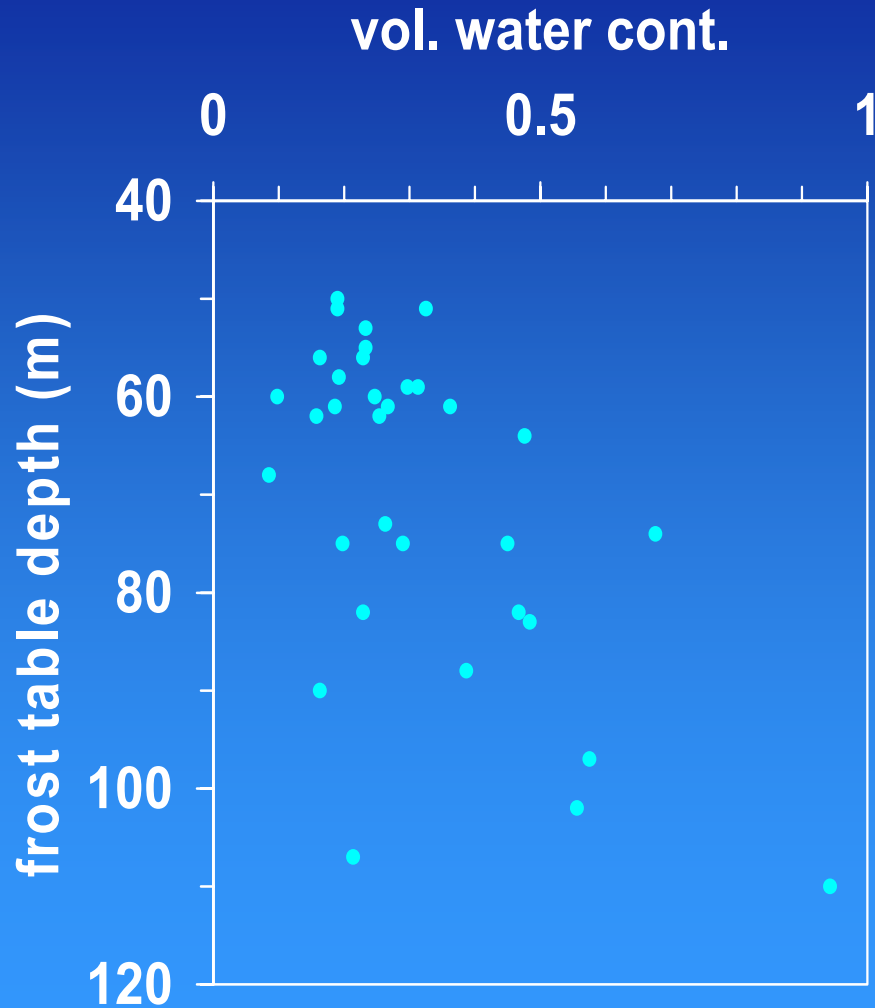


Frost Table Transect:

