# Ecophysiological evidence for superior soil water acquisition in *Centaurea maculosa* compared to competing rangeland grasses

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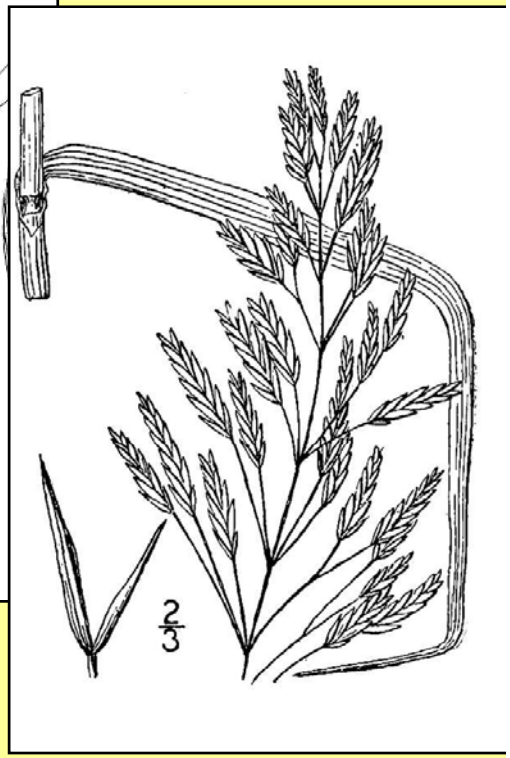
# Research Objectives

- Why is *C. maculosa* (CEMA) such a successful invader?
- Do the photosynthetic and water relation properties of CEMA differ from its co-occurring species?
- Does CEMA differ in its resource use and acquisition?

*Pseudoregneria spicata*

(Bluebunch wheatgrass)

*Agropyron smithii* (Western wheatgrass)

