

A photograph of a coastal dune environment. The foreground is dominated by dense, dark green vegetation, likely beach grasses and shrubs, growing on sandy soil. In the background, a calm body of water (likely a Great Lake) stretches across the horizon under a blue sky with scattered white clouds. The overall scene is bright and natural.

**Life in a dynamic environment: future
directions for ecological research on Great
Lakes coastal dunes.**

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Outline

Introduction

- The ecological importance of Great Lakes coastal dune systems
- A focus on integrated research approaches

Case Study: The Ecological Significance of Burial to Woody Plants

- Ecosystem: Blowout dynamics and spatial patterns of vegetation burial
- Community: Burial induced species zonation on dune slopes
- Population/Individual: Growth and morphological responses to burial

Summary of Implications

- Conceptual model of the ecological significance of burial
- Application of integrated approaches to solve emerging problems



PRINCIPLES OF SUCCESSION AND CLIMAX

COWLES concluded that “the condition of equilibrium is never reached, and when we say that there is an approach to a mesophytic forest we speak only roughly and approximately. As a matter of fact we have a variable approaching a variable rather than a constant. These conditions do not destroy the validity of a physiographic classification, but rather they require an enlargement of the conception” (14:81).

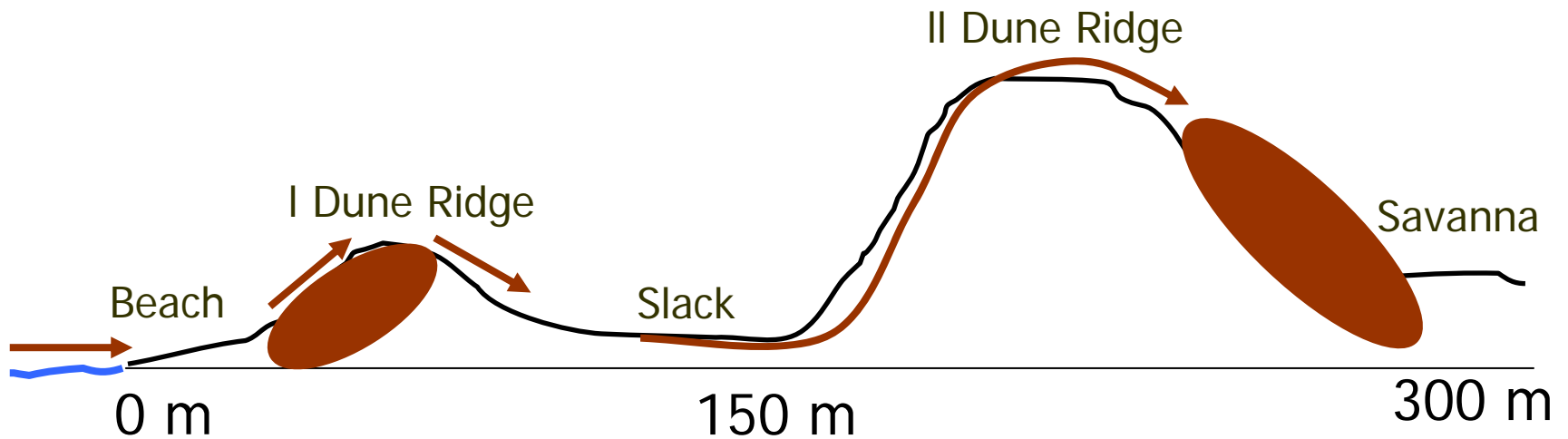








Burial in Coastal Dune Ecosystems





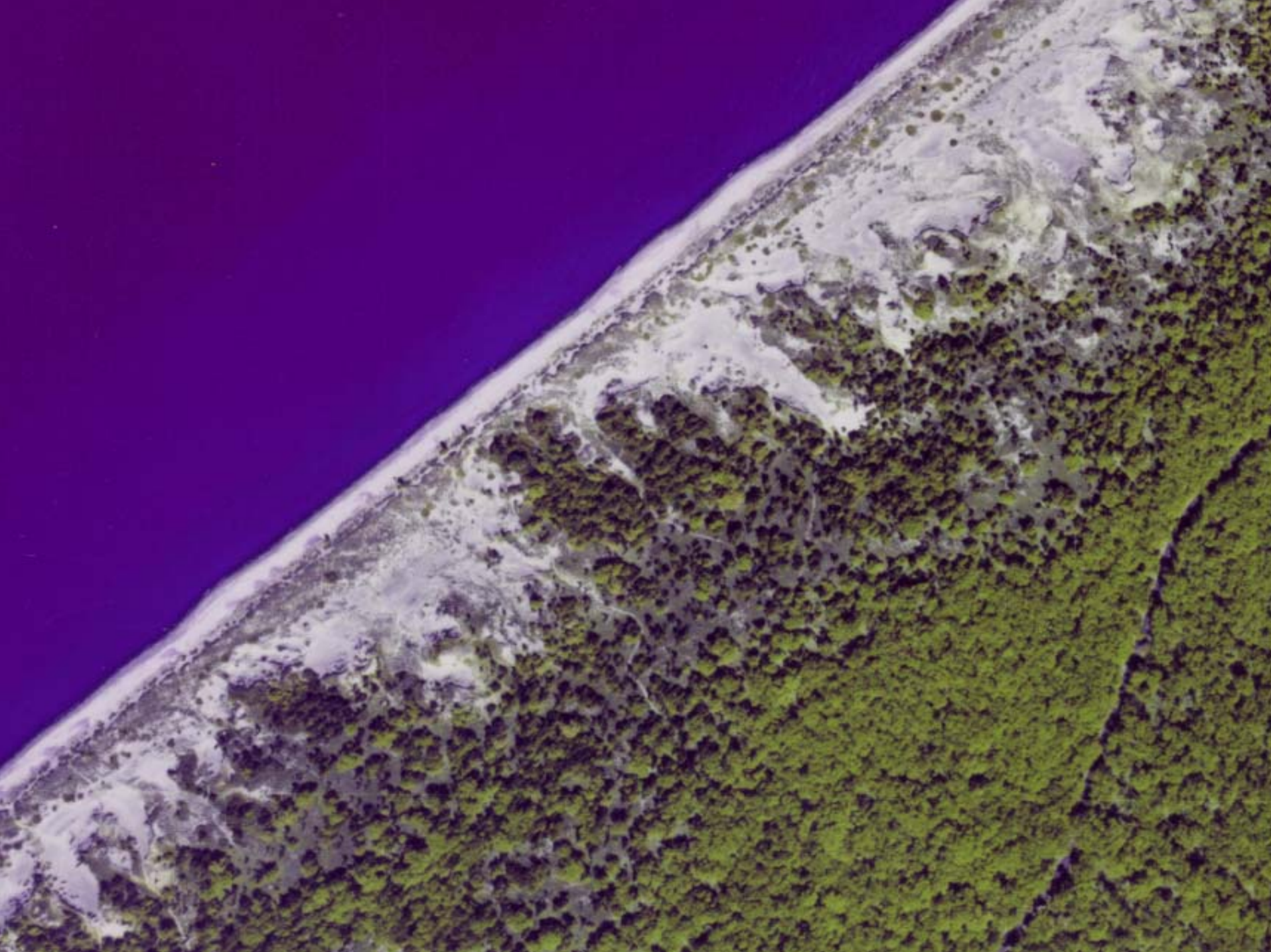
Research Goal

- To determine the ecological significance of sand burial to **woody plants** of coastal dune ecosystems on the Great Lakes by studying its affects at **multiple levels** of biological organization

Pinery Provincial Park

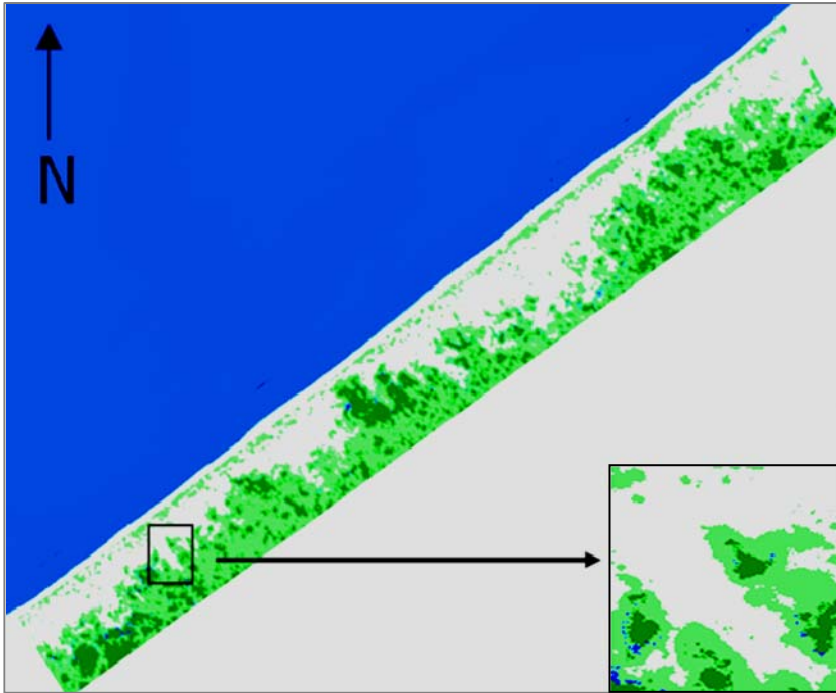


- Southeastern coast of Lake Huron
- 75 km northwest of London, ON
- 2, 532 Ha, 13 km Shoreline
- Dunes formed since 5000 y BP.
- 1km stretch of shoreline protected