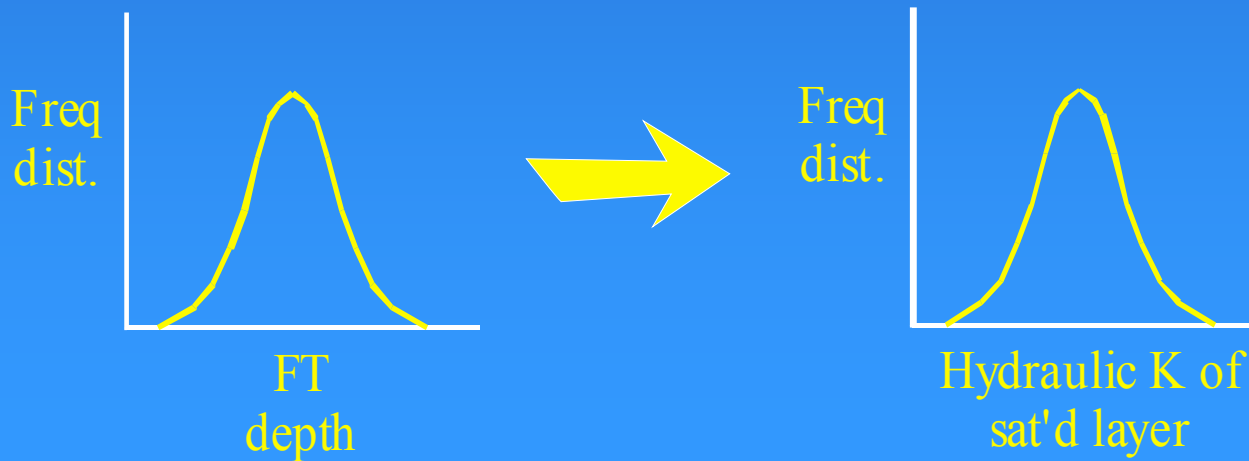
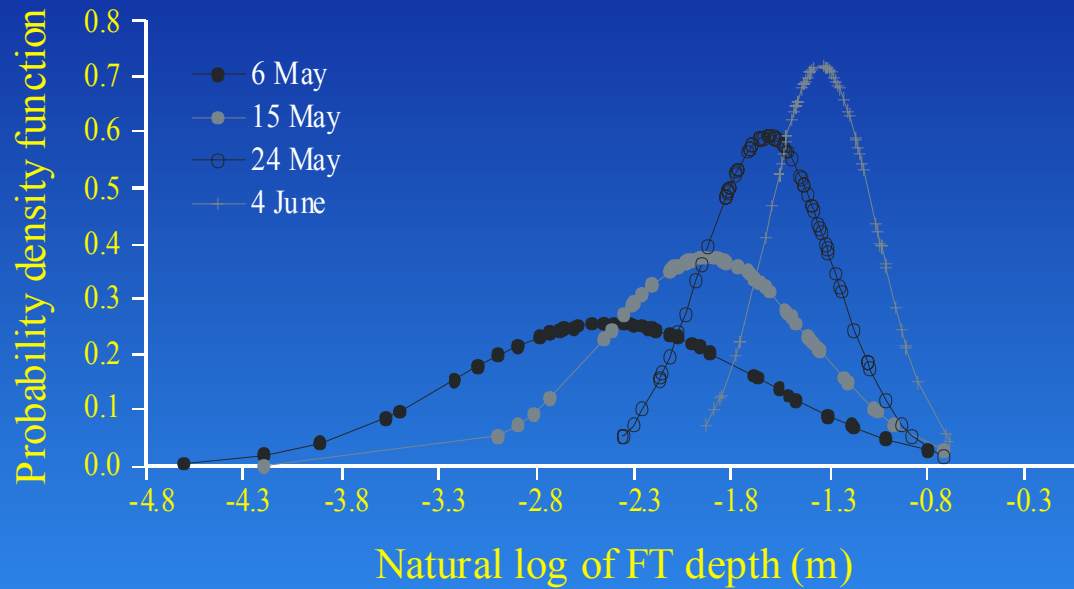


Sep. 5, 2005
Sep. 3, 2006

Effects of Water Content and Albedo:



Depth Distribution of FT:



Runoff Modelling:

? Channel Fen runoff

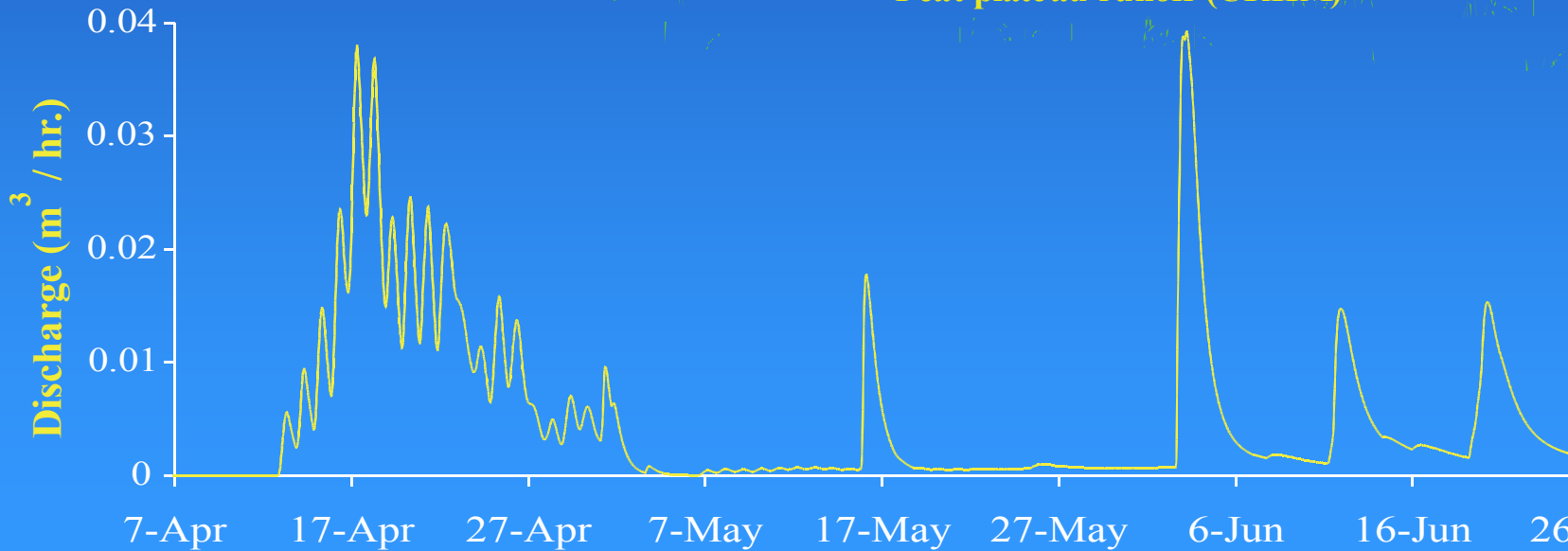


Water table

Frost table

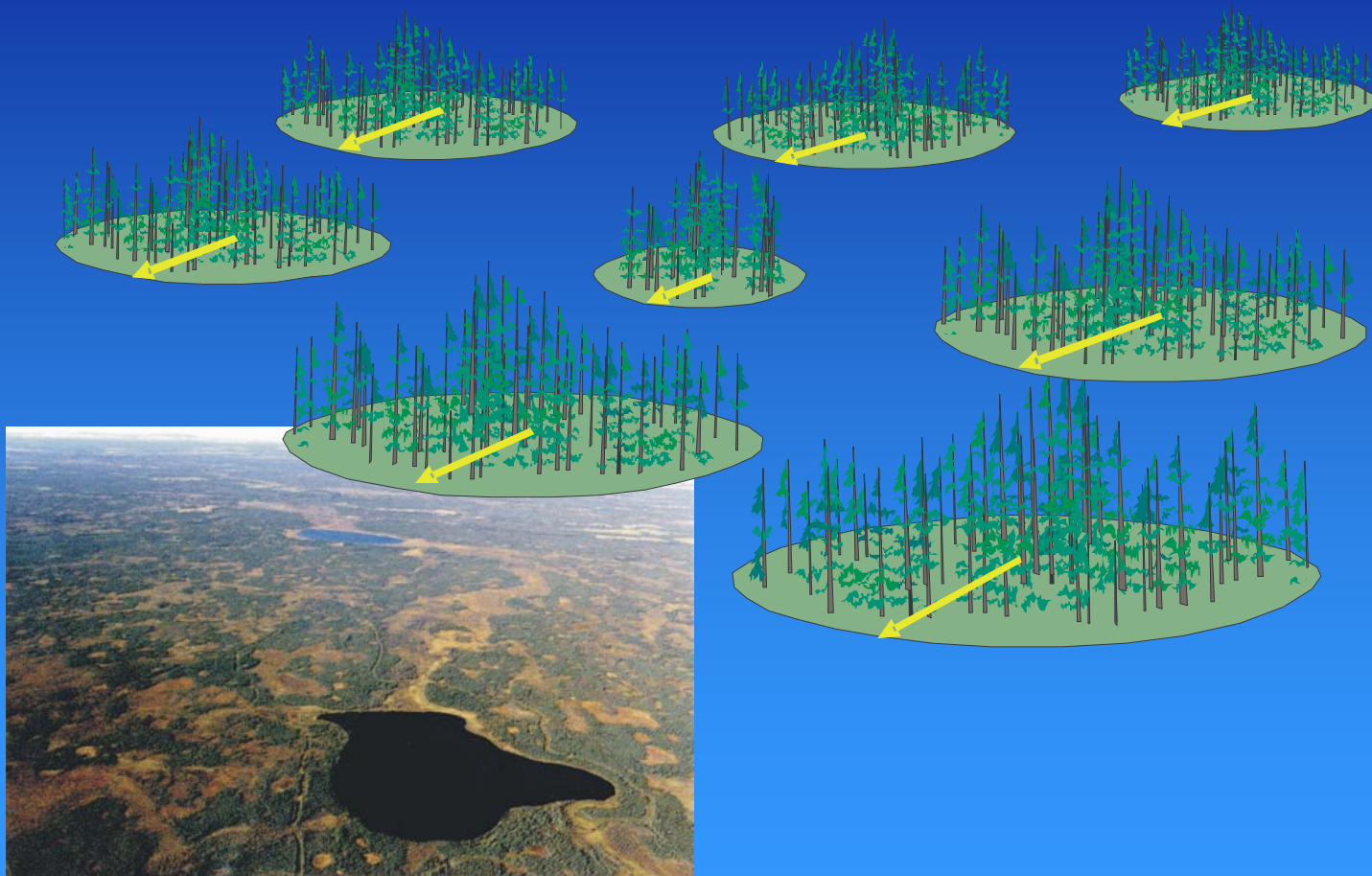