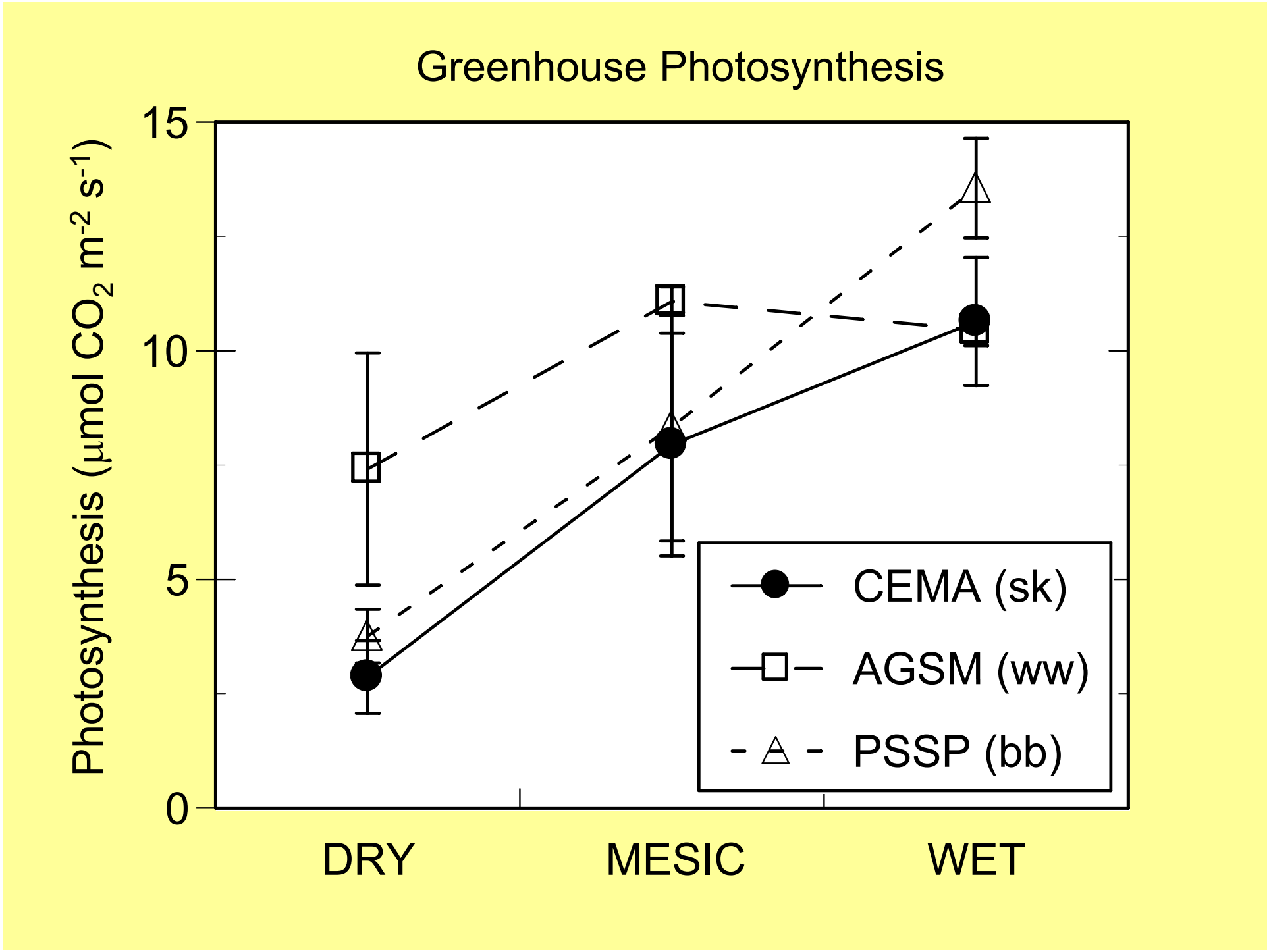


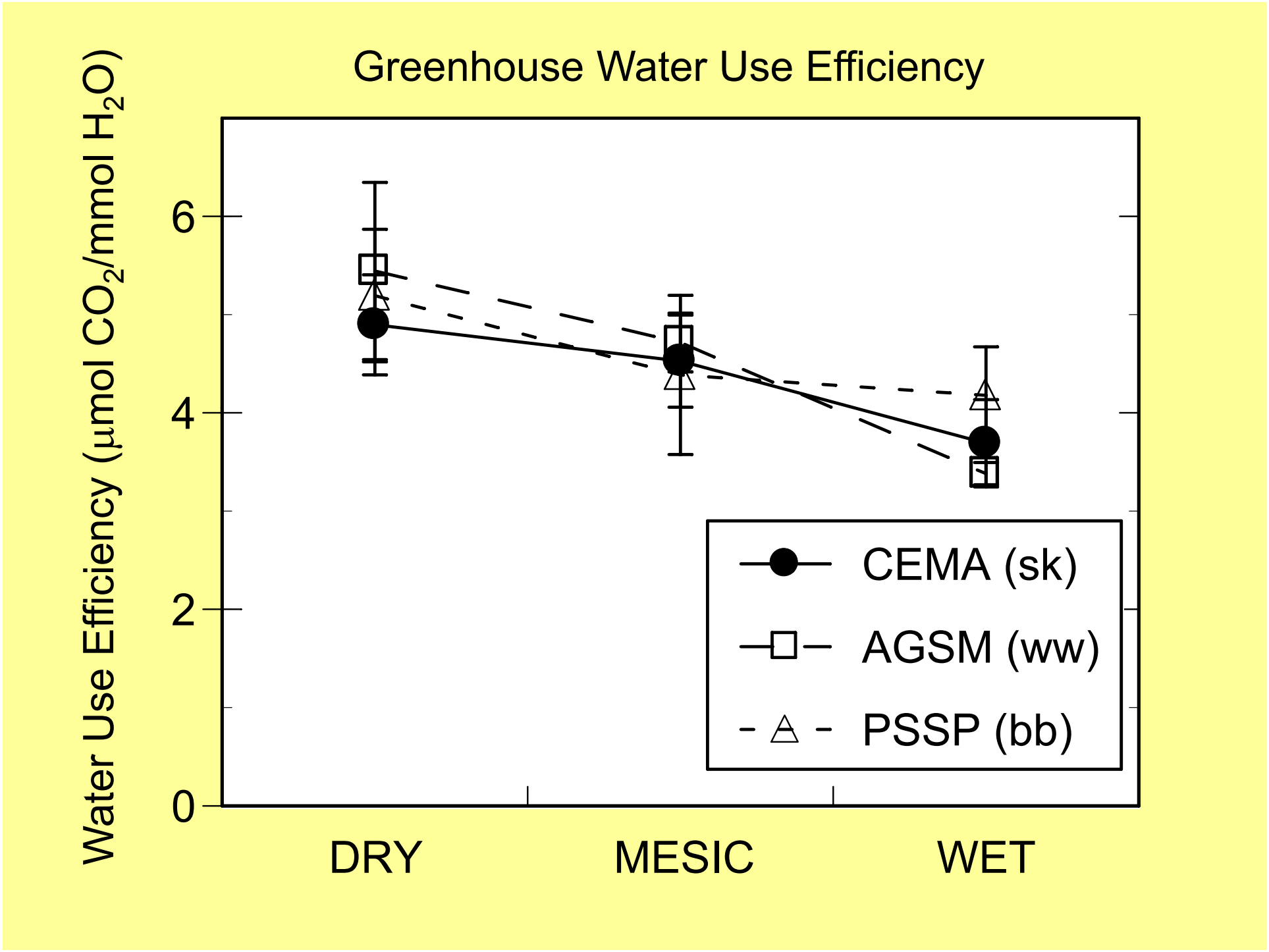

*Centaurea maculosa* (Knapweed)

*Bromus inermis*
(Smooth brome)

