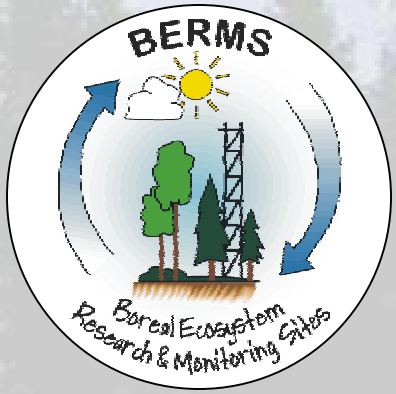
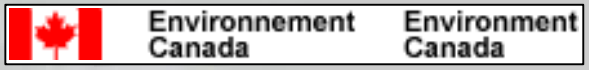
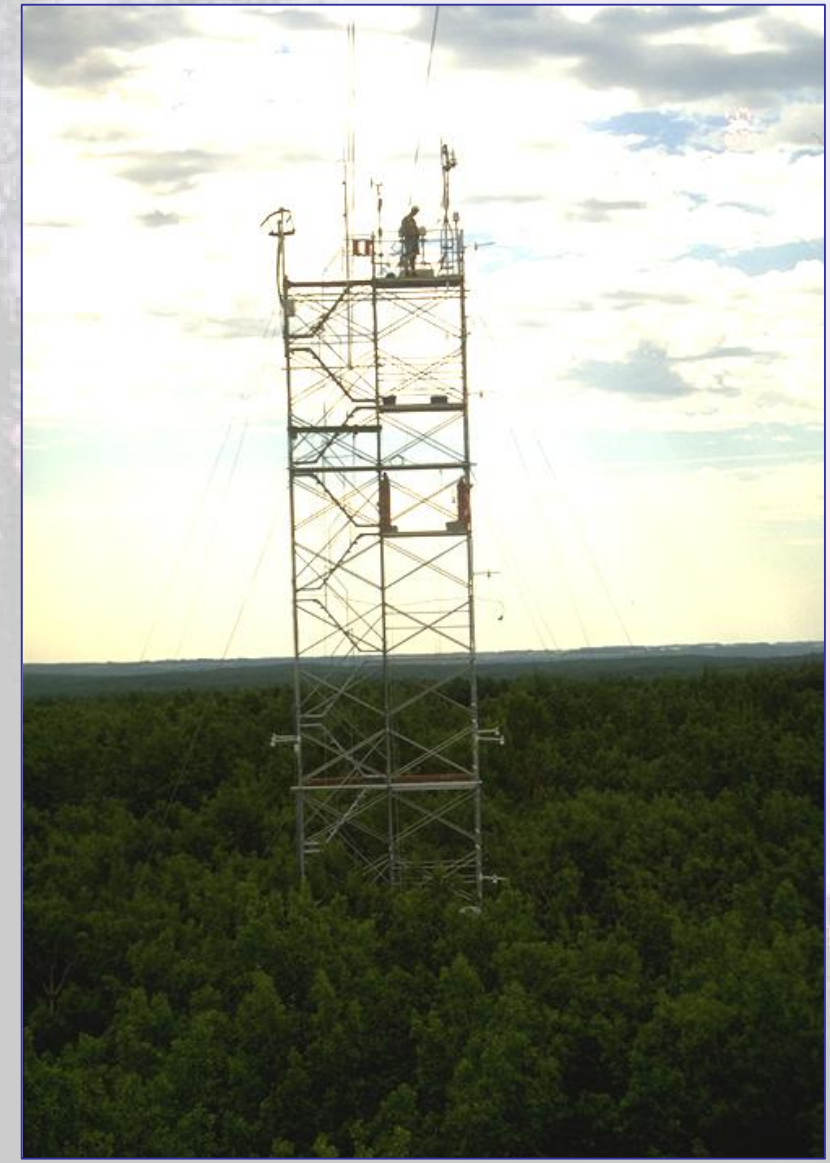


Evapotranspiration from the Southern Boreal Forest 1999 to 2006

A.G. Barr [1], T.A. Black [2], J.H. McCaughey [3], G. van der Kamp [1], and Z. Nesic [2]

[1] Science and Technology Branch, Environment Canada;
[2] Agroecology, U.B.C.; [3] Geography, Queen's U.