1 m

Peat plateau runoff (CRHM)

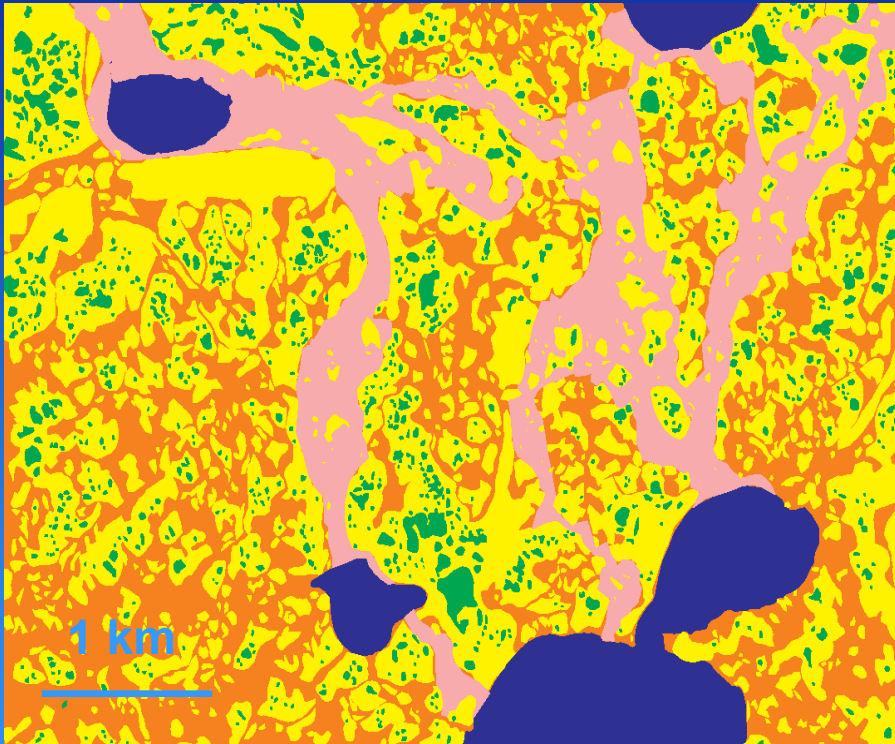


2003

Distributing Plateau Runoff:



Size Distribution of Peat Plateaus:



Lake

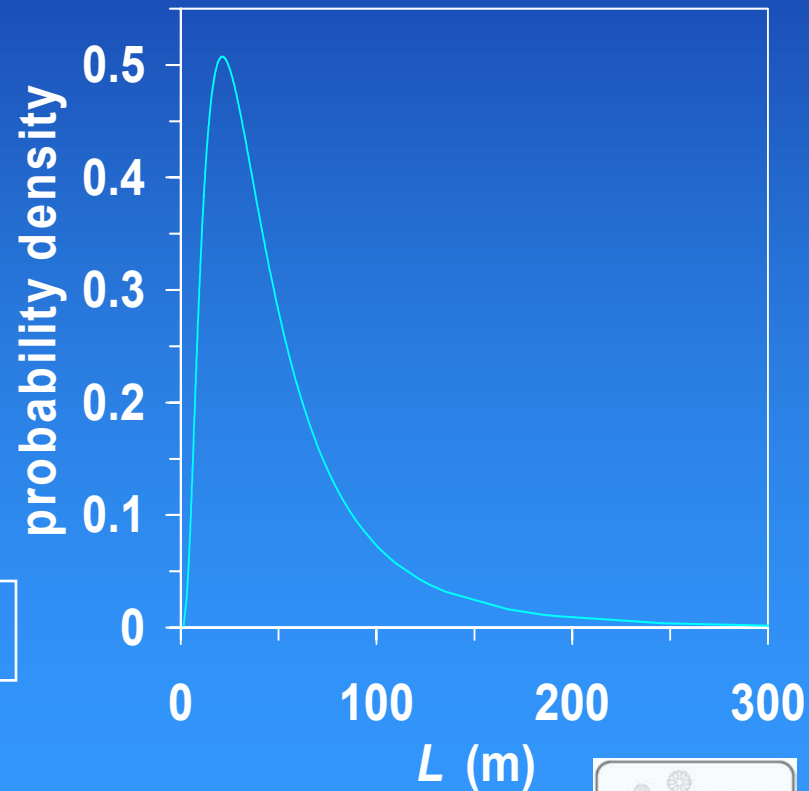
Isolated bog

Connected bog

