

COLD TEMPERATURE SURVIVAL IN PLANTS

Evergreen versus Deciduous

BIO 3610

#22

Resources: Text: Marchand, Ch. 3, p. 54-67; Handout excerpt from *Bioscience* 40(11): 1990

A. WE HAVE NOTED THREE STRATEGIES FOR SURVIVING WINTER

1. H _____ M _____ R _____
2. These have been distinguished under categories of AVOIDANCE or CONFRONTATION

B. PERENNIAL PLANTS (or organs) DEMONSTRATE BOTH AVOIDANCE AND CONFRONTATION

1. CONFRONTATION – cold acclimation of exposed buds, seeds, stems, evergreen leaves
 - a. EVERGREEN TREES – retain foliage which must resist freezing (Marchand, p 54-56)
 - b. Crown architecture -- "spire shape" Benefits? _____
 - i. Black Spruce – *Picea mariana*
 - ii. Balsam Fir – *Abies balsamea*
 - c. Winter Stress Illustrated: First, describe what you think would be the most physiologically stressful winter day for an evergreen plant. Then consult Marchand, Chap. 3, p 56-67 and summarize his description below using leaf physiology concepts.

2. AVOIDANCE:

- a. Annual plants – survive only as dormant _____
- b. Herbaceous perennials – survive as underground r _____ or r _____ in more stable soil environment
- c. Deciduous Woody Perennials – partial avoidance via _____

C. WHAT ARE PRO'S AND CONS OF "EVERGREENNESS?"

1. PRO – a. Photosynthesis –
 - b. Foliar Nutrients –
2. CON – a. Desiccation of exposed leaves (needles) in winter
 - b. "Cost"/area of a xeromorphic leaf is greater – _____

- D. CASE EXAMPLE: *Larix* (larch, tamarack) – is competitive as deciduous conifer
 - grows to arctic timberline; - 65 F in Siberia

Reference (handout) *Bioscience* 40(11): 1990:

1. WHAT ACCOUNTS FOR ITS COMPETITIVENESS?

- a. _Photosynthesis – deciduous; therefore, no solar capture by foliage in winter
- b. Nutrient loss – Table 3 > Compare re-translocation of N among deciduous species

Conclusion: _____

- c. Leaf morphology – Table 2 > Compare SLA (cm²/gram) to evergreen conifers?

i.) With respect to xeromorphy? – _____

ii.) With respect to “cost”/area of solar collection? – _____

- 2. *Populus* (aspens) – competitive as deciduous broadleaf trees
 - high chlorophyll content in periderm (outer bark) tissues

- E. MARCHAND SUGGESTS (p 42): *In the end it is the physiology of these plants, rather than their morphological differences, that gets them through the winter.*

What is your reaction to this statement with respect to

- a. Larch leaf physiology/morphology _____

- b. Aspen photosynthesis: _____