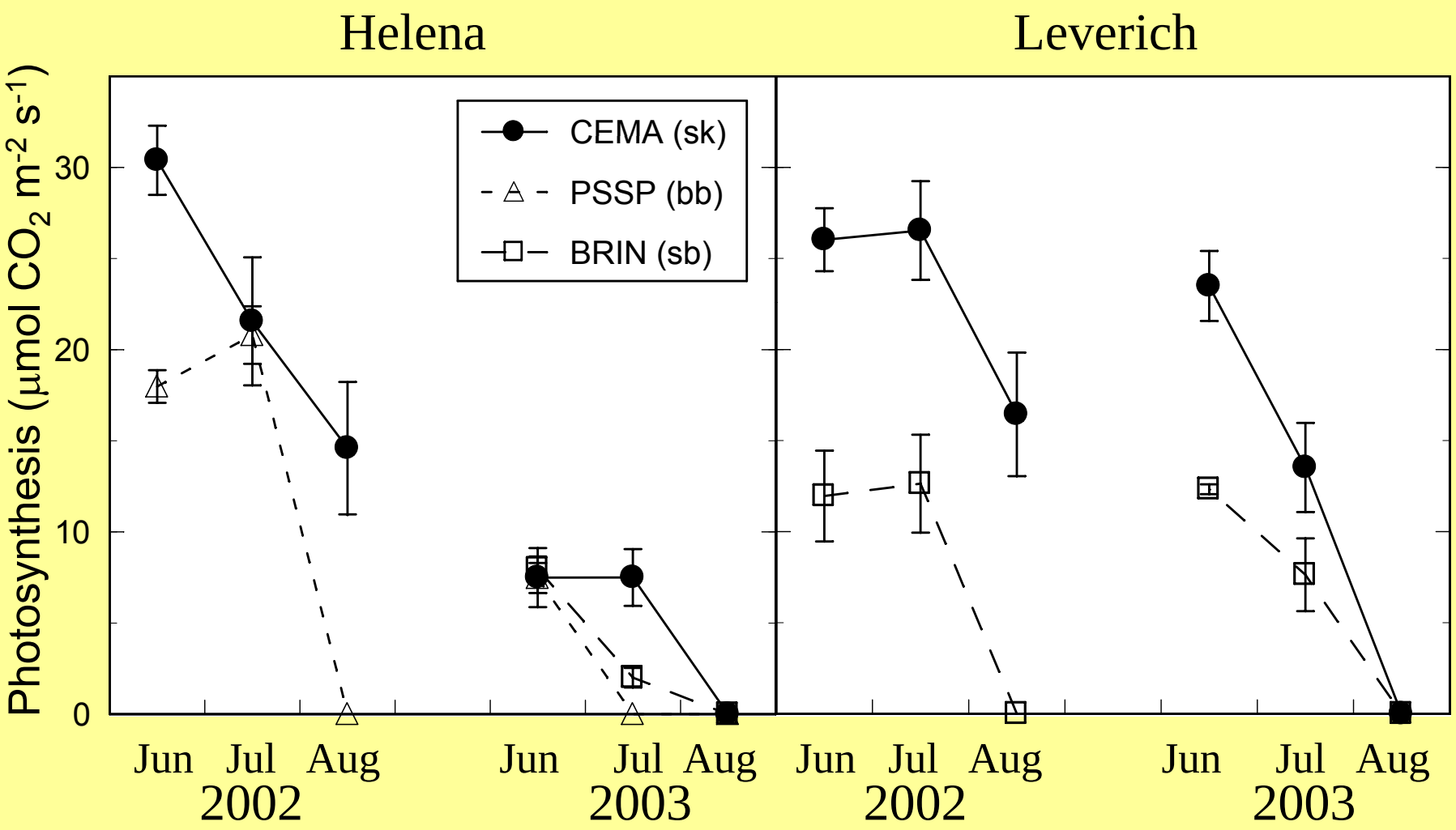
http://plants.usda.gov/

http://www.usask.ca/agriculture/plantsci/classes/range/pseudoregneria.html