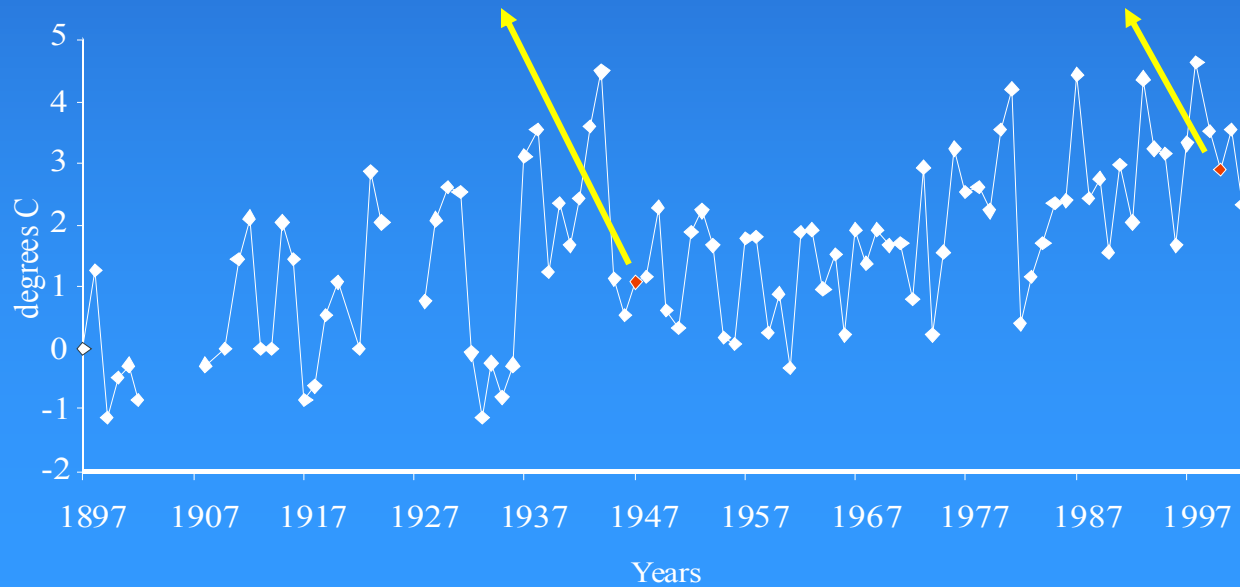
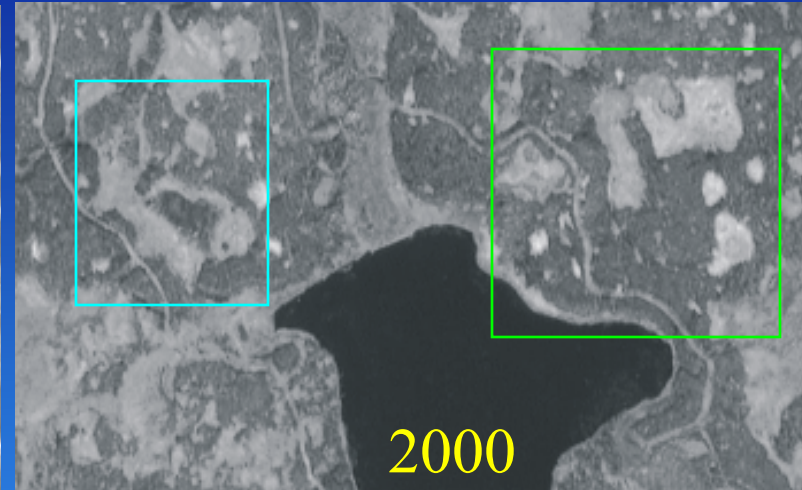
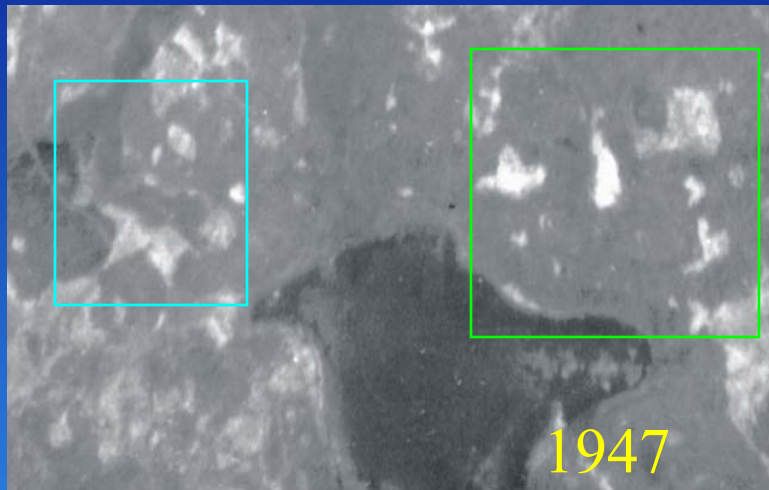
Peat plateau