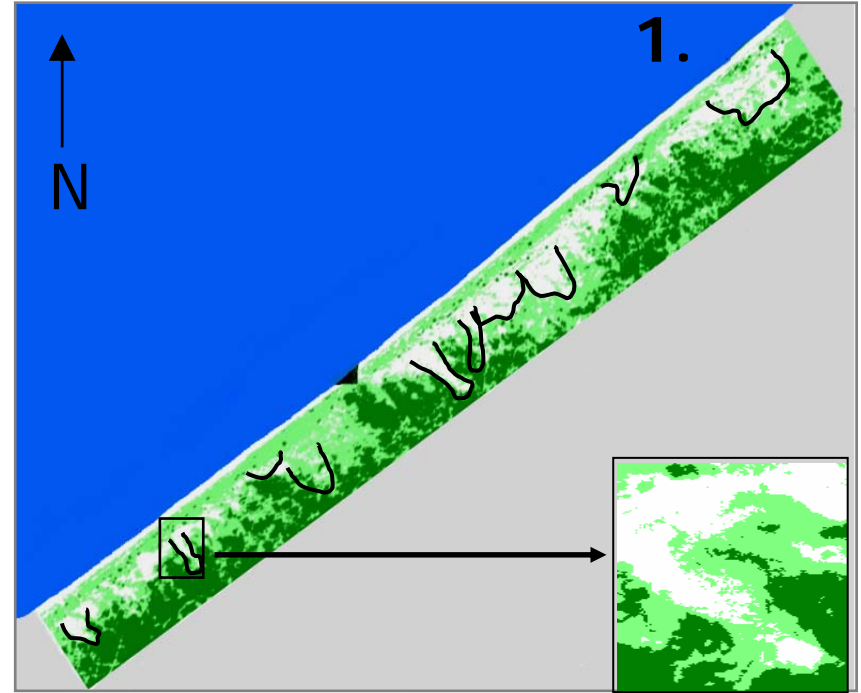


Land Cover Classification Maps

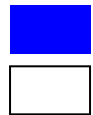
June 22, 1973



October 10, 1998



Legend



Water
Sand

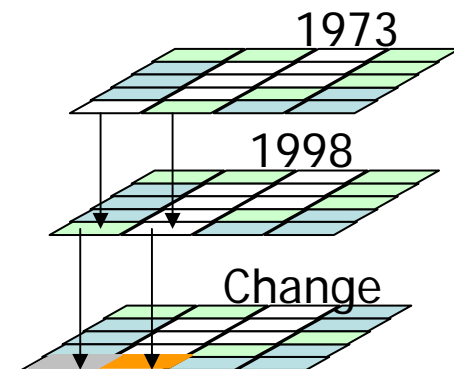


Grass
Trees

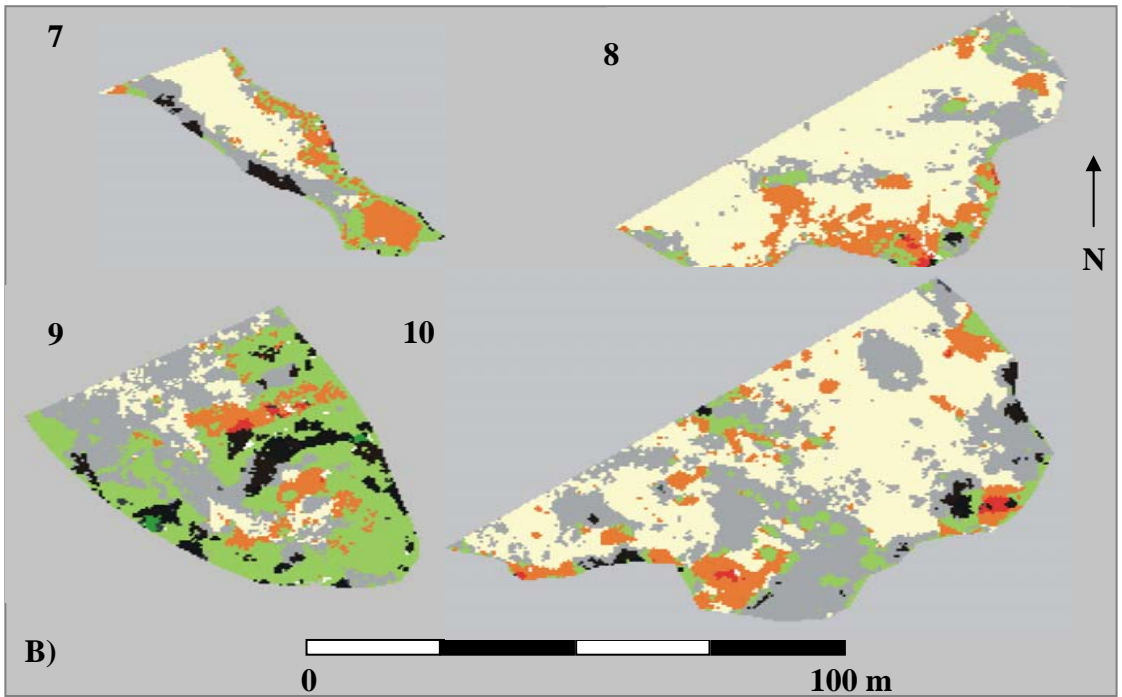