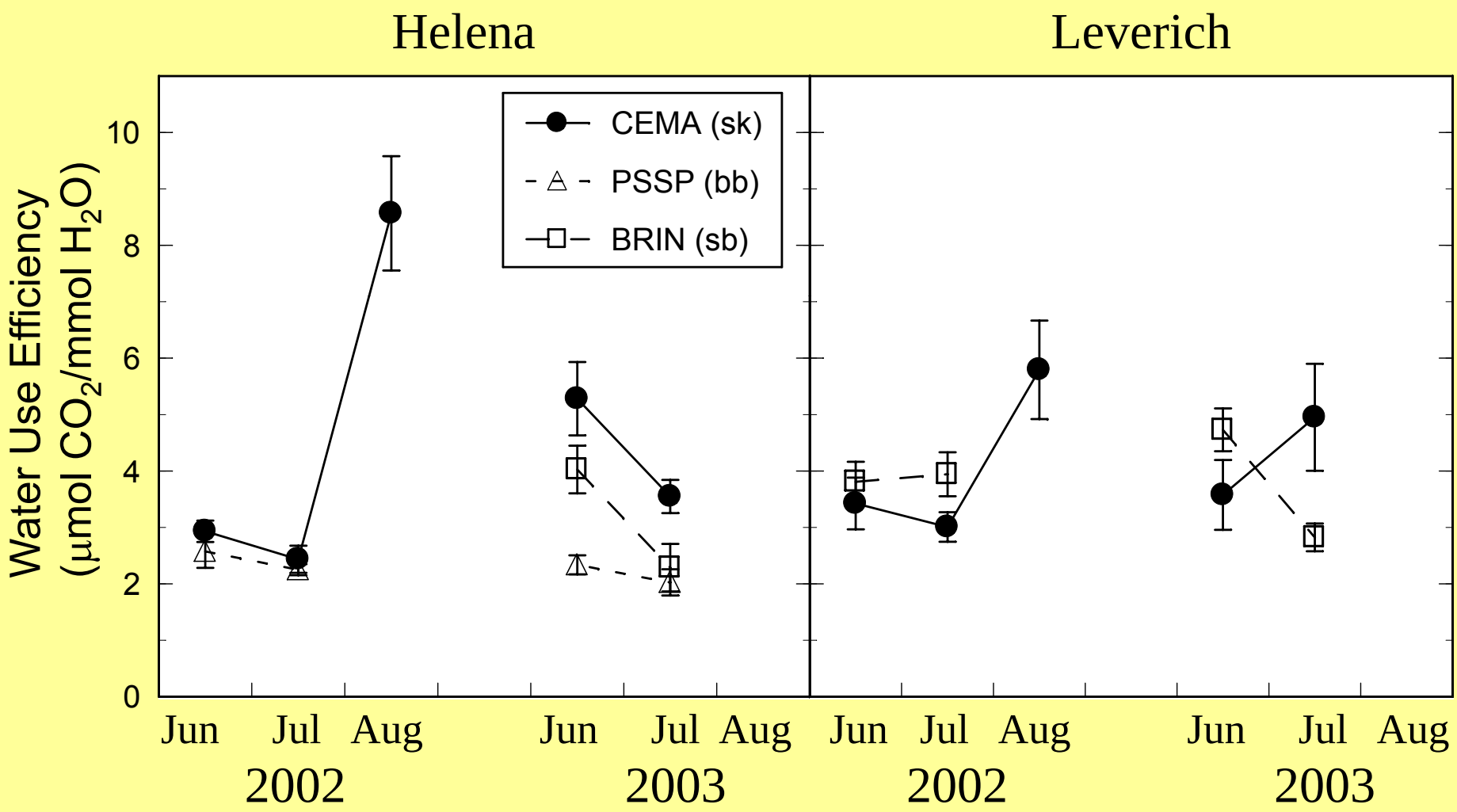

Greenhouse Photosynthesis
Photosynthesis (µmol CO2 m-2 s-1)
15
10
5
0
DRY
MESIC
WET
CEMA (sk)
AGSM (ww)
PSSP (bb)