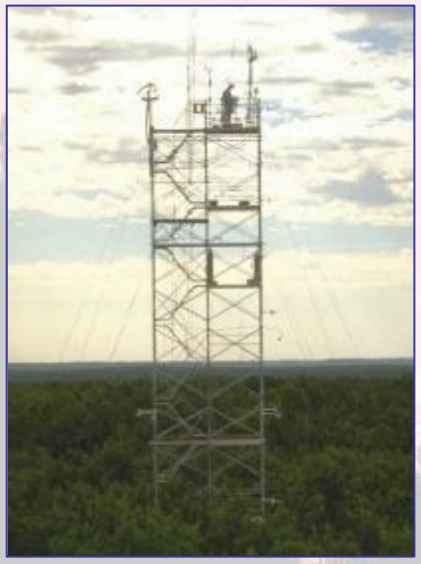




Purpose

Introduce BERMS data sets

Explore responses to 2001-2003 drought



Outline

Introduction

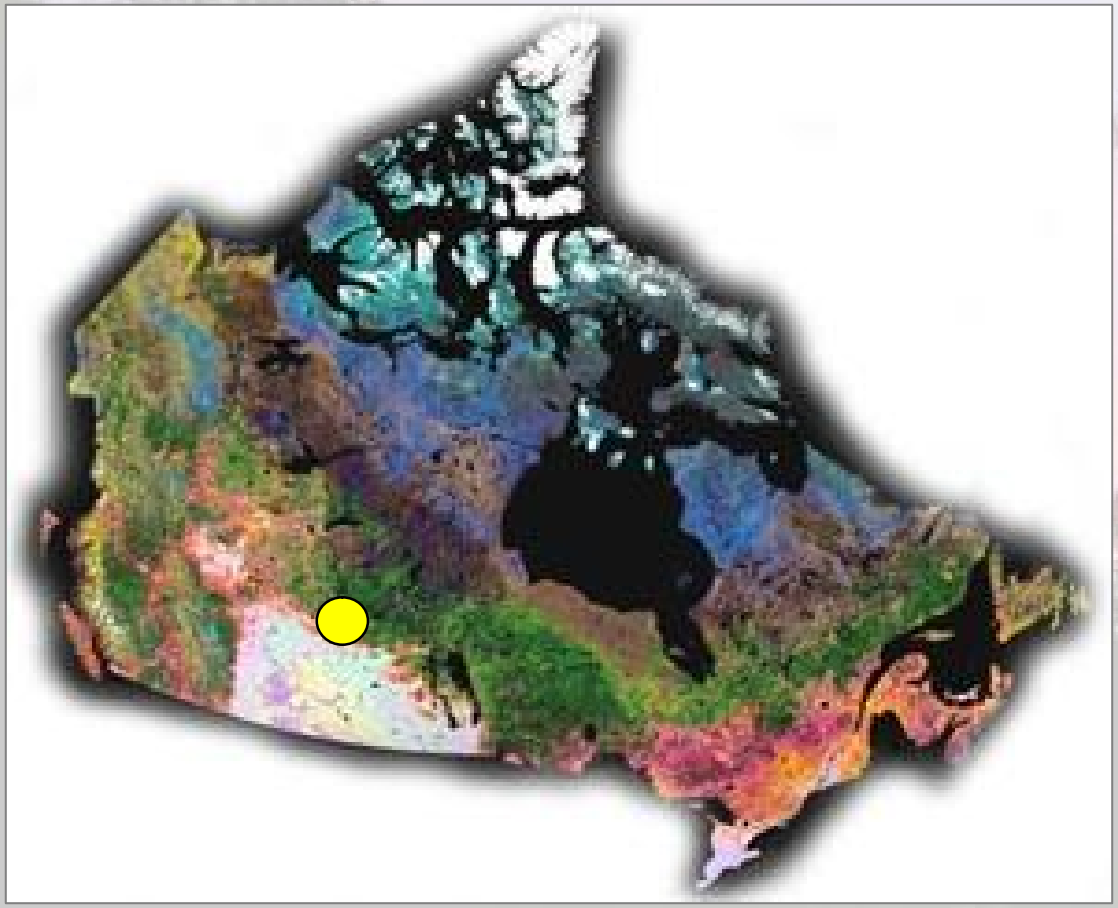
2001-2003 Drought

Evapotranspiration

Water Balance

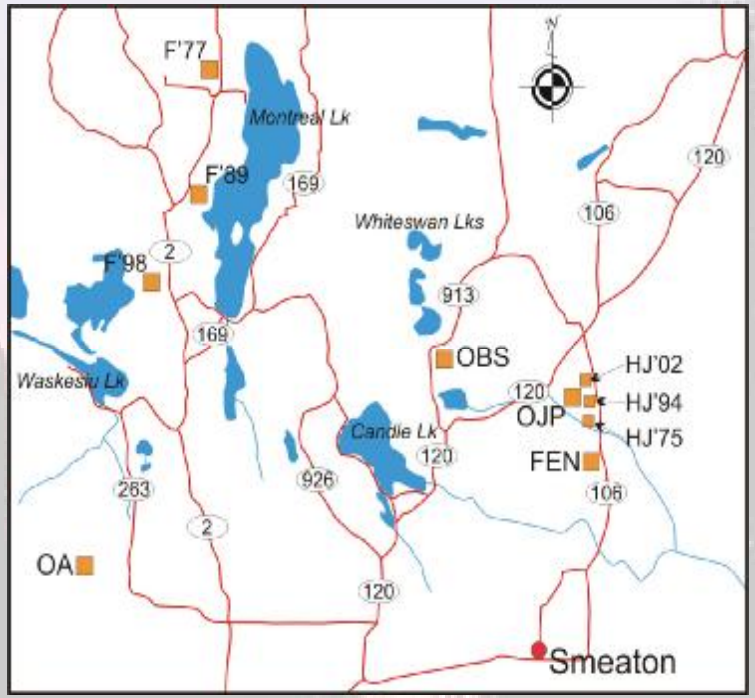
Summary

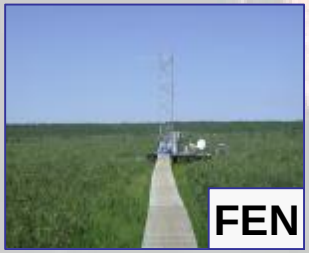
Boreal Ecosystem Research and Monitoring Sites (BERMS)



- Eddy-covariance flux towers 1994+
- Located at southern edge of boreal forest
- Ecotone controlled by water balance, sensitive to climate change

BERMS Flux Towers





Environnement Canada Environment Canada

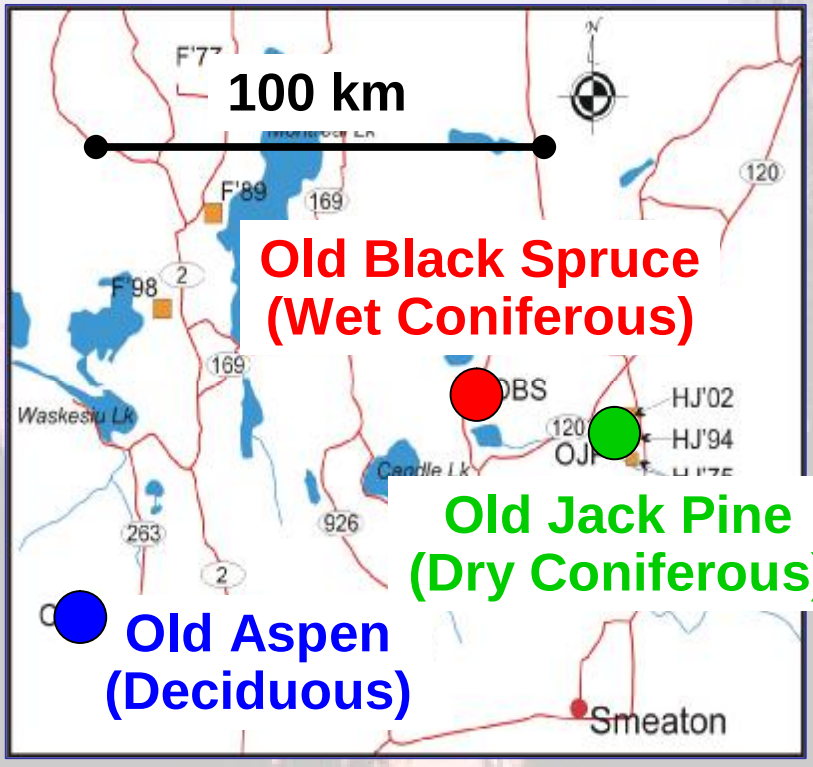

F89


OBS

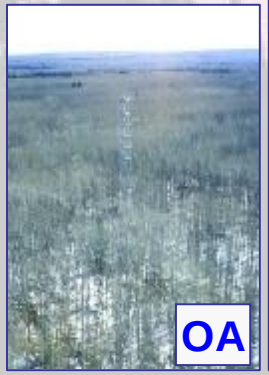

OBS


H94


F98


100 km
F'77
F'89
F'98
169
2
120
Old Black Spruce
(Wet Coniferous)
OBS
HJ'02
HJ'94
OJP
Waskesiu Lk
Candle Lk
926
263
Old Jack Pine
(Dry Coniferous)
Old Aspen
(Deciduous)
Smeaton