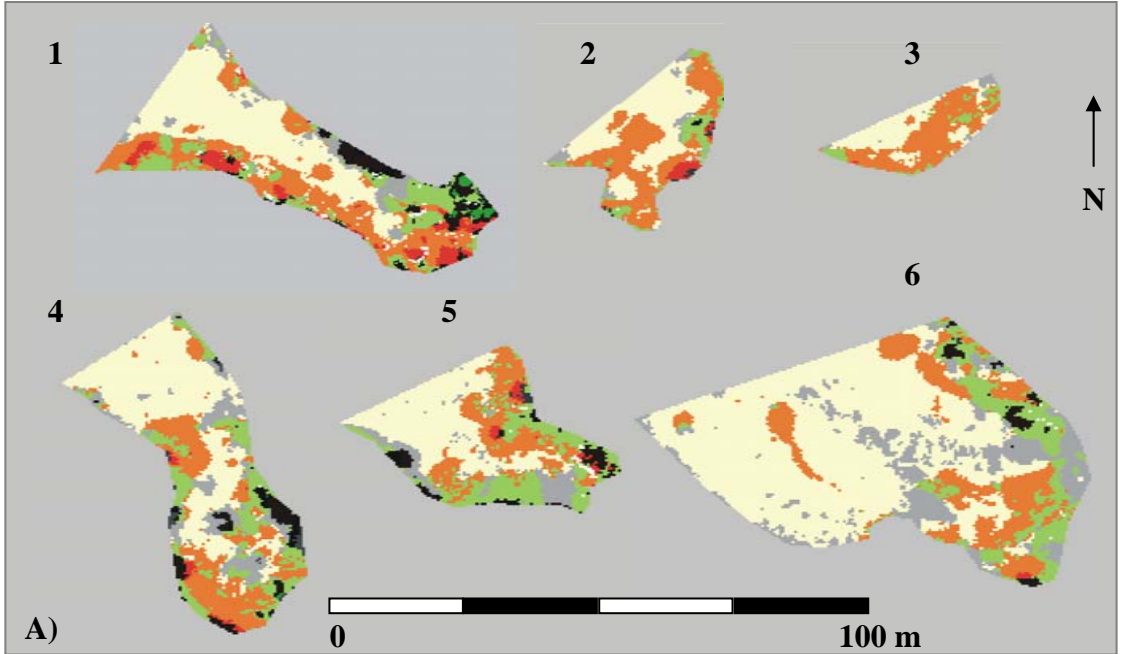
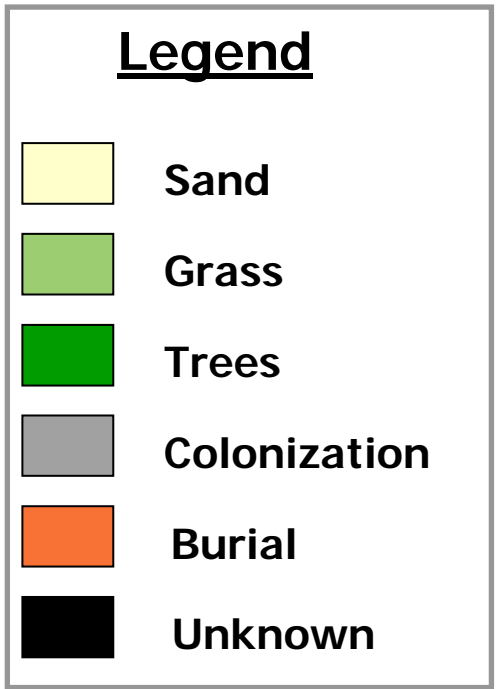
1. Isolation of Blowouts

2. Overlay and Change Detection

2.



Blowout Dynamics (1973-1998)



Dech, J.P., Maun, M.A., and Pazner, M.I. 2005. Catena 165-180.