Fen

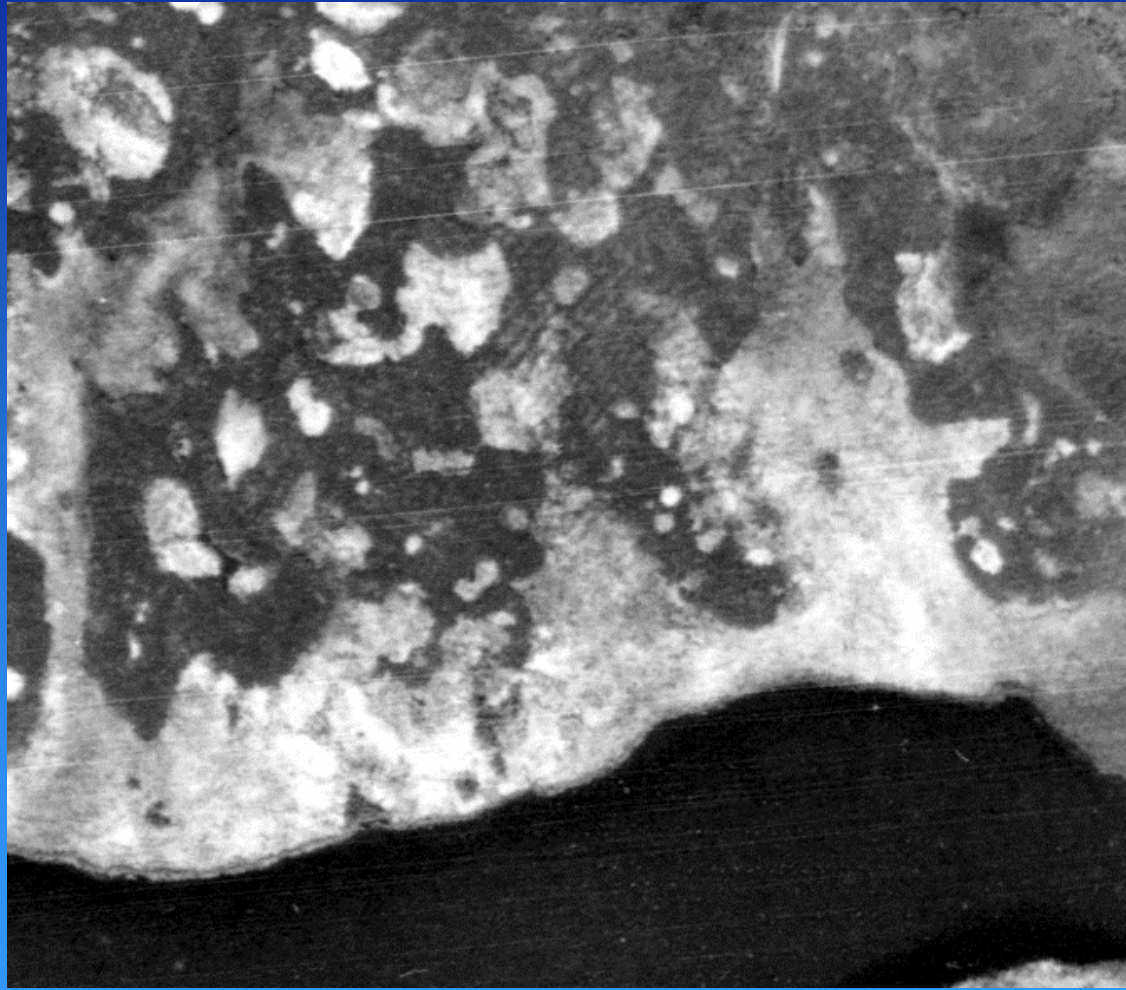
Hydraulic radius
 $L = 2 * \text{area} / \text{perimeter}$



Permafrost melt:



Landscape evolution: 1950–2000:



From: Robinson, 2002.

Acknowledgements

- Canadian Foundation for Climate and Atmospheric Sciences
- Natural Sciences and Engineering Research Council
- NWRI (Saskatoon)
- Aurora Research Institute (Inuvik)
- Gerry Wright, Roger Pilling (WSC)
- Tom Brown (Centre for Hydrology)