H02


OA


H94


OA

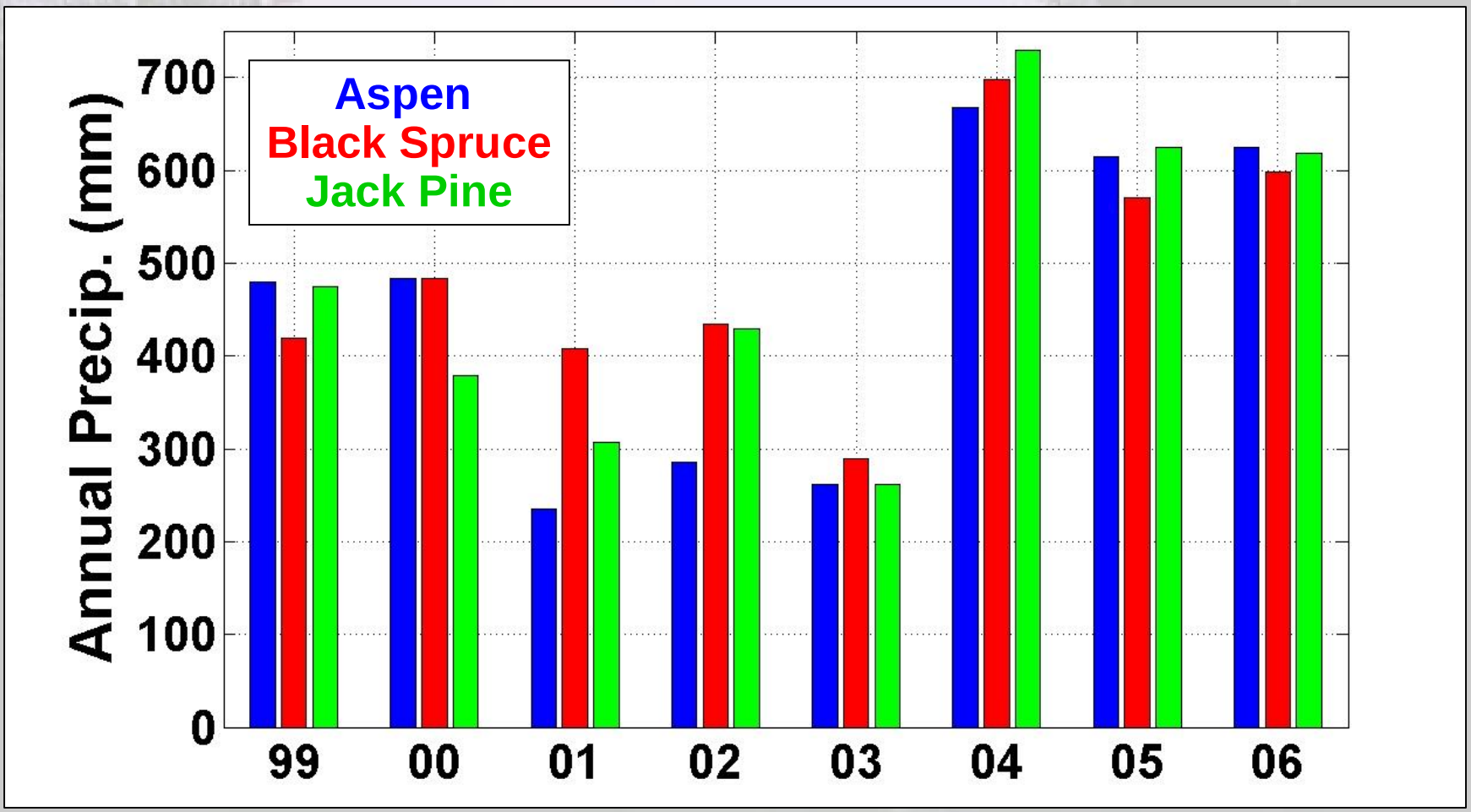

FEN


OJP


H75

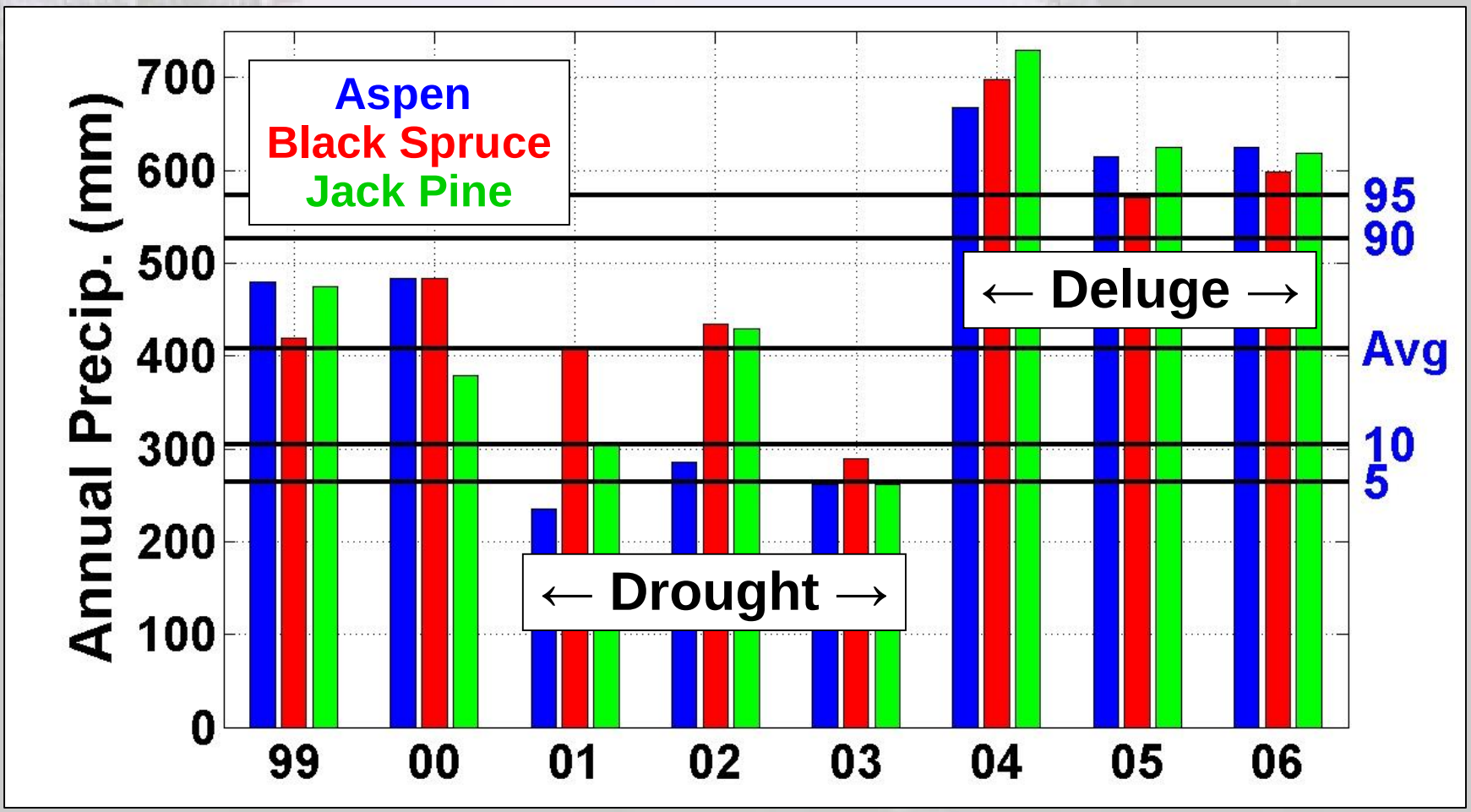
Annual Precipitation 1999 to 2006

Mature Forest Sites



Annual Precipitation 1999 to 2006

(The horizontal lines show percentiles from Prince Albert, 1900-2000)



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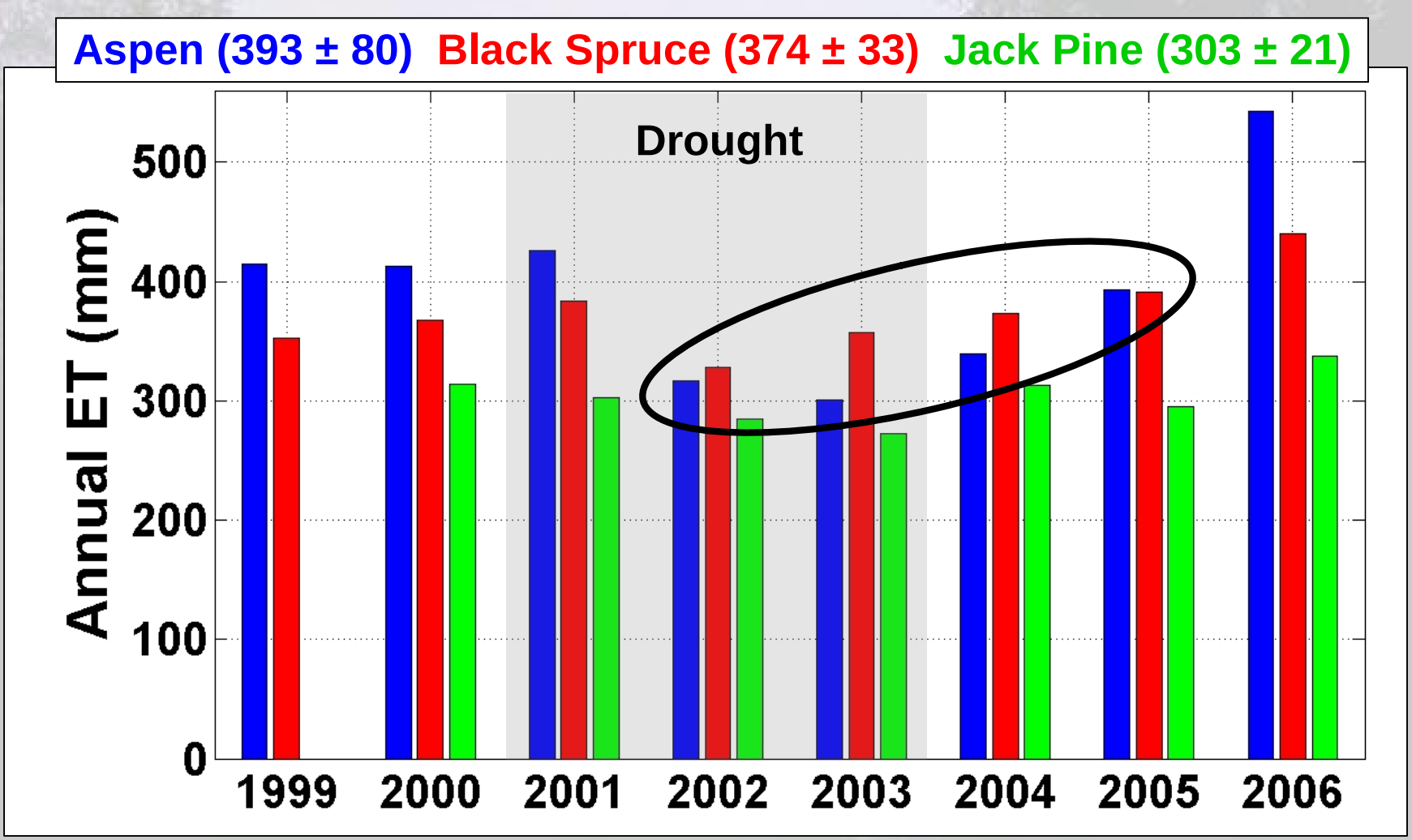
Annual Evapotranspiration 1999 to 2006