Surveys of Stand Composition



Active Dune Stands

Stable Dune Stands

0 100 200

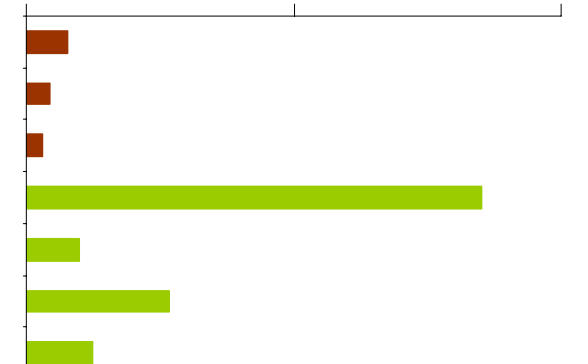
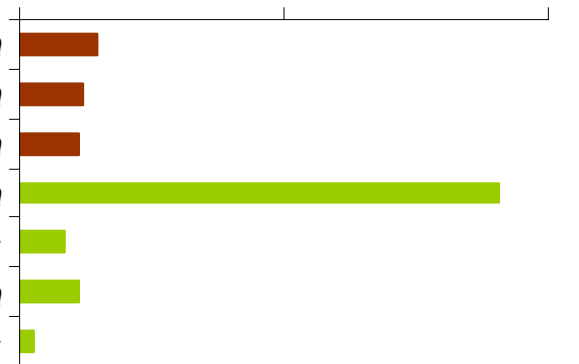
0 100 200

0 50 100

0 50 100

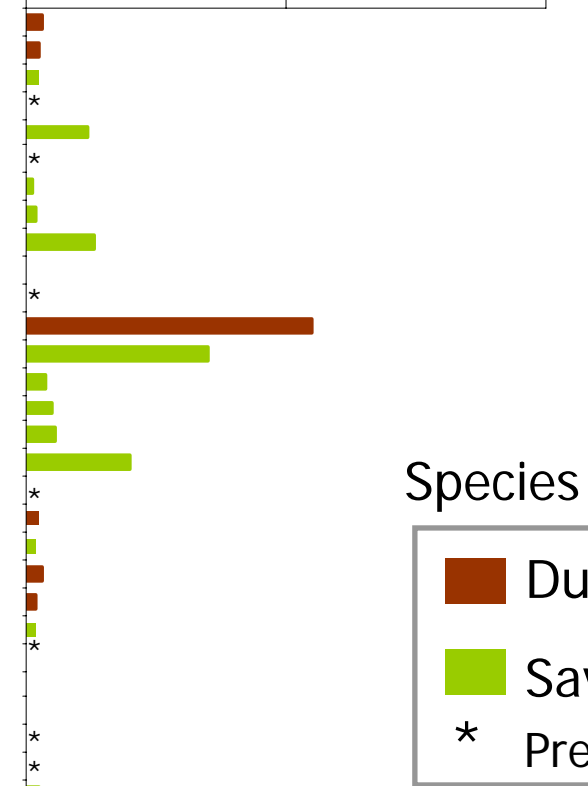
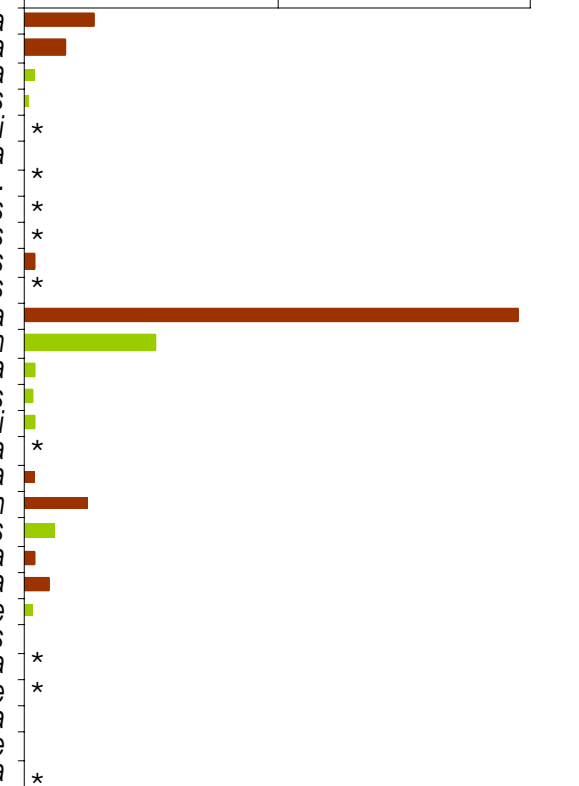
Canopy

Quercus rubra
Prunus virginiana
Pinus resinosa
Juniperus virginiana
Quercus prinoides
Quercus velutina
Pinus strobus