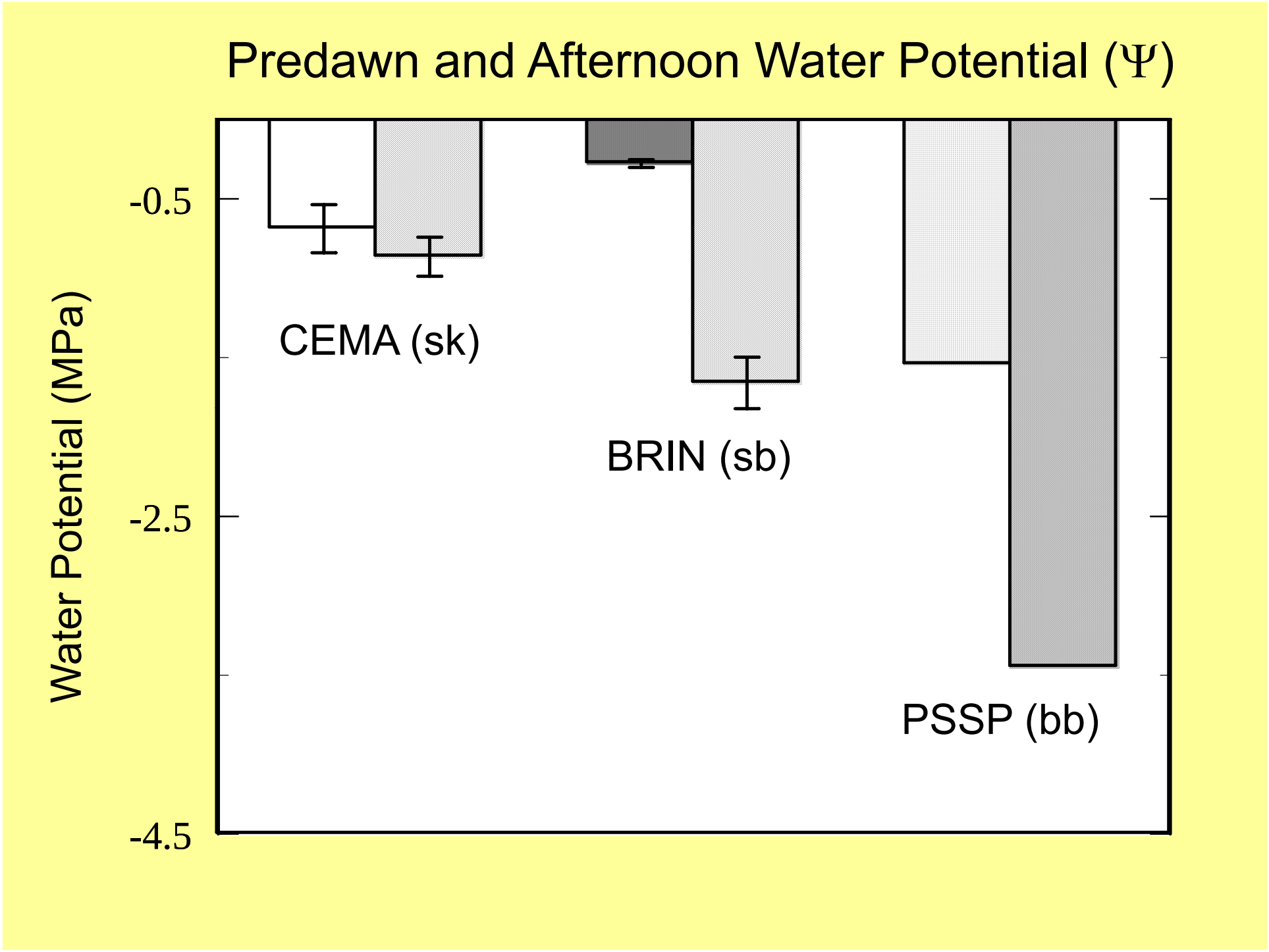

Greenhouse Water Use Efficiency
Water Use Efficiency (µmol CO2/mmol H2O)
6
4
2
0
DRY
MESIC
WET
CEMA (sk)
AGSM (ww)
PSSP (bb)