(adjusted by ~ +15% for energy-balance closure)



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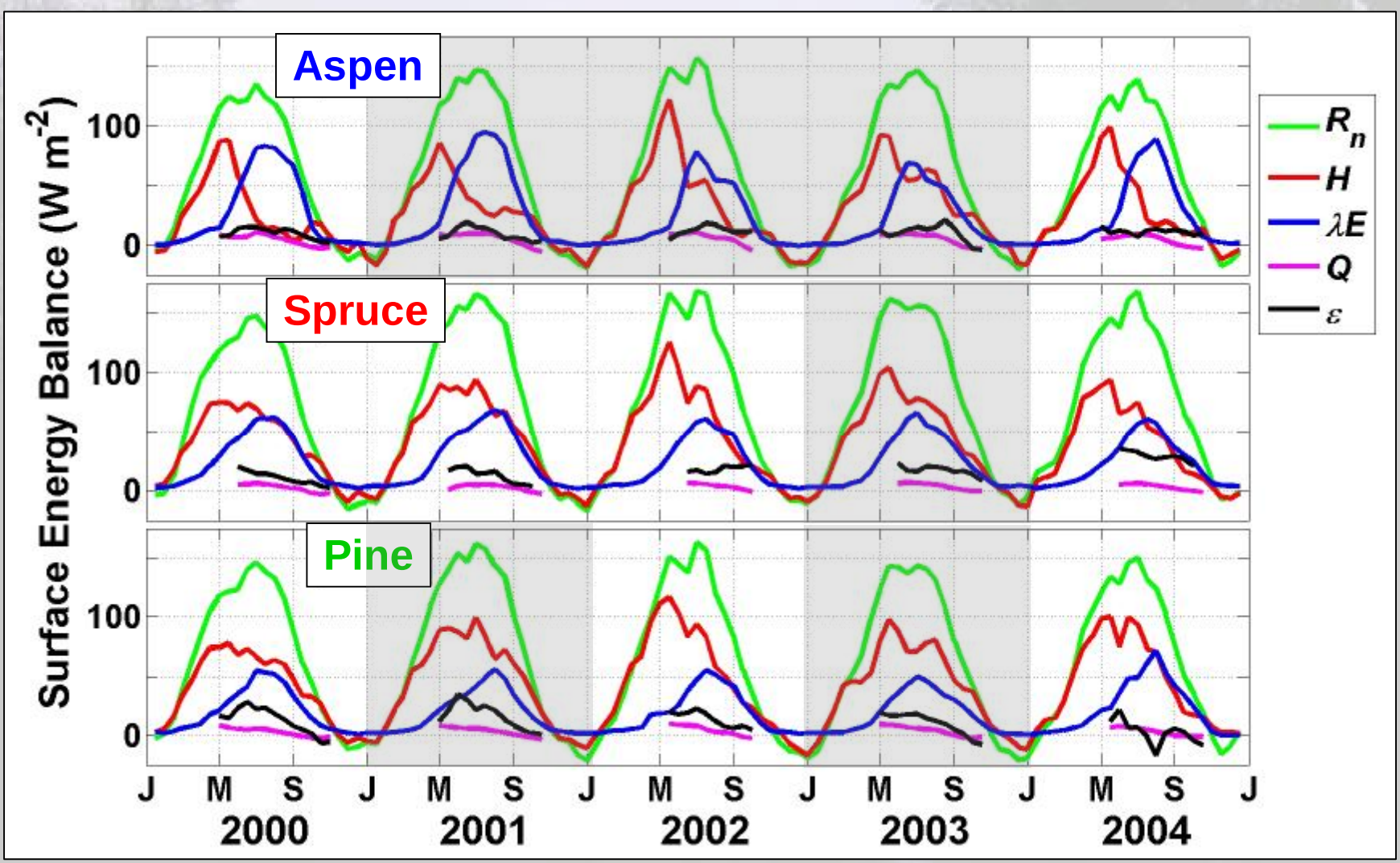
Surface Energy Balance 2000 to 2004

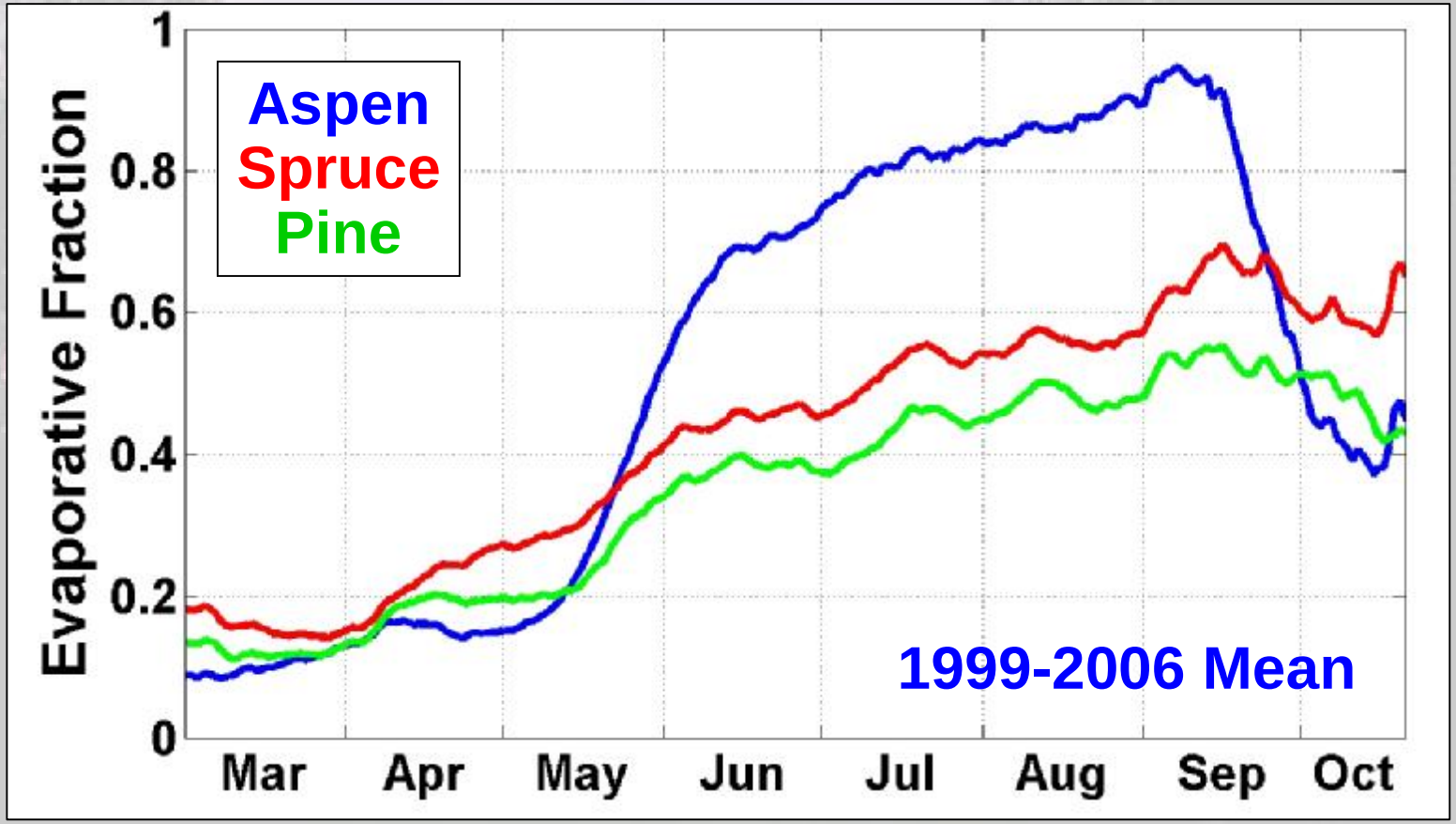
(14-day means, R_n-Q = H+λE+ε)