Understorey

Vitis riparia
Rosa blanda
Rhus aromatica
Celastrus scandens
Arctostaphylos uva-ursi
Cornus alternifolia
Amelanchier sp.
Symphoricarpus albus
Juniperus communis
Elymus canadensis
Poa pratensis
Calamovilfa longifolia
Schizachyrium scoparium
Poa compressa
Sorghastrum nutans
Andropogon gerardii
Carex eburnea
Cakile edentula
Corispermum hyssopifolium
Artemisia campestris
Smilacina stellata
Solidago hispida
Lithospermum caroliense
Pedicularis canadensis
Asclepias viridiflora
Maianthemum canadense
Liatris cylindracea
Ditrichum flexicaule
Tortella tortuosa



Species Affiliation

■ Dune
 ■ Savanna
 * Present

Active Dune Stands



Stable Dune Stands



Burial Activity

HIGH/MODERATE

LOW/NONE



Canopy

Understory

Canopy

Understory

Richness

6-7

16-23

5-6

21-28

Diversity (H)

1.01-1.63

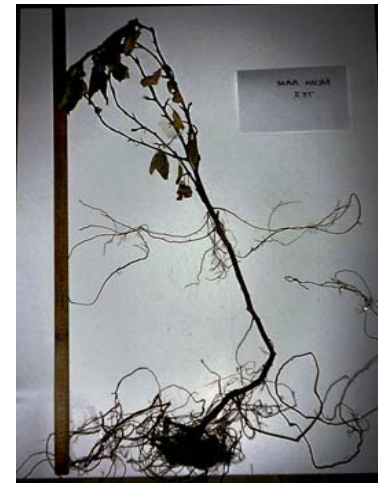
1.64-1.82

0.86-1.39

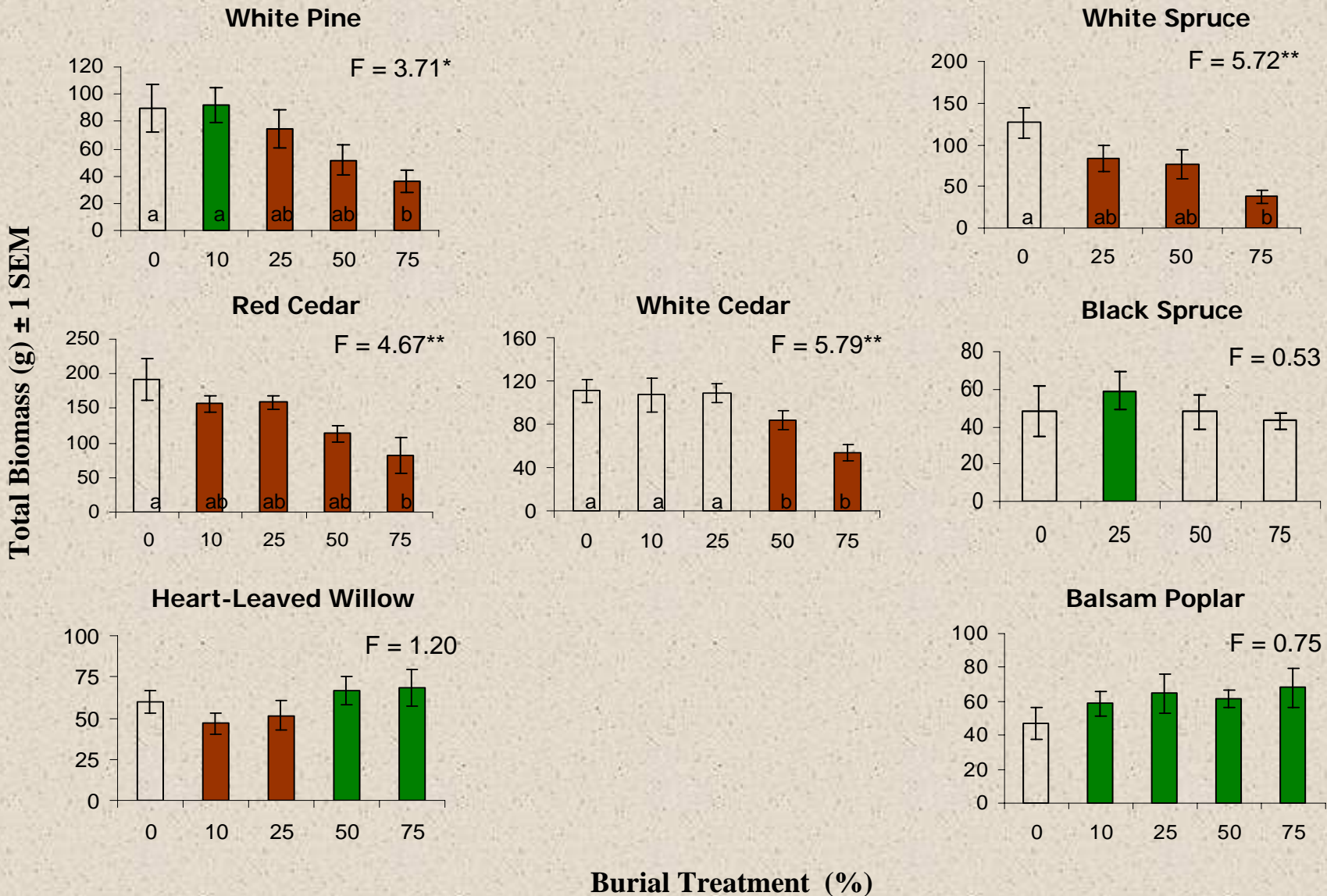
1.77-2.75



Artificial Burial Experiment



Burial Responses: Total Plant Biomass



No Change
 Stress
 Stimulation

Stimulation of Adventitious Rooting

Balsam Poplar



1m

0m

Control

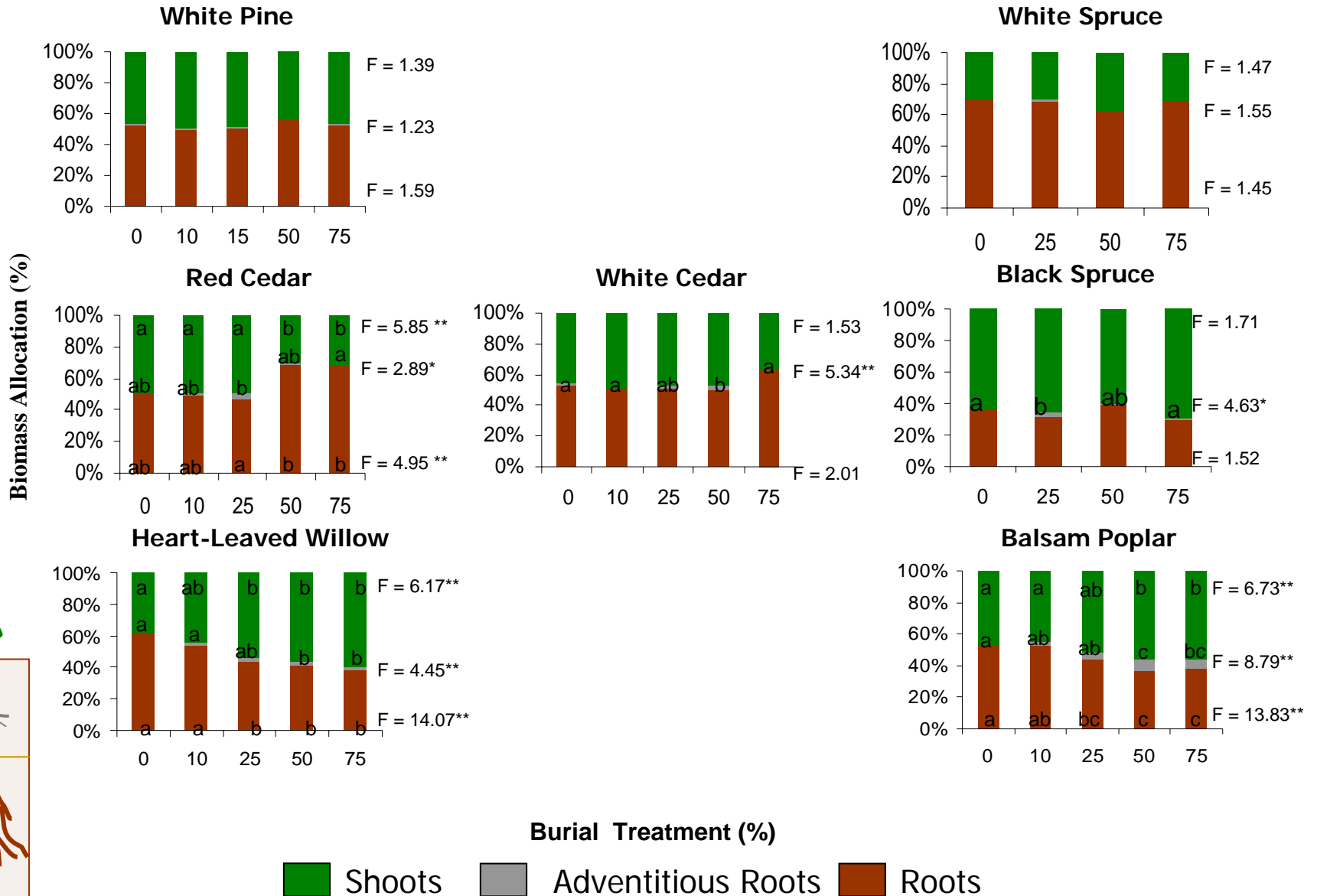
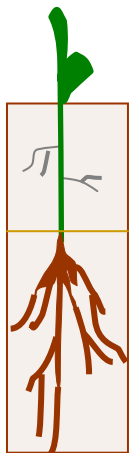