# Midday Photosynthesis of Naturally Occurring Plants

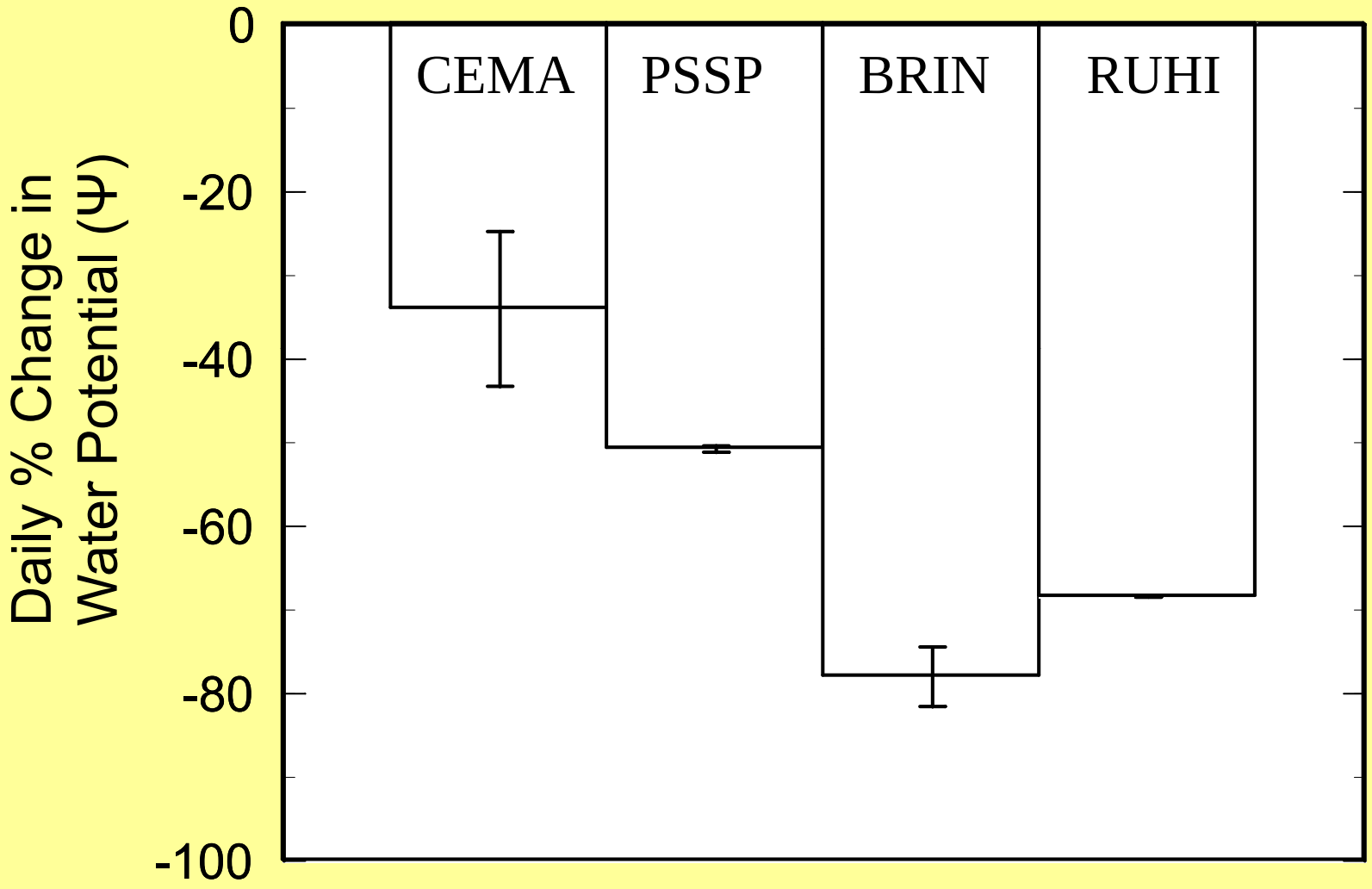


# Midday Water Use Efficiency of Naturally Occurring Plants



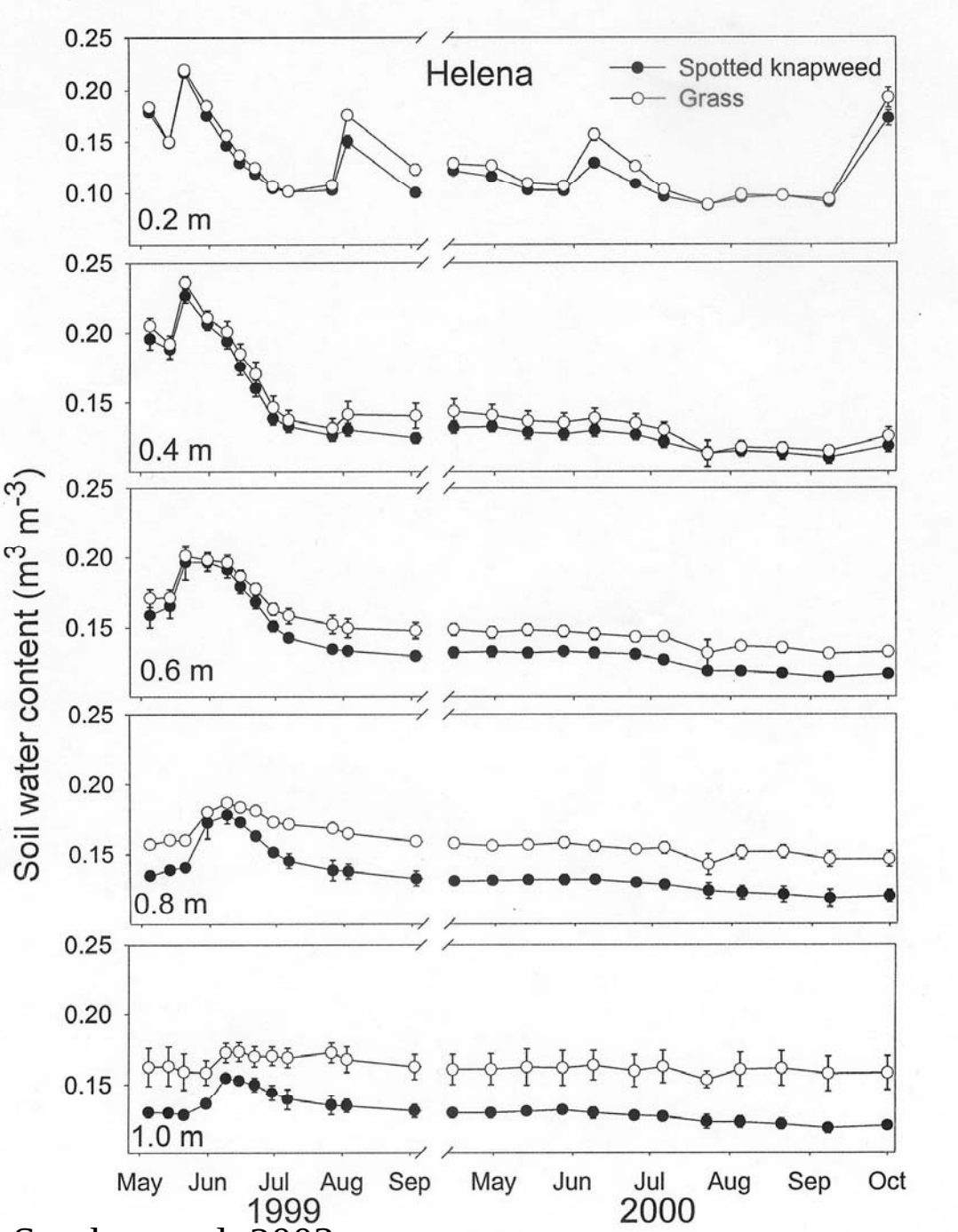

Predawn and Afternoon Water Potential (Ψ)
Water Potential (MPa)
-0.5
-2.5
-4.5
CEMA (sk)
BRIN (sb)
PSSP (bb)

# Diurnal Change in Water Potential (Ψ)



# Summary

- Greenhouse
  - CEMA did not have greater *A* or WUE
- Field
  - CEMA had greater *A* and stomatal conductance, therefore greater transpiration
  - CEMA better able to sustain Ψ
- *Must be pulling more moisture from soil…..How?*




Sperber et al. 2003

# Possible Cause of Success for *C. maculosa*

- Photosynthesis of CEMA was enhanced by greater soil water extraction
  - Maintains Ψ throughout the day
- High water acquisition, and flexibility in WUE, allows increased carbon assimilation throughout the growth season
- Lower water availability for competitors, along with increased *A*, may lead to the increased ecological success of *C. maculosa*
- *Research possible through grants from USDA/NRI and NASA*