Seasonal Cycle of Evaporative Fraction

(ratio of λE to available energy, $\lambda E / (R_n - Q)$)

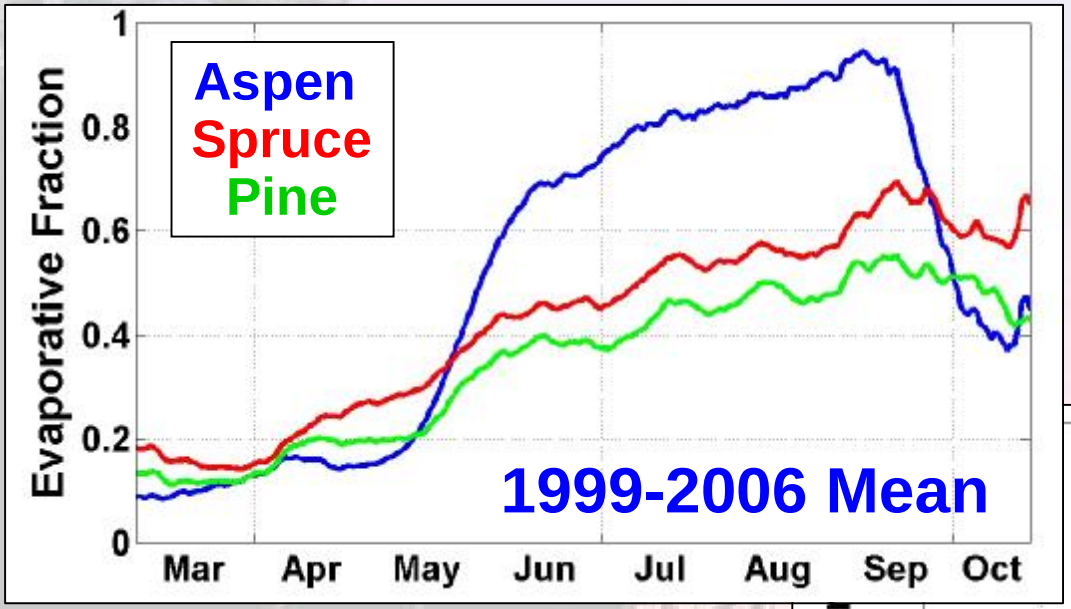
(14-day means)

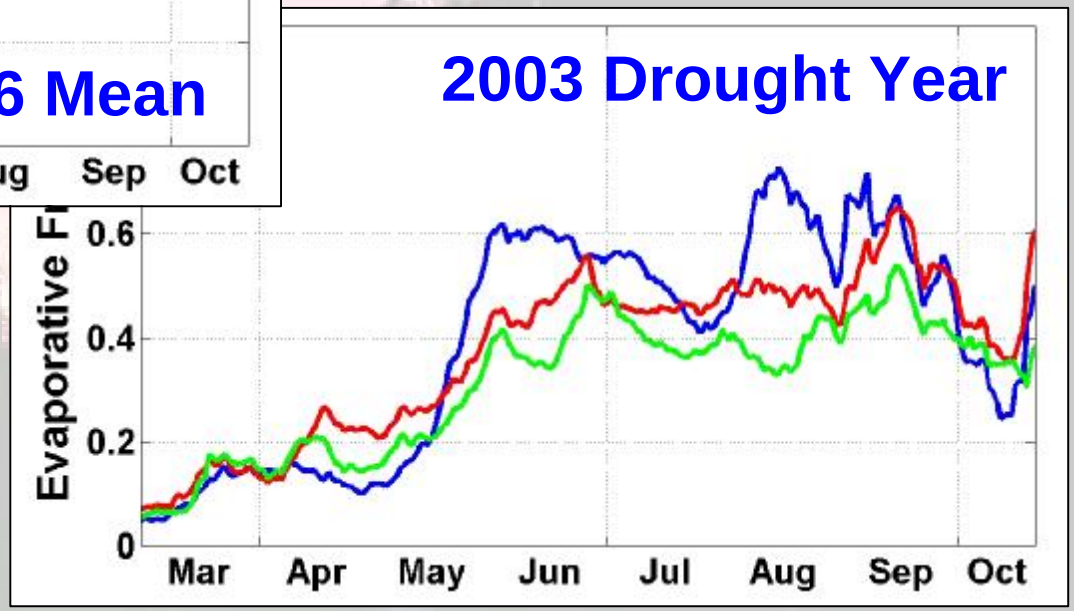


Seasonal Cycle of Evaporative Fraction

(ratio of ET to available energy, λE / (R_n-Q))

(14-day means)





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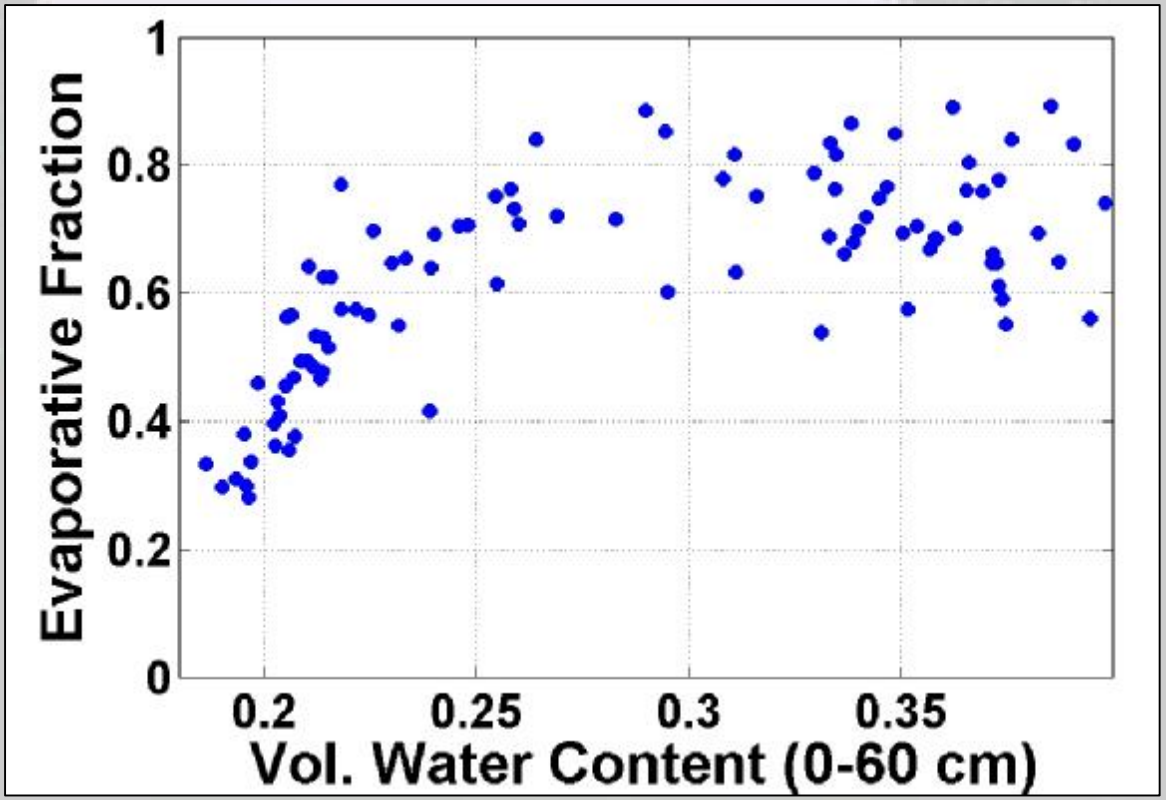
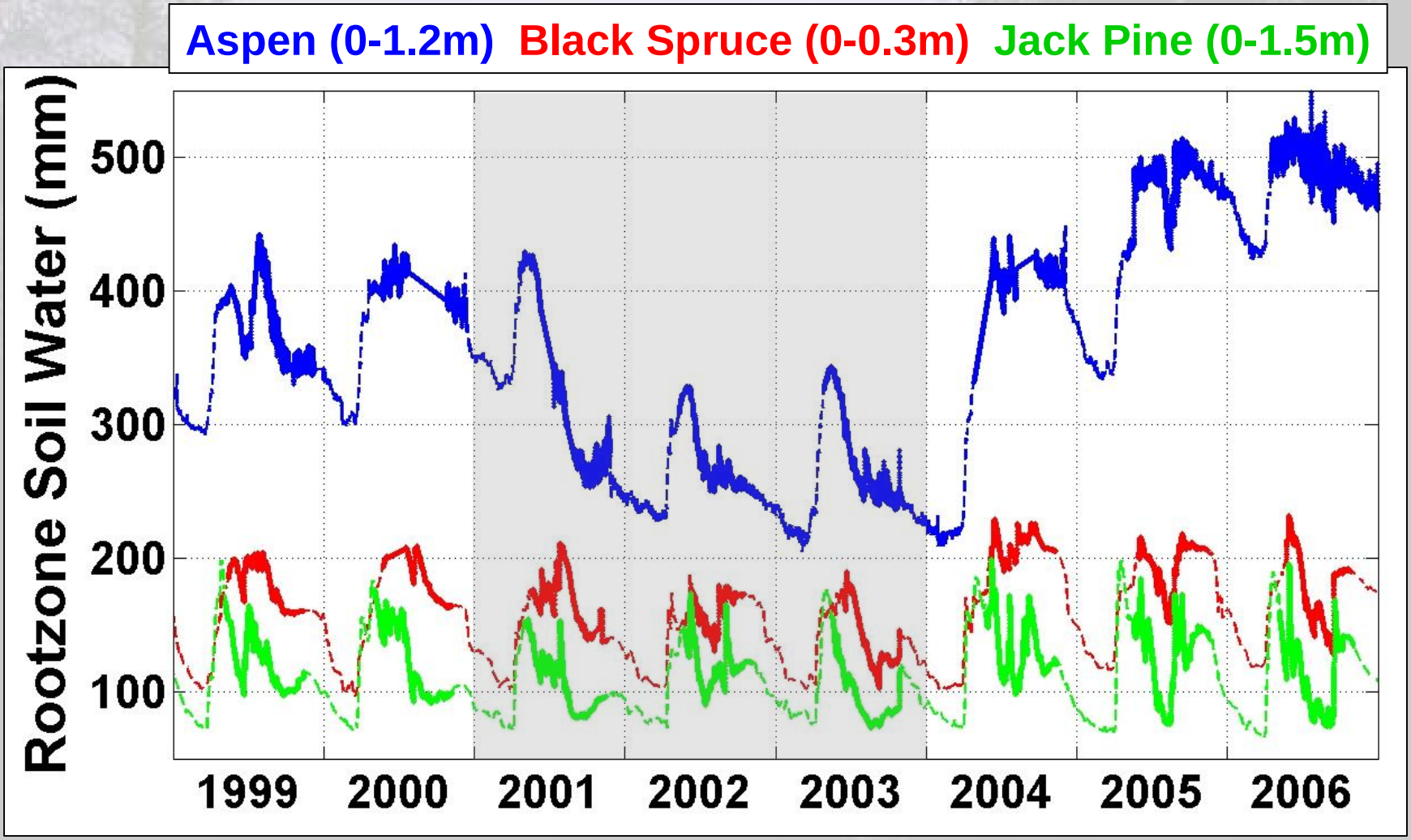
Influence of Soil Water on Evaporative Fraction