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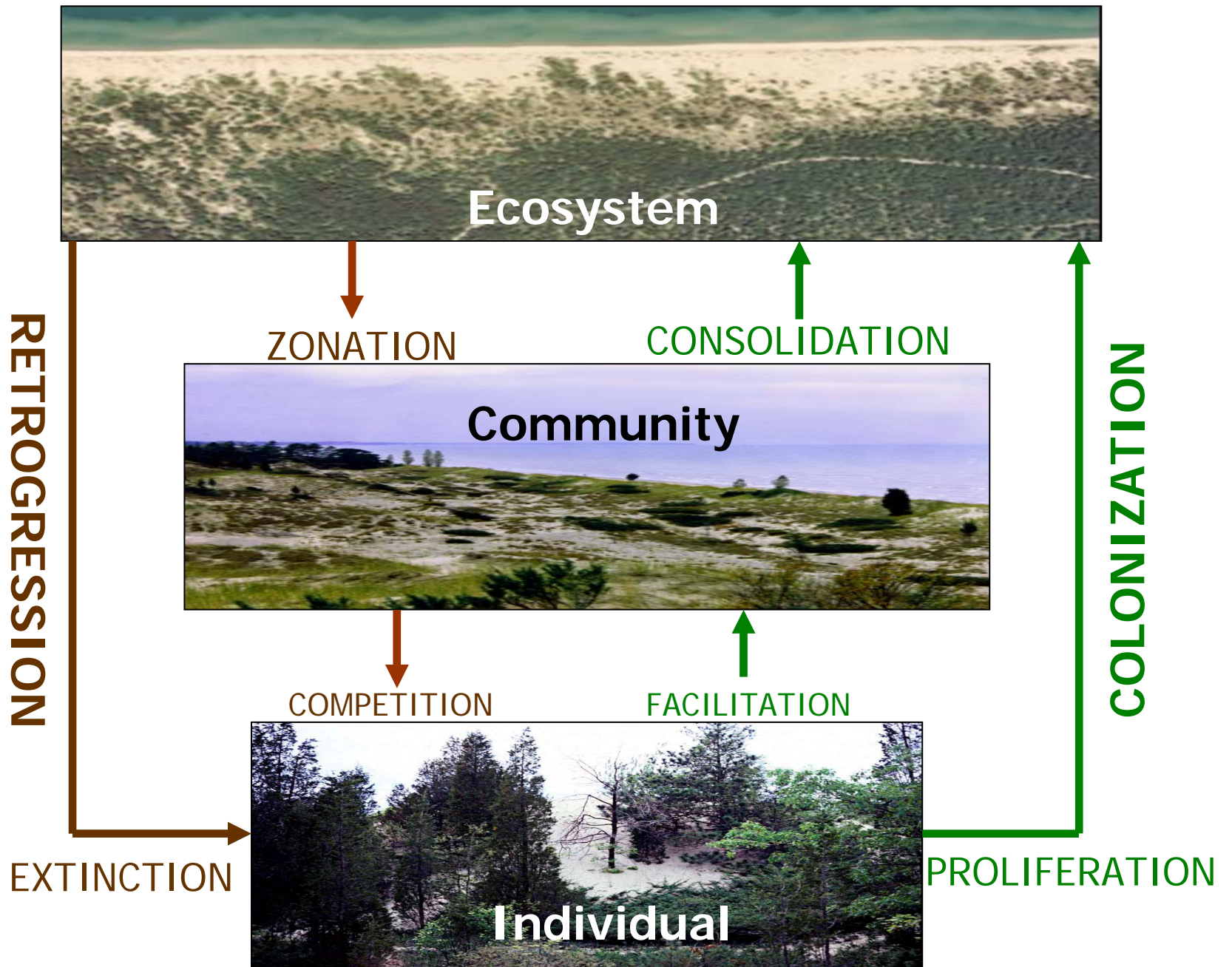
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Adaptive Traits: Biomass Allocation Patterns





Emerging Research Problems

1



Photo: M.A. Maun



Acknowledgements

UWO

- M.A. Maun
- D. Fahselt, R.G. Thorn
- M. van Hal, V. Cuthbertson
- P. Duenk, C. Rasenberg
- D. Yakobchuk
- Sand Dune Ecology Lab
- D.G. Hillis
- M. Pazner (Dept. of Geography)

Pinery Provincial Park

- T. Crabe
- T. Purdy

Funding

- Natural Sciences and Engineering Research Council of Canada
- Ontario Graduate Scholarships in Science and Technology