BERMS Aspen Site, Fully-Leafed Period

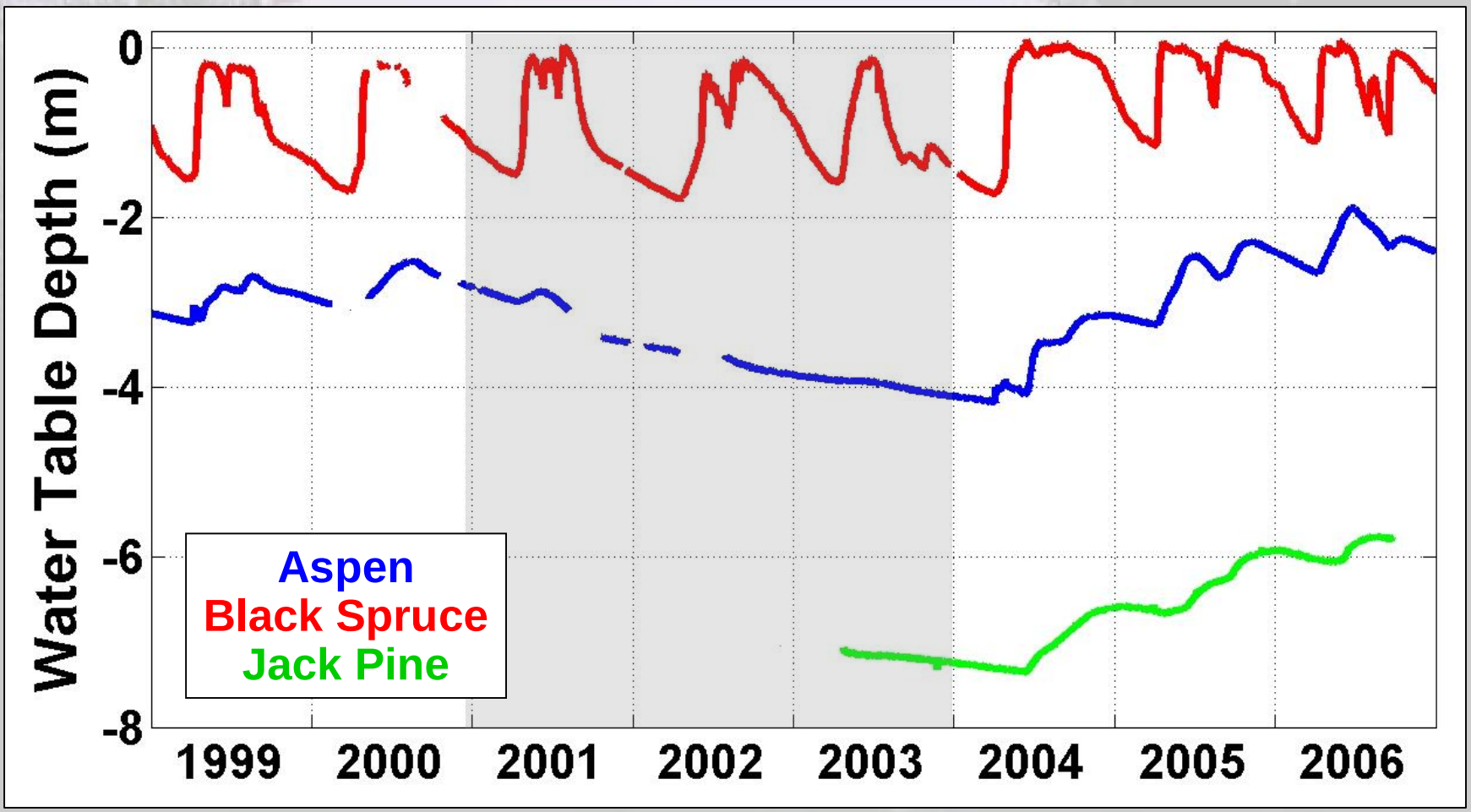


Integrated Root-Zone Soil Water

(dashed lines indicate frozen soil)

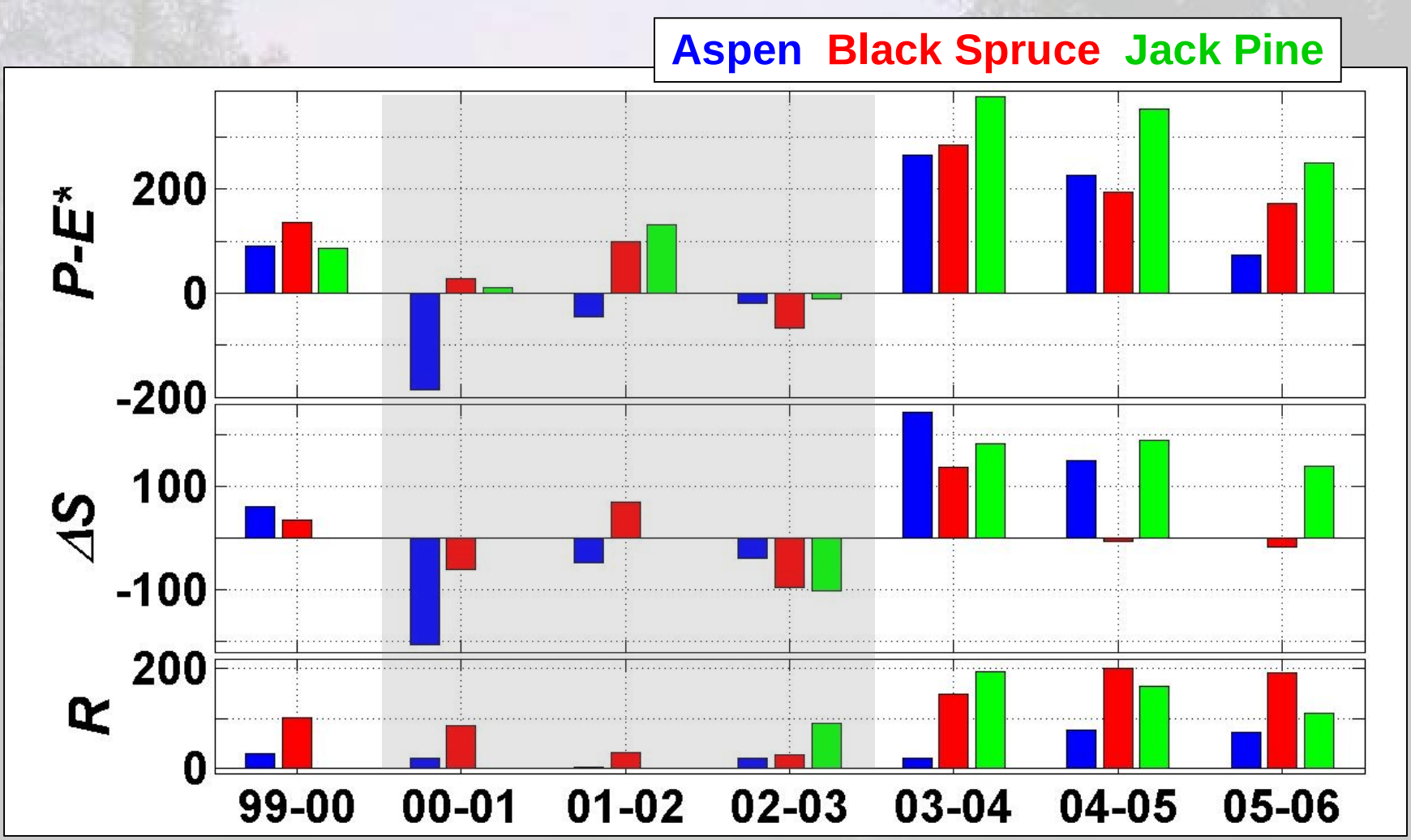


Water Table Depth



Annual Water Balance ($R = P - E^* - \Delta S$)

(Oct-Sept water years)



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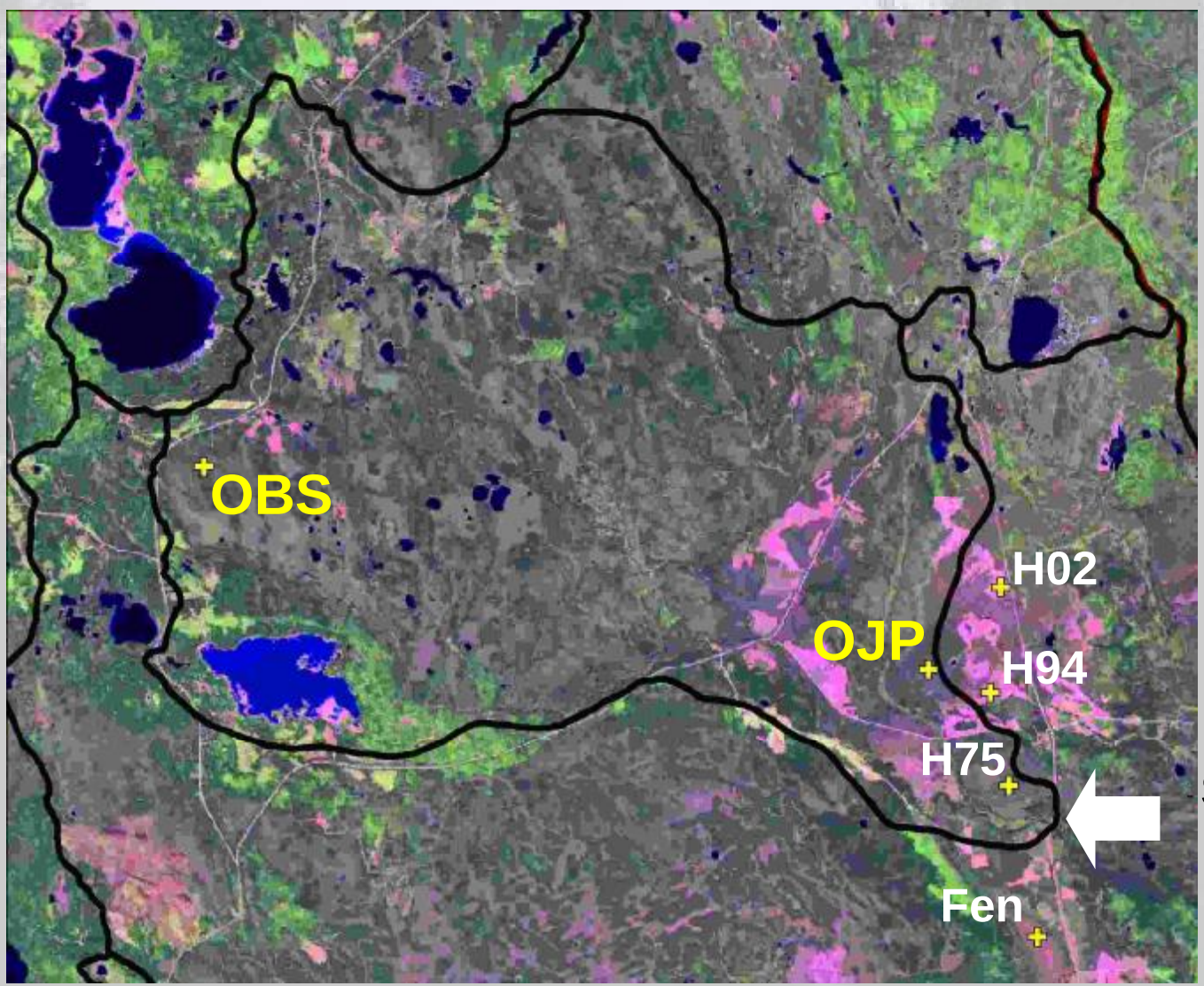
White Gull Basin (629 km^2)

(Green - mixed wood; dark grey - conifers; light grey - wetlands; pink - disturbed)



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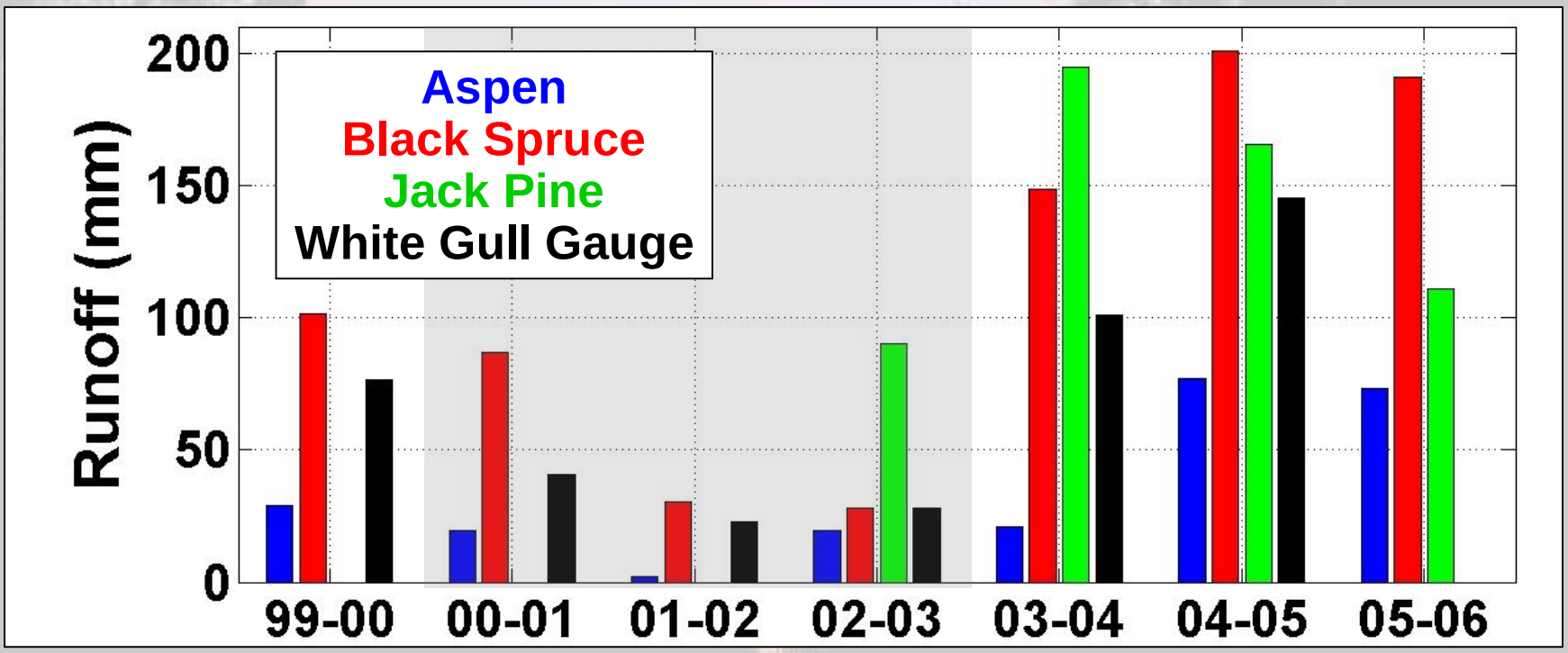
Annual Runoff (*P* - *E** - *ΔS*) at Flux Towers vis-à-vis Gauged White Gull Streamflow

(Oct-Sept water years)



Opportunities

- Use of flux-tower network data for evaluation of atmospheric models
- Hydrologic modelling, modelling studies of the coupled carbon and water cycles

Summary

- Severe 2001-2003 drought followed by extreme wet years of 2004-2006
- Variable drought intensity within BERMS study area
- Large drought impact on *E*, $\mathit{D}S$ and *R*, ecosystem differences in *E* diminished by drought
- Deep $\mathit{D}S$ partially sustained *E* through drought, especially at aspen site
- Realistic closure of water balance at flux towers but only after +15% energy closure adjustment to *E*

Acknowledgements

- EC, CFS, Parks Canada, NASA
- NSERC, CFCAS, BIOCAP
- Action Plan 2000 on Climate Change
- Climate Change Action Fund
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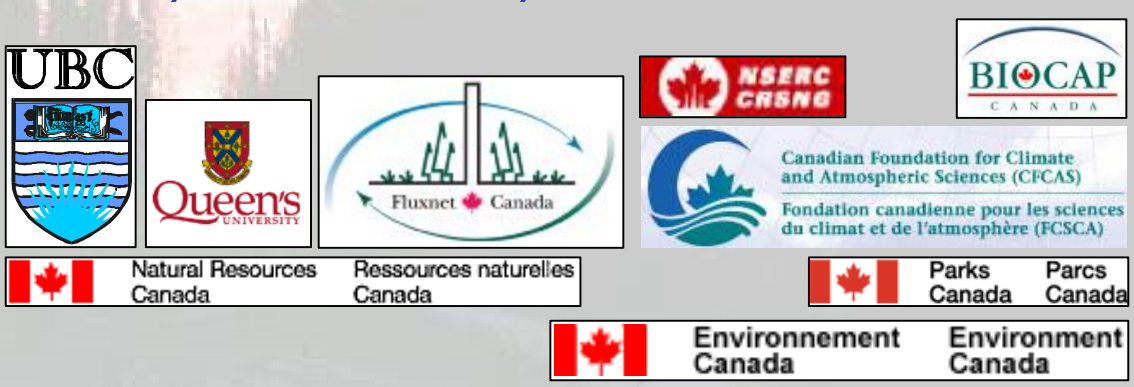
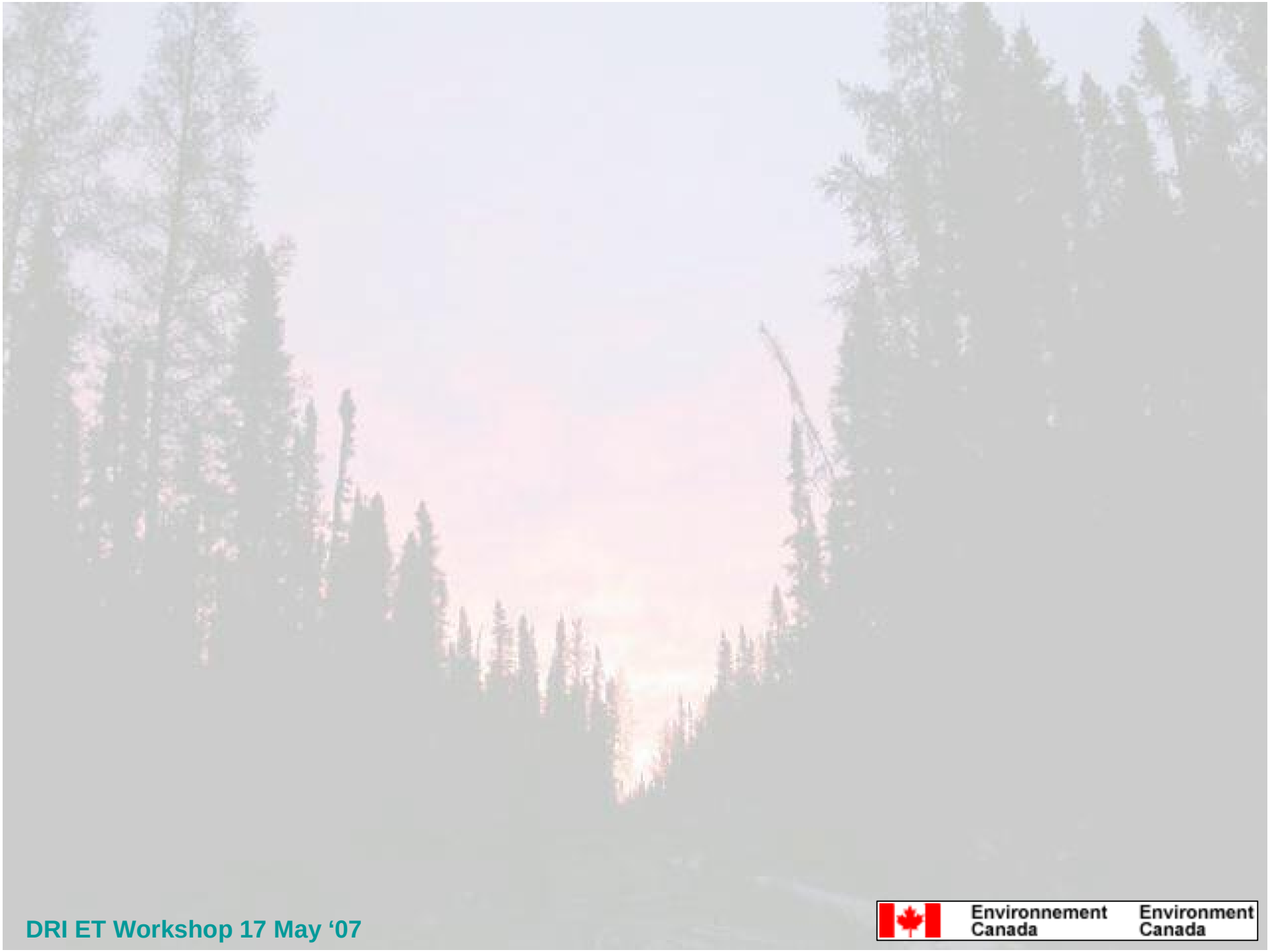
- Bob Stewart, Ted Hogg CFS
- Kai Morgenstern, Praveena Krishnan, Andrew Sauter, Dominic Lessard, Rick Ketler, UBC
- Dan Finch, Sheila McQueen, Don Zuiker, Queen's U.
- Norm Stolle, Murray Peterson, Dave Wieder, Parks Canada





Gauged Streamflow
White Gull